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

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- TECHNICAL MEMORANDUM. Scientific and technical findings that are of preliminary or specialized interest, e.g., quick release reports, working papers, and bibliographies that contain minimal annotation. Does not contain extensive analysis.
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- Telephone the NASA STI Help Desk at (301) 621-0390
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  NASA STI Help Desk
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  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.

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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

A Biweekly Publication of the National Aeronautics and Space Administration

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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*.

20040077355 Lawrence Livermore National Lab., Livermore, CA
Computational Design and Analysis of a Microtab Based Aerodynamic Loads Control System for Lifting Surfaces
Van Dam, C. P.; Yen Nakafuji, D.; Bauer, C.; Chao, D.; Standish, K.; Oct. 31, 2002; In English
Report No.(s): DE2003-15005035; UCRL-JC-150324; No Copyright; Avail: National Technical Information Service (NTIS)

A computational design and analysis of a microtab based aerodynamic loads control system is presented. The microtab consists of a small tab that emerges from a wing approximately perpendicular to its surface in the vicinity of its trailing edge. Tab deployment on the upper side of the wing causes a decrease in the lift generation whereas deployment on the pressure side causes an increase. The computational methods applied in the development of this concept solve the governing Reynolds-averaged Navier-Stokes equations on structured, overset grids. The application of these methods to simulate the flows over lifting surface including the tabs has been paramount in the development of these devices. The numerical results demonstrate the effectiveness of the microtab and that it is possible to carry out a sensitivity analysis on the positioning and sizing of the tabs before they are implemented in successfully controlling the aerodynamic loads.
NTIS
Computation; Aerodynamic Loads; Computational Grids; Design Analysis

20040079676 Lawrence Livermore National Lab., Livermore, CA
Aerodynamic Design of Heavy Vehicles. August 8, 2002
McCallen, R.; Salari, K.; Ortega, J.; Yen-Nakafuji, D.; Dunn, T.; Aug. 08, 2002; In English
Report No.(s): DE2004-15002133; UCRL-ID-149631; No Copyright; Avail: National Technical Information Service (NTIS)

Activities for this quarter include an effort to simulate the flow structure in the wake region of the trailer and in the gap region between the tractor and the trailer for the GTS geometry. Two-dimensional simulations have been conducted on both flow structures using LLNL's ALE3D code. With the information obtained from these calculations, three-dimensional (3D) grids are constructed for the wake and the gap regions. Due to complexity of the required grid generation, two different grid generation tools have been utilized. The ALE3D code and NASA's Overflow code are both being used for the 3D simulations; ALE3D for large-eddy simulation and Overflow for Reynolds-averaged Navier-Stokes simulations.
NTIS
Aerodynamics; Design Analysis; Tractors; Trailers; Large Eddy Simulation; Design

20040079782 NASA Wallops Flight Facility, Wallops Island, VA, USA
NASA Balloon Technology Developments
Fairbrother, D. A.; [2004]; 1 pp.; In English; 35th COSPAR Scientific Assembly, 18-25 Jul. 2004, Paris, France; No Copyright; Avail: Other Sources; Abstract Only

The National Aeronautics and Space Administration (NASA) Balloon Program has been, and will continue to be, committed to improving the capabilities of balloons to support science missions. Fundamental to vehicle improvement is a program of technology development that will enable improved flight performance throughout the next decade. The program s technology thrust areas include: materials, vehicle design & development, structural analysis, operations & support systems, performance modeling and planetary balloons. Building on the foundations of the 18-year research and development program, a technology roadmap has been generated which identifies specific areas of interest to NASA and the vision of future

developments. The major components of the roadmap are: vehicle systems, balloon-craft systems, operational and safety support systems, and planetary vehicles. Current technology activities include nanocomposite balloon films, a new balloon designed to lift 3600 kgs to 36 km, a balloon rotation rate study and Mars pumpkin balloon investigations. The technology roadmap, as well as specific projects and recent advancements, will be presented.
Author
Balloons; Design Analysis; Performance Prediction

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*.

20040077278 NASA Ames Research Center, Moffett Field, CA, USA
Microphone Array Phased Processing System (MAPPS): Version 4.0 Manual
Watts, Michael E.; Mosher, Marianne; Barnes, Michael; Bardina, Jorge; March 1999; 143 pp.; In English; Original contains black and white illustrations
Contract(s)/Grant(s): 519-20-21
Report No.(s): NASA/TM-1999-208755; A-9900429; No Copyright; Avail: CASI; A07, Hardcopy

A processing system has been developed to meet increasing demands for detailed noise measurement of individual model components. The Microphone Array Phased Processing System (MAPPS) uses graphical user interfaces to control all aspects of data processing and visualization. The system uses networked parallel computers to provide noise maps at selected frequencies in a near real-time testing environment. The system has been successfully used in the NASA Ames 7- by 10-Foot Wind Tunnel.
Author
Noise Measurement; Graphical User Interface; Microphones; Parallel Computers

20040079635 Swedish Defence Research Establishment, Stockholm
Adaptive Structures for Aeronautical Applications, a Literature Survey AD 2003
Jarlas, R.; Andersson, B.; Hammer, O.; Hanifi, A.; Levin, K.; 2003; 62 pp.; In Swedish
Report No.(s): PB2004-104627; FOI-R-0914-SE; No Copyright; Avail: CASI; A04, Hardcopy

Progress in the development of adaptive structures for aeronautical applications, i.e. development of aircraft structures with an adaptive exterior or interior shape, is believed to have a potential to significantly improve the performance of future aircraft and UCAV's. Severe radar-signature requirements and increased traditional aeronautical performance and flexibility requirements may, in combination with the technical progress, push innovative technical designs. This survey points at activities reported internationally, with a focus on techniques that may be applicable to future UCAV's. Focus is on work concerning how to accomplish changes to the vehicles' exterior shape and the influence on aircraft performance. Investigations are carried out worldwide based on simulations, wind tunnel- and flight-tests to gather experience and to make estimates of potential future aeronautical performance gains. Extensive activities are among other things carried out regarding development of components based on new techniques to accomplish mechanical motion. In the long term this may lead to new designs for instance replacing current designs based on hydraulics. Studies of more significant shape- or configuration-changes, so called morphing has also been reported. Such morphing requires significant technical evolution in actuator- and material-development.
NTIS
Aircraft Structures; Actuators; Flexibility; Aircraft Performance

20040081236 Army Missile Command, Moffett Field, CA, USA
Aerodynamic Characteristics of SC1095 and SC1094 R8 Airfoils
Bousman, William G.; December 2003; 50 pp.; In English
Report No.(s): NASA/TP-2003-212265; A-0309129; AFDD/TR-04-003; No Copyright; Avail: CASI; A03, Hardcopy

Two airfoils are used on the main rotor blade of the UH-60A helicopter, the SC1095 and the SC1094 R8. Measurements of the section lift, drag, and pitching moment have been obtained in ten wind tunnel tests for the SC1095 airfoil, and in five of these tests, measurements have also been obtained for the SC1094 R8. The ten wind tunnel tests are characterized and

described in the present study. A number of fundamental parameters measured in these tests are compared and an assessment is made of the adequacy of the test data for use in look-up tables required by lifting-line calculation methods.
Author
Aerodynamic Characteristics; Airfoils; Wind Tunnel Tests; Rotor Blades (Turbomachinery); Uh-60a Helicopter

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*.

20040074498 Federal Aviation Administration, Atlantic City, NJ, USA
Behavior of Bromotrifluoropropene and Pentafluoroethane when Subjected to a Simulated Aerosol Can Explosion
Reinhardt, J. W.; May 2004; 30 pp.; In English
Report No.(s): PB2004-105484; DOT/FAA/AR-TN04/4; No Copyright; Avail: CASI; A03, Hardcopy
This technical note presents the data from simulated aerosol can explosion tests while using bromotrifluoropropene (BTP) and pentafluoroethane (HFC-125) as fire suppression agents for aircraft cargo compartments. These explosion tests were conducted at below inert volumetric concentrations to determine the agent's explosion attenuation performance. The tests were conducted inside a 402-ft3 pressure vessel. The collected data showed that BTP and HFC-125, at these below inert concentrations, enhanced the explosion (acted as fuel) instead of mitigating it.
NTIS
Aerosols; Explosions; Pressure Vessels

20040078795 Air Force Occupational Measurement Center, Randolph AFB, TX
Occupational Survey Report AFSC 2A6X3; Aircrew Egress Systems
Alanis, Nora; Jan. 20, 2004; 35 pp.; In English; Original contains color illustrations
Report No.(s): AD-A423235; No Copyright; Avail: CASI; A03, Hardcopy
No abstract available
Armed Forces (United States); Education; Egress; Flight Crews; Military Personnel; Occupation; Personnel; Surveys; Tasks

20040079360 NASA Ames Research Center, Moffett Field, CA, USA
Fleet Assignment Using Collective Intelligence
Antoine, Nicolas E.; Bieniawski, Stefan R.; Kroo, Ilan M.; Wolpert, David H.; [2004]; 5 pp.; In English; Copyright; Avail: CASI; A01, Hardcopy
Airline fleet assignment involves the allocation of aircraft to a set of flights legs in order to meet passenger demand, while satisfying a variety of constraints. Over the course of the day, the routing of each aircraft is determined in order to minimize the number of required flights for a given fleet. The associated flow continuity and aircraft count constraints have led researchers to focus on obtaining quasi-optimal solutions, especially at larger scales. In this paper, the authors propose the application of an agent-based integer optimization algorithm to a "cold start" fleet assignment problem. Results show that the optimizer can successfully solve such highly- constrained problems (129 variables, 184 constraints).
Author
Airline Operations; Intelligence; Algorithms

20040081054 Nebraska Univ., Omaha, NE, USA
The Conference Proceedings of the 2003 Air Transport Research Society (ATRS) World Conference, Volume 3
Bowen, Brent, Editor; Gudmundsson, Sveinn, Editor; Oum, Tae, Editor; July 2003; 229 pp.; In English; 2003 Air Transport Research Society World Conference, 10-12 Jul. 2003, Toulouse, France
Report No.(s): UNOAI-03-7-Vol-3; Copyright; Avail: CASI; A11, Hardcopy
Distinguished guests, ladies and gentlemen! It gives me a great pleasure to welcome all of you to the ATRS World Conference being hosted jointly by Groupe ESC (Toulouse Business School) and the ENAC (Ecole Nationale de Aviation Civile). Today and tomorrow, in addition to the Opening and the Closing Plenary sessions, 112 papers will be presented on virtually all aspects of air transport and related topics. 2003 is a particularly challenging year to air transport policy makers,

aviation executives and researchers as most of the major network airlines are experiencing unprecedented level of financial difficulties in the 100-year history of aviation. Airlines are succeeding in restructuring their service networks, and streamlining their operations to an unprecedented level, and start to listen to what their customers and markets are telling them more closely. Most major network camers in the USA and Canada have achieved a unit cost reduction of about 25% via their recent restructuring efforts. They will be coming out of these crises with resounding success in order to serve the rising demands for efficient and cost effective services. Now, I believe it is turn for the airports and air traffic control systems to do a restructuring comparable to what airlines have been doing in recent years. In this regard, I am particularly happy to see many papers and presentations in this conference are focusing the airports and air traffic control systems.
Author (revised)
Air Transportation; Airline Operations; Airports

20040081155 NASA Langley Research Center, Hampton, VA, USA
Pilot in Command: An Illustration of Autonomous Flight Management
Wing, David J.; Ponthieux, Joseph G.; June 2004; In English
Contract(s)/Grant(s): WU 23-727-01-10; No Copyright; Avail: CASI; V01, Videotape-VHS; B01, Videotape-Beta

Several years of NASA research have produced the concept for air traffic management called "Distributed Air/Ground Traffic Management," a major operational advancement that should significantly increase the capacity of the National Airspace System. A key component, "Autonomous Flight Management," introduces a new class of aircraft operations in which pilots are authorized to freely maneuver and execute optimal trajectories independent from air traffic controllers. These aircraft operators would benefit from significant increases in flexibility to optimize all flight operations and from avoiding most of the delays associated with ground-controlled operations. Responsibilities for aircraft separation and arrival flow conformance are transferred to the flight deck, and the pilots use computerized decision-support tools to accomplish these tasks. A research prototype of these tools called the "Autonomous Operations Planner" is being developed at the NASA Langley Research Center. This 14-minute video illustrates Autonomous Flight Management from the airline pilot's perspective.
CASI
Decision Support Systems; Aircraft Landing; Flight Plans; Air Traffic Control

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*.

20040077259 Illinois Univ., Savoy, IL, USA
3D Navigation and Integrated Hazard Display in Advanced Avionics: Workload, Performance, and Situation Awareness
Wickens, Christopher D.; Alexander, Amy L.; June 2004; 14 pp.; In English
Contract(s)/Grant(s): NAG1-03014
Report No.(s): AHFD-04-9/NASA-04-3; No Copyright; Avail: CASI; A03, Hardcopy

We examined the ability for pilots to estimate traffic location in an Integrated Hazard Display, and how such estimations should be measured. Twelve pilots viewed static images of traffic scenarios and then estimated the outside world locations of queried traffic represented in one of three display types (2D coplanar, 3D exocentric, and split-screen) and in one of four conditions (display present/blank crossed with outside world present/blank). Overall, the 2D coplanar display best supported both vertical (compared to 3D) and lateral (compared to split-screen) traffic position estimation performance. Costs of the 3D display were associated with perceptual ambiguity. Costs of the split screen display were inferred to result from inappropriate attention allocation. Furthermore, although pilots were faster in estimating traffic locations when relying on memory, accuracy was greatest when the display was available.
Author
Three Dimensional Models; Navigation Aids; Hazards; Display Devices

20040079838 NASA Goddard Space Flight Center, Greenbelt, MD, USA

An Environment for Hardware-in-the-Loop Formation Navigation and Control Simulation

Burns, Rich; January 30, 2004; 1 pp.; In English; AIAA/AAS Astrodynamics Conference, Aug. 2004, Providence, RI, USA
Contract(s)/Grant(s): GS-35F-0060N; No Copyright; Avail: Other Sources; Abstract Only

Recent interest in formation flying satellite systems has spurred a considerable amount of research in the relative navigation and control of satellites. Development in this area has included new estimation and control algorithms as well as sensor and actuator development specifically geared toward the relative control problem. This paper describes a simulation facility, the Formation Flying Testbed (FFTB) at NASA's Goddard Space Flight Center, which allows engineers to test new algorithms for the formation flying problem with relevant GN&C hardware in a closed loop simulation. The FFTB currently supports the injection of GPS receiver hardware into the simulation loop, and support for satellite crosslink ranging technology is at a prototype stage. This closed-loop, hardware inclusive simulation capability permits testing of navigation and control software in the presence of the actual hardware with which the algorithms must interact. This capability provides the navigation or control developer with a perspective on how the algorithms perform as part of the closed-loop system. In this paper, the overall design and evolution of the FFTB are presented. Each component of the FFTB is then described in detail. Interfaces between the components of the FFTB are shown and the interfaces to and between navigation and control software are described in detail. Finally, an example of closed-loop formation control with GPS receivers in the loop is presented and results are analyzed.

Author

Computerized Simulation; Control Simulation; Formation Flying; Guidance (Motion); Navigation; Feedback Control; Actuators

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*.

20040077263 General Electric Co., Lynn, MA, USA

Contingency Power Study for Short Haul Civil Tiltrotor

D'Angelo, Marin M.; May 2004; 56 pp.; In English
Contract(s)/Grant(s): NAS3-26617; WBS 714-70-00
Report No.(s): NASA/CR-2004-213096; E-14571; No Copyright; Avail: CASI; A04, Hardcopy

NASA has concluded from previous studies that the twin engine tiltrotor is the most economical and technologically viable rotorcraft for near-term civil applications. Twin engine civil rotorcraft must be able to hover safely on one engine in an emergency. This emergency power requirement generally results in engines 20 to 50 percent larger than needed for normal engine operation, negatively impacting aircraft economics. This study identifies several contingency power enhancement concepts, and quantifies their potential to reduce aircraft operating costs. Many unique concepts were examined, and the selected concepts are simple, reliable, and have a high potential for near term realization. These engine concepts allow extremely high turbine temperatures during emergency operation by providing cooling to the power turbine and augmenting cooling of both turbines and structural hardware. Direct operating cost are reduced 3 to percent, which could yield a 30 to 80 percent increase in operating profits. The study consists of the definition of an aircraft economics model and a baseline engine, and an engine concept screening study, and a preliminary definition of the selected concepts. The selected concepts are evaluated against the baseline engine, and the critical technologies and development needs are identified, along with applications for this technology.

Author

Tilt Rotor Aircraft; Propulsion; Turbines; Augmentation; Engine Design

20040077374 NASA Ames Research Center, Moffett Field, CA, USA

Effects of V-22 Blade Modifications on Whirl Flutter and Loads

Acree, C. W., Jr.; 2004; 15 pp.; In English; No Copyright; Avail: CASI; A03, Hardcopy

A CAMRAD II model of the V-22 Osprey tiltrotor was constructed for the purpose of analyzing the effects of blade design changes on whirl flutter. The model incorporated a dual load-path grip/yoke assembly, a swashplate coupled to the transmission case, and a drive train. A multiple-trailer free wake was used for loads calculations. The effects of rotor design

changes on whirl-mode stability were calculated for swept blades and offset tip masses. A rotor with swept tips and inboard tuning masses was examined in detail to reveal the mechanisms by which these design changes affect stability and loads. Certain combinations of design features greatly increased whirl-mode stability, with (at worst) moderate increases to loads. Author

Tilt Rotor Aircraft; Rotor Aerodynamics; V-22 Aircraft; Wakes

20040078793 Civil Aeromedical Inst., Oklahoma City, OK

Performance Criteria for Development of Extended Use Protective Breathing Equipment

Garner, Robert P.; Utechtt, Jeffrey S.; Feb. 2004; 8 pp.; In English

Report No.(s): AD-A423233; DOT/FAA/AM-04/3; No Copyright; Avail: CASI; A02, Hardcopy

The Federal Aviation Administration (FAA) requires under Federal Aviation Regulation (FAR) 121.337 that crew protective breathing equipment (PBE) for smoke and fume protection is installed aboard aircraft and that crewmembers be trained in the proper use of PBE (FAR 121.417). A variety of designs currently exist that meet the requirements of these regulations. However, the threat posed by atmospheric contamination in an environment that cannot be quickly escaped suggest that extending the protective capabilities of PBE devices beyond what is mandated by the FAA may be beneficial in aviation and other arenas. These experiments were conducted to evaluate the use of one style of PBE in terms of potential for long-term (>20 min) use and to identify issues critical to long-term use. A closed-circuit PBE device utilizing lithium hydroxide (LiOH) technology for carbon dioxide (CO2) removal was tested.

DTIC

Aircraft Equipment; Breathing Apparatus; Commercial Aircraft; Protectors

20040078841 Army War Coll., Carlisle Barracks, PA

Navy/Marine Corps TacAir Integration Plan: Transformation or Reorganization for the Marine Corps It's the STOVL Imperative

Bottorff, Francis P.; Mar. 19, 2004; 26 pp.; In English; Original contains color illustrations

Report No.(s): AD-A423314; No Copyright; Avail: CASI; A03, Hardcopy

The Navy/Marine Corps TACAIR integration plan is an aggressive long-term initiative that will seamlessly meld the fixed wing tactical aviation assets of both the Navy and Marine Corps. If fully and successfully integrated the efficiencies gained could save billions over the next 15-17 years. The intent of this project is to fiscally and operationally review the planned integration and make change recommendations as appropriate.

DTIC

Military Aviation; Navy; Support Systems; V/Stol Aircraft

20040079751 General Accounting Office, Washington, DC

Military Aircraft: DOD Needs to Determine Its Aerial Refueling Aircraft Requirements

Jun. 2004; 46 pp.; In English

Report No.(s): PB2004-105543; GAO-04-349; No Copyright; Avail: CASI; A03, Hardcopy

With the heavy pace of operations in support of the war on terrorism, the Department of Defense (DOD) and the Air Force have become increasingly concerned about their aging aerial refueling aircraft. We last reviewed the aerial refueling fleet in 1996 and found that KC-135 aircraft were aging and becoming increasingly costly to maintain and operate. In December 2001, we began new work on the Air Forces requirements for refueling aircraft. However, we suspended our work several times to provide testimony and other products on the condition of the current fleet and Air Force plans to accelerate replacement. We were asked to review (1) the extent to which the current fleet has met aerial refueling needs, and the cost and effort to operate and sustain the fleet, (2) DOD's current refueling requirements, and (3) options to meet future aerial refueling needs.

NTIS

Tanker Aircraft; Refueling; C-135 Aircraft

20040079755 General Accounting Office, Washington, DC

Joint Strike Fighter Acquisition: Observations on the Supplier Base

May 2004; 24 pp.; In English

Report No.(s): PB2004-105535; GAO-04-554; No Copyright; Avail: CASI; A03, Hardcopy

As the Department of Defenses (DOD) most expensive aircraft program, and its largest international program, the Joint Strike Fighter (JSF) has the potential to significantly affect the worldwide defense industrial base. As currently planned, it will

cost an estimated $245 billion for DOD to develop and procure about 2,400 JSF aircraft and related support equipment by 2027. In addition, the program expects international sales of 2, 000 to 3,500 aircraft. If the JSF comes to dominate the market for tactical aircraft as DOD expects, companies that are not part of the program could see their tactical aircraft business decline. Although full rate production of the JSF is not projected to start until 2013, contracts awarded at this point in the program will provide the basis for future awards. GAO was asked to determine the limits on and extent of foreign involvement in the JSF supplier base. To do this, GAO (1) determined how the Buy American Act and the Preference for Domestic Specialty Metals clause apply to the JSF development phase and the extent of foreign subcontracting on the program and (2) identified the data available to the JSF Program Office to manage its supplier base, including information on suppliers of critical technologies. DOD provided technical comments on a draft of this report, which GAO incorporated as appropriate.
NTIS
Fighter Aircraft; Commerce; Costs

20040079764 Transportation Security Administration, Washington, DC, USA
Qualitative Assessment of Catastrophic Risk to Commercial Aircraft from Federal Flight Deck Officer Weapon Discharge
Fleisher, H.; Emmerling, W.; Aishton, T.; Hawkins, P.; Jones, C.; Nov. 2003; 126 pp.; In English
Report No.(s): PB2004-104988; DHS/TSA/TSL-03/57; No Copyright; Avail: CASI; A07, Hardcopy

The qualitative risk assessment reported herein is in response to a congressional requirement (title XIV of the Homeland Security Act of 2002) for 'an analysis of the risk of catastrophic failure of an aircraft as a result of the discharge (including an accidental discharge) of a firearm to be used in the (FFDO) program into the avionics, electrical systems, or other sensitive areas of the aircraft.' A Task Force comprising specialists from the TSA, FAA, and DoD was assembled and planned and executed the data collection and analysis during a six-month time period beginning in May 2003. Tasks included review of prior work, identification of critical systems and components that could be damaged by firearm discharged in the cockpit, ballistics testing of systems and components at the NAWCD test facility at China Lake, a computer modeling demonstration calculating the probability of catastrophic failure using an existing survivability modeling tool, expert analysis of all collected data, and drafting of conclusions and recommendations. In general, it appears unlikely that any single shot from an FFDO weapon would result in either a catastrophic accident or a significant reduction in airworthiness of the airplane.
NTIS
Risk; Commercial Aircraft

20040081233 NASA Ames Research Center, Moffett Field, CA, USA
Analysis of In-Flight Vibration Measurements from Helicopter Transmissions
Mosher, Marianne; Huff, Ed; Barszcz; 2004; 16 pp.; In English; 60th Forum of American Helicopter Society, 8-10 Jun. 2004, Baltimore, MD, USA; Original contains black and white illustrations
Contract(s)/Grant(s): 704-01-30; Copyright; Avail: CASI; A03, Hardcopy

In-flight vibration measurements from the transmission of an OH-58C KIOWA are analyzed. In order to understand the effect of normal flight variation on signal shape, the first gear mesh components of the planetary gear system and bevel gear are studied in detail. Systematic patterns occur in the amplitude and phase of these signal components with implications for making time synchronous averages and interpreting gear metrics in flight. The phase of the signal component increases as the torque increases; limits on the torque range included in a time synchronous average may now be selected to correspond to phase change limits on the underlying signal. For some sensors and components, an increase in phase variation and/or abrupt change in the slope of the phase dependence on torque are observed in regions of very low amplitude of the signal component. A physical mechanism for this deviation is postulated. Time synchronous averages should not be constructed in torque regions with wide phase variation.
Author
Oh-58 Helicopter; Helicopter Propeller Drive; Transmissions (Machine Elements); Vibration Measurement; Flight Tests; Systems Health Monitoring

06
AVIONICS AND AIRCRAFT INSTRUMENTATION

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

20040079631 Swedish Defence Research Establishment, Linkoeping
Concept Studies Guidance Radar Final Report 2003
Herberthson, M.; Dec. 2003; 28 pp.; In Swedish
Report No.(s): PB2004-104636; FOI-R-1040-SE; No Copyright; Avail: CASI; A03, Hardcopy

Research activities in VHF/UHF radar are interesting for several reasons. One main reason is that the comparably low frequencies enable some detection capability through foliage (ground targets) or, in particular in combination with bistatic measurement geometries, enable detection of air targets of stealth type. These issues, especially the latter, have been studied in the project 'Concept studies Guidance Radar'. The work is summarized in this report. In particular, the concept with a ground based distributed radar for air surveillance (AASR - associative aperture synthesis radar) has been studied. In this concept, multistatic geometries in combination with frequencies which are in near resonance with the targets, give a system with good capacity of detection, positioning and tracking of air targets, including stealth targets. On the other hand, the particular measurement geometry gives non-trivial signal processing problems; we have shown, within the project, how to solve the so-called association problem. The work is well in line with the international development. There is an increasing interest for bi- and multistatic sensor systems, one reason being that signal processing demand which were previously without reach, with the current processing power are surmountable. The work is also important considering Sweden's upcoming need for a modernization of the air surveillance radars.
NTIS
Low Frequencies; Very High Frequencies; Aerial Reconnaissance

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*.

20040078909 Defense Acquisition Univ., Alexandria, VA
How Compensation in Test and Evaluation Affects Aircraft Acquisition
Alford, Lionel D.; Apr. 2004; 15 pp.; In English
Report No.(s): AD-A423468; No Copyright; Avail: CASI; A03, Hardcopy

Systems developers and testers have assumed that human compensation is measurable, or at least that a cognizant and trained tester is able to identity and detect compensation. More than one study conducted at the Wright-Patterson LAMAPS facility indicates that this is not necessarily true. Test pilots were able to compensate sufficiently to fly and meet defined performance standards on intentionally crippled aircraft flight control designs. These flight control systems were designed to trigger pilot induced oscillations, but in most cases, test pilots could compensate sufficiently to prevent pilot induced oscillations and to control the simulated aircraft. Test pilot compensation hides critical handling qualities cliffs that can lead to loss of an aircraft when encountered by less skilled pilots. This observation has vast ramifications for test, evaluation, and development of all human interface systems.
DTIC
Evaluation; Flight Control; System Effectiveness

20040079383 NASA Ames Research Center, Moffett Field, CA, USA
UIVerify: A Web-Based Tool for Verification and Automatic Generation of User Interfaces
Shiffman, Smadar; Degani, Asaf; Heymann, Michael; 2004; 5 pp.; In English; No Copyright; Avail: CASI; A01, Hardcopy

In this poster, we describe a web-based tool for verification and automatic generation of user interfaces. The verification component of the tool accepts as input a model of a machine and a model of its interface, and checks that the interface is adequate (correct). The generation component of the tool accepts a model of a given machine and the user's task, and then generates a correct and succinct interface. This write-up will demonstrate the usefulness of the tool by verifying the correctness of a user interface to a flight-control system. The poster will include two more examples of using the tool: verification of the

interface to an espresso machine, and automatic generation of a succinct interface to a large hypothetical machine.
Author
Flight Control; User Requirements; Proving

20040081034 NASA Ames Research Center, Moffett Field, CA, USA
User's Guide for ENSAERO_FE Parallel Finite Element Solver
Eldred, Lloyd B.; Guruswamy, Guru P.; April 1999; 39 pp.; In English
Contract(s)/Grant(s): 509-10-11
Report No.(s): NASA/TM-1999-208781; A-99V0021; No Copyright; Avail: CASI; A03, Hardcopy

A high fidelity parallel static structural analysis capability is created and interfaced to the multidisciplinary analysis package ENSAERO-MPI of Ames Research Center. This new module replaces ENSAERO's lower fidelity simple finite element and modal modules. Full aircraft structures may be more accurately modeled using the new finite element capability. Parallel computation is performed by breaking the full structure into multiple substructures. This approach is conceptually similar to ENSAERO's multizonal fluid analysis capability. The new substructure code is used to solve the structural finite element equations for each substructure in parallel. NASTRANKOSMIC is utilized as a front end for this code. Its full library of elements can be used to create an accurate and realistic aircraft model. It is used to create the stiffness matrices for each substructure. The new parallel code then uses an iterative preconditioned conjugate gradient method to solve the global structural equations for the substructure boundary nodes.
Author
Parallel Computers; Structural Analysis; Finite Element Method; Stiffness Matrix; Aircraft Structures

20040081158 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Approach for Autonomous Control of Unmanned Aerial Vehicle Using Intelligent Agents for Knowledge Creation
Dufrene, Warren R., Jr.; 2004; 1 pp.; In English; 23rd Digital Avionics Systems Conference, 24-28 Oct. 2004, Salt Lake City, UT, USA; No Copyright; Avail: Other Sources; Abstract Only

This paper describes the development of a planned approach for Autonomous operation of an Unmanned Aerial Vehicle (UAV). A Hybrid approach will seek to provide Knowledge Generation thru the application of Artificial Intelligence (AI) and Intelligent Agents (IA) for UAV control. The application of many different types of AI techniques for flight will be explored during this research effort. The research concentration will be directed to the application of different AI methods within the UAV arena. By evaluating AI approaches, which will include Expert Systems, Neural Networks, Intelligent Agents, Fuzzy Logic, and Complex Adaptive Systems, a new insight may be gained into the benefits of AI techniques applied to achieving true autonomous operation of these systems thus providing new intellectual merit to this research field. The major area of discussion will be limited to the UAV. The systems of interest include small aircraft, insects, and miniature aircraft. Although flight systems will be explored, the benefits should apply to many Unmanned Vehicles such as: Rovers, Ocean Explorers, Robots, and autonomous operation systems. The flight system will be broken down into control agents that will represent the intelligent agent approach used in AI. After the completion of a successful approach, a framework of applying a Security Overseer will be added in an attempt to address errors, emergencies, failures, damage, or over dynamic environment. The chosen control problem was the landing phase of UAV operation. The initial results from simulation in FlightGear are presented.
Author
Artificial Intelligence; Automatic Control; Pilotless Aircraft; Approach Control; Control Systems Design

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)*.

20040078849 Air Force Occupational Measurement Center, Randolph AFB, TX
Occupational Survey Report AFSC 2A6X1A Aerospace Propulsion (Jet Engines)
Allick, David; Nov. 25, 2003; 51 pp.; In English; Original contains color illustrations
Report No.(s): AD-A423341; No Copyright; Avail: CASI; A04, Hardcopy

No abstract available
Aircraft Maintenance; Jet Engines; Spacecraft Propulsion; Surveys

20040078889 Air Force Logistics Management Center, Gunter AFS, AL
Air Force Journal of Logistics. Volume 13, Number 2, Spring 1989
Jan. 1989; 44 pp.; In English
Report No.(s): AD-A423430; No Copyright; Avail: CASI; A03, Hardcopy
No abstract available
Aircraft Maintenance; Logistics

20040079836 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Goddard Space Flight Center Spacecraft Magnetic Test Facility Restoration Project
Vernier, Robert; Bonalksy, Todd; Slavin, James; 2004; 1 pp.; In English; 23rd Space Simulation Conference, 8-11 Nov. 2004, Annapolis, MD, USA; No Copyright; Avail: Other Sources; Abstract Only

The Goddard Space Flight Center Spacecraft Magnetic Test Facility (SMTF) was constructed in the 1960's for the purpose of simulating geomagnetic and interplanetary magnetic field environments. The facility includes a three axis Braunbek coil system consisting of 12 loops, 4 loops on each of the three orthogonal axes; a remote earth field sensing magnetometer and servo control building; and a remote power control and instrumentation building. The inner coils are 42-foot in diameter and a 10-foot by 10-foot opening through the outer coils accommodates spacecraft access to the test volume. The physical size and precision of the facility are matched by only two other such facilities in the world. The facility was used extensively from the late 1960's until the early 1990's when the requirement for spacecraft level testing diminished. New NASA missions planned under the Living with a Star, Solar Terrestrial Probes, Explorer, and New Millennium Programs include precision, high-resolution magnetometers to obtain magnetic field data that is critical to fulfilling their scientific mission. It is highly likely that future Lunar and Martian exploration missions will also use precision magnetometers to conduct geophysical magnetic surveys. To ensure the success of these missions ground testing using a magnetic test facility such as the GSFC SMTF will be required. This paper describes the history of the facility, the future mission requirements that have renewed the need for spacecraft level magnetic testing, and the plans for restoring the facility to be capable of performing to its original design specifications.
Author
Design Analysis; Magnetic Surveys; Restoration; Test Facilities

20040081235 NASA Ames Research Center, Moffett Field, CA, USA, Army Missile Command, Moffett Field, CA, USA
Rotor Design Options for Improving XV-15 Whirl-Flutter Stability Margins
Acree, C. W., Jr.; Peyran, R. J.; Johnson, Wayne; March 2004; 54 pp.; In English
Contract(s)/Grant(s): 21-745-00-00
Report No.(s): NASA/TP-2004-212262; AFDD/TR-04-001; A-0309307; No Copyright; Avail: CASI; A04, Hardcopy

Rotor design changes intended to improve tiltrotor whirl-flutter stability margins were analyzed. A baseline analytical model of the XV-15 was established, and then a thinner, composite wing was designed to be representative of a high-speed tiltrotor. The rotor blade design was modified to increase the stability speed margin for the thin-wing design. Small rearward offsets of the aerodynamic-center locus with respect to the blade elastic axis created large increases in the stability boundary. The effect was strongest for offsets at the outboard part of the blade, where an offset of the aerodynamic center by 10% of tip chord improved the stability margin by over 100 knots. Forward offsets of the blade center of gravity had similar but less pronounced effects. Equivalent results were seen for swept-tip blades. Appropriate combinations of sweep and pitch stiffness completely eliminated whirl flutter within the speed range examined; alternatively, they allowed large increases in pitch-flap coupling (delta-three) for a given stability margin. A limited investigation of the rotor loads in helicopter and airplane configuration showed only minor increases in loads.
Author
Flutter; Rotor Aerodynamics; Xv-15 Aircraft; Mathematical Models; Aircraft Design; Rotary Stability

20040081237 NASA Ames Research Center, Moffett Field, CA, USA, Sverdrup Technology, Inc., Moffett Field, CA, USA
Direct Validation of the Wall Interference Correction System of the Ames 11-Foot Transonic Wind Tunnel
Ulbrich, Norbert; Boone, Alan R.; May 2003; 64 pp.; In English
Contract(s)/Grant(s): NAS2-98083
Report No.(s): NASA/TM-2003-212268; A-03010210; No Copyright; Avail: CASI; A04, Hardcopy

Data from the test of a large semispan model was used to perform a direct validation of a wall interference correction system for a transonic slotted wall wind tunnel. At first, different sets of uncorrected aerodynamic coefficients were generated

by physically changing the boundary condition of the test section walls. Then, wall interference corrections were computed and applied to all data points. Finally, an interpolation of the corrected aerodynamic coefficients was performed. This interpolation made sure that the corrected Mach number of a given run would be constant. Overall, the agreement between corresponding interpolated lift, drag, and pitching moment coefficient sets was very good. Buoyancy corrections were also investigated. These studies showed that the accuracy goal of one drag count may only be achieved if reliable estimates of the wall interference induced buoyancy correction are available during a test.
Author
Correction; Transonic Wind Tunnels; Wall Flow; Wind Tunnel Tests; Aerodynamic Interference; Slotted Wind Tunnels

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*.

20040077301 Lawrence Livermore National Lab., Livermore, CA
Space Debris De-Orbiting by Vaporization Impulse Using Short Pulse Laser
Early, J. T.; Bibeau, C.; Phipps, C.; Sep. 16, 2003; 18 pp.; In English
Report No.(s): DE2004-15006465; UCRL-JC-155482; No Copyright; Avail: Department of Energy Information Bridge

Space debris constitutes a significant hazard to low earth orbit satellites and particularly to manned spacecraft. A quite small velocity decrease from vaporization impulses is enough to lower the perigee of the debris sufficiently for atmospheric drag to de-orbit the debris. A short pulse (picosecond) laser version of the Orion concept can accomplish this task in several years of operation. The 'Mercury' short pulse Yb:S-FAP laser being developed at LLNL for laser fusion is appropriate for this task.
NTIS
Space Debris; Evaporation; Pulsed Lasers

20040078817 Texas Univ. at Dallas, Richardson, TX
Sensor Development Thermospheric Neutral Wind Measurements
Heelis, R. A.; May 16, 2003; 8 pp.; In English
Contract(s)/Grant(s): F19628-00-C-0028; Proj-2310
Report No.(s): AD-A423272; AFRL-VS-TR-2003-1579; AFRL-VS-HA-TR-2004-1027; No Copyright; Avail: CASI; A02, Hardcopy

The final preparatory work toward the functional design of a flight sensor for neutral wind measurements has been completed. Extensive laboratory testing has been followed by digital control design that will allow the input drivers and the output currents to be assembled for delivery to the ground. A flexible format for energy discrimination in the retarding potential analyzer must allow for the expected geophysical variation in the velocity and temperature of the species. The instrument operation must also be synchronized to allow autonomous data reduction on the ground from a single packet of data.
DTIC
Measuring Instruments; Neutral Atmospheres; Thermosphere; Wind Measurement; Wind Velocity; Winds Aloft

20040078843 Army War Coll., Carlisle Barracks, PA
USSTRATCOM: The Continuing Transformation of Military Space
Costello, Eugene D.; May 3, 2004; 25 pp.; In English
Report No.(s): AD-A423321; No Copyright; Avail: CASI; A03, Hardcopy

Since the end of the Cold War the USA has experienced a dramatic shift in strategic and military threats. The terror attacks of September 11 2001 have identified that emerging threats of the new millennium threats led by rogue nations and terror organizations are capable of inflicting substantial economic and physical damage to the USA. The organization and employment of space systems which are crucial in the strategic operational and tactical levels of military operations need to transform in order to meet the increasing command control and information dissemination requirements. This paper will determine if the merger between U.S. Space Command and U.S. Strategic Command enables the Department of Defense to transform its military space operations in order to engage and defend against the emerging asymmetric threats of the 21st

century. This study will review the military objectives for transformation previous examples of transformations in the military space program and the external factors which drove the current need for transformation. This paper concludes that the U.S. Space Command and U.S. Strategic Command merger is an evolutionary transformation that not only meets the requirements for today but will also enable future transformations in space operations as emerging capabilities and threats develop.
DTIC
Military Operations; Space Missions

20040078916 Georgia Inst. of Tech., Atlanta, GA
Nonlinear Spacecraft Control with Applications to Combined Attitude and Energy Storage
Tsiotras, Panagiotis; Apr. 2004; 23 pp.; In English
Contract(s)/Grant(s): F49620-00-1-0374
Report No.(s): AD-A423478; AFRL-SR-AR-TR-04-0272; No Copyright; Avail: CASI; A03, Hardcopy

The period of performance for this research award was from August 2000 to January 2004. The main objective of this research was to support the Air Force efforts in the development of an Integrated Power and Attitude Controls System (IPACS) for spacecraft applications. An IPACS will combine the attitude control and power distribution subsystems onboard a spacecraft reducing the bus mass, and thus leading to increased payload. Several options for IPACS have been investigated in this work including clusters of momentum wheels and variable-speed control moment gyros. The latter seem to be ideally suited for IPACS applications since they naturally decompose the power storage/release function using the wheel acceleration, and the attitude control function using the gimbal acceleration. Consequently, the focus of this research has thus been confined to the use of VSCMG5. Several practical and theoretical issues were encountered and were successfully addressed.
DTIC
Attitude (Inclination); Attitude Control; Energy Storage; Nonlinearity; Spacecraft Control

20040079766 Space Environment Services Center, Boulder, CO, USA
Space Environment Center 2002-2003
Feb. 2004; In English
Report No.(s): PB2004-104650; No Copyright; Avail: National Technical Information Service (NTIS)

Contents include the following: Welcome to Space Environment Center; SEC-Past, Present, and Future; Space Weather Forecasting; Directed Research; GOES Acquisition; POES Acquisition; Product Development and Transition; Satellite and Data Services; System and User Support; Environmental Literacy; Vision of SEC in 5 Years; Facts About SEC; SEC Staff List; Publications.
NTIS
Aerospace Environments; Weather Forecasting; Meteorology

20040081028 NASA Marshall Space Flight Center, Huntsville, AL, USA
NASA Workshop on Technology for Human Robotic Exploration and Development of Space
Mankins, J. C.; Marzwell, N.; Mullins, C. A.; Christensen, C. B.; Howell, J. T.; O'Neil, D. A.; March 1, 2004; 1 pp.; In English
Report No.(s): NASA/CP-2004-213090; M-1101; No Copyright; Avail: Other Sources; Abstract Only

Continued constrained budgets and growing interests in the industrialization and development of space requires NASA to seize every opportunity for assuring the maximum return on space infrastructure investments. This workshop provided an excellent forum for reviewing, evaluating, and updating pertinent strategic planning, identifying advanced concepts and high-risk/high-leverage research and technology requirements, developing strategies and roadmaps, and establishing approaches, methodologies, modeling, and tools for facilitating the commercial development of space and supporting diverse exploration and scientific missions. Also, the workshop addressed important topic areas including revolutionary space systems requiring investments in innovative advanced technologies; achieving transformational space operations through the insertion of new technologies; revolutionary science in space through advanced systems and new technologies enabling experiments to go anytime to any location; and, innovative and ambitious concepts and approaches essential for promoting advancements in space transportation. Details concerning the workshop process, structure, and results are contained in the ensuing report.
Author
Conferences; Space Exploration; Manned Space Flight; Unmanned Spacecraft

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)*.

20040077268 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Agent Technology, Complex Adaptive Systems, and Autonomic Systems: Their Relationships
Truszkowski, Walt; Rash, James; Rouff, Chistopher; Hincheny, Mike; [2004]; 9 pp.; In English; IEEE, ECBS,/EASE 2004, 24-27 May 2004, Brno, Czech Republic; Copyright; Avail: CASI; A02, Hardcopy

To reduce the cost of future spaceflight missions and to perform new science, NASA has been investigating autonomous ground and space flight systems. These goals of cost reduction have been further complicated by nanosatellites for future science data-gathering which will have large communications delays and at times be out of contact with ground control for extended periods of time. This paper describes two prototype agent-based systems, the Lights-out Ground Operations System (LOGOS) and the Agent Concept Testbed (ACT), and their autonomic properties that were developed at NASA Goddard Space Flight Center (GSFC) to demonstrate autonomous operations of future space flight missions. The paper discusses the architecture of the two agent-based systems, operational scenarios of both, and the two systems autonomic properties.
Author
Nanosatellites; Ground Operational Support System; Autonomy; Complex Systems

20040081294 Colsa, Inc., Huntsville, AL, USA
Remote Operations and Ground Control Centers
Bryant, Barry S.; Lankford, Kimberly; Pitts, R. Lee; [2004]; 10 pp.; In English; Space Ops 2004, 17-21 May 2004, Montreal, Canada; No Copyright; Avail: CASI; A02, Hardcopy

The Payload Operations Integration Center (POIC) at the Marshall Space Flight Center supports the International Space Station (ISS) through remote interfaces around the world. The POIC was originally designed as a gateway to space for remote facilities; ranging from an individual user to a full-scale multiuser environment. This achievement was accomplished while meeting program requirements and accommodating the injection of modern technology on an ongoing basis to ensure cost effective operations. This paper will discuss the open POIC architecture developed to support similar and dissimilar remote operations centers. It will include technologies, protocols, and compromises which on a day to day basis support ongoing operations. Additional areas covered include centralized management of shared resources and methods utilized to provide highly available and restricted resources to remote users. Finally, the effort of coordinating the actions of participants will be discussed.
Author
Ground Based Control; Payload Integration; International Space Station; Architecture (Computers); Operations Research

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*.

20040078828 Air Force Research Lab., Hanscom AFB, MA
A Critical Overview on Spacecraft Charging Mitigation Methods
Lai, Shu T.; Dec. 2003; 8 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): Proj-5021
Report No.(s): AD-A423290; AFRL-VS-HA-TR-2004-1073; No Copyright; Avail: CASI; A02, Hardcopy

Interactions between hazardous space plasmas and spacecraft surfaces often result in spacecraft charging. Spacecraft charging may disturb the scientific measurements onboard, affect communications, control, and operations of spacecraft, and may be harmful to the health of the electronics on the spacecraft. Several mitigation methods have been proposed or tested in recent years. This paper presents a critical overview on all of the mitigation methods known to date: 1) passive methods using sharp spikes and high secondary emission coefficient surface materials and 2) active methods using controlled emissions of electrons, ions, plasmas, neutral gas, and polar molecules. Paradoxically, emission of low-energy positive ions from a highly negatively charged spacecraft can reduce the charging level, because the ions tend to return and may generate secondary

electrons which then escape. We discuss the advantages and disadvantages of each of the methods and illustrate the ideas by means of examples of results obtained on SCATHA and DSCS satellites. Finally, mitigation of deep dielectric charging is briefly discussed.
DTIC
Electric Charge; Spacecraft Charging

20040078856 Air Force Research Lab., Hanscom AFB, MA
Molecular Beams in Space: Sources of OH(A yields X) Emission in the Space Shuttle Environment
Bernstein, L. S.; Chiu, Y.; Gardner, J. A.; Broadfoot, A. L.; Lester, M. I.; Nov. 2003; 13 pp.; In English
Report No.(s): AD-A423353; No Copyright; Avail: CASI; A03, Hardcopy

OH(A yields X) emission bands have been observed in the molecular beam jets produced by Space Shuttle engine exhaust using the GLO imager spectrograph located in the payload bay. Spectra were collected at a resolution of 4 Angstrom for both daytime and nighttime solar illumination conditions, all at an altitude of approximately 390 km. A spectral analysis is presented that identifies and quantifies four separate OH(A) excitation processes. These include (i) solar-induced fluorescence of the OH(X) in the exhaust flow, (ii) solar-induced photodissociation of H2O in the exhaust at the strong Lyman-alpha solar emission line (1216 Angstrom), (iii) solar-induced photodissociation of H2O in the far UV, at shorter wavelengths than Lyman-alpha, and (iv) luminescent collisions between atmospheric species and exhaust constituents, most probably the reaction O + H2O yields OH(A) + OH(X). Process (i) produces a very rotationally cold and spectrally narrow component due to the rapid cooling of the OH(X) in the supersonic expansion of the exhaust flow. Processes (ii) and (iii) produce extremely excited OH(A), not well characterized by thermal vibrational or rotational distributions. The 0 + H2O chemiluminescence reaction has a substantial activation energy, 4.79 eV, and is only slightly above threshold for the ram geometry, where the engine exhaust is directed into the atmospheric wind.
DTIC
Aerospace Environments; Molecular Beams; Space Shuttles; Ultraviolet Spectra

20040078941 Defense Acquisition Univ., Alexandria, VA
The Transformation of Contract Incentive Structures
Graham, Robert; Jan. 2003; 27 pp.; In English
Report No.(s): AD-A423525; No Copyright; Avail: CASI; A03, Hardcopy

The National Polar-orbiting Operational Environmental Satellite Systems Acquisition and Operations contract for the next generation of weather satellites uses innovative incentive structures to motivate contractor performance. The incentive approach combines an award fee and mission success fee arrangement to include a cost mitigation approach putting fee at risk and tying corporate executive pay to contract performance. This business approach is complemented by a shared ownership approach to the development and production of the satellites. These innovative approaches give the government the flexibility to share system responsibility while motivating the contractor toward outstanding performance on the contract.
DTIC
Contract Incentives; Contractors; Meteorological Satellites

20040081109 NASA Ames Research Center, Moffett Field, CA, USA
Human Health Risk Assessment Simulations in a Distributed Environment for Shuttle Launch
Thirumalainambi, Rajkumar; Bardina, Jorge; 2004; 10 pp.; In English; No Copyright; Avail: CASI; A02, Hardcopy

During the launch of a rocket under prevailing weather conditions, commanders at Cape Canaveral Air Force station evaluate the possibility of whether wind blown toxic emissions might reach civilian and military personnel in the near by area. In our model, we focused mainly on Hydrogen chloride (HCL), Nitrogen oxides (NOx) and Nitric acid (HNO3), which are non-carcinogenic chemicals as per USA Environmental Protection Agency (USEPA) classification. We have used the hazard quotient model to estimate the number of people at risk. It is based on the number of people with exposure above a reference exposure level that is unlikely to cause adverse health effects. The risk to the exposed population is calculated by multiplying the individual risk and the number in exposed population. The risk values are compared against the acceptable risk values and GO or NO-go situation is decided based on risk values for the Shuttle launch. The entire model is simulated over the web and different scenaria can be generated which allows management to choose an optimum decision.
Author
Spacecraft Launching; Computerized Simulation; Public Health; Mathematical Models; Risk; Space Shuttles

20040081124 NASA Goddard Space Flight Center, Greenbelt, MD, USA

The Wallops Flight Facility Rapid Response Range Operations Initiative

Underwood, Bruce E.; Kremer, Steven E.; 2004; 2 pp.; In English; AIAA Responsive Space Conference, 19-22 Apr. 20004, USA; No Copyright; Avail: Other Sources; Abstract Only

While the dominant focus on short response missions has appropriately centered on the launch vehicle and spacecraft, often overlooked or afterthought phases of these missions have been launch site operations and the activities of launch range organizations. Throughout the history of organized spaceflight, launch ranges have been the bane of flight programs as the source of expense, schedule delays, and seemingly endless requirements. Launch Ranges provide three basic functions: (1) provide an appropriate geographical location to meet orbital other mission trajectory requirements, (2) provide project services such as processing facilities, launch complexes, tracking and data services, and expendable products, and (3) assure safety and property protection to participating personnel and third-parties. The challenge with which launch site authorities continuously struggle, is the inherent conflict arising from projects whose singular concern is execution of their mission, and the range s need to support numerous simultaneous customers. So, while tasks carried out by a launch range committed to a single mission pale in comparison to efforts of a launch vehicle or spacecraft provider and could normally be carried out in a matter of weeks, major launch sites have dozens of active projects separate sponsoring organizations. Accommodating the numerous tasks associated with each mission, when hardware failures, weather, maintenance requirements, and other factors constantly conspire against the range resource schedulers, make the launch range as significant an impediment to responsive missions as launch vehicles and their cargo. The obvious solution to the launch site challenge was implemented years ago when the Department of Defense simply established dedicated infrastructure and personnel to dedicated missions, namely an Inter Continental Ballistic Missile. This however proves to be prohibitively expensive for all but the most urgent of applications. So the challenge becomes how can a launch site provide acceptably responsive mission services to a particular customer without dedicating extensive resources and while continuing to serve other projects? NASA's Wallops Flight Facility (WFF) is pursuing solutions to exactly this challenge. NASA, in partnership with the Virginia Commercial Space Flight Authority, has initiated the Rapid Response Range Operations Initiative (R3Ops). R3Ops is a multi-phased effort to incrementally establish and demonstrate increasingly responsive launch operations, with an ultimate goal of providing ELV-class services in a maximum of 7-10 days from initial notification routinely, and shorter schedules possible with committed resources. This target will be pursued within the reality of simultaneous concurrent programs, and ideally, largely independent of specialized flight system configurations. WFF has recently completed Phase 1 of R3Ops, an in-depth collection (through extensive expert interviews) and software modeling of individual steps by various range disciplines. This modeling is now being used to identify existing inefficiencies in current procedures, to identify bottlenecks, and show interdependencies. Existing practices are being tracked to provide a baseline to benchmark against as new procedures are implemented. This paper will describe in detail the philosophies behind WFF's R3Ops, the data collected and modeled in Phase 1, and strategies for meeting responsive launch requirements in a multi-user range environment planned for subsequent phases of this initiative.
Author

Test Facilities; Launch Vehicles; Mission Planning; Time Response; Wallops Island

16
SPACE TRANSPORTATION AND SAFETY

Includes passenger and cargo space transportation, e.g., shuttle operations; and space rescue techniques. For related information see also *03 Air Transportation and Safety; 15 Launch Vehicles and Launch Operations*; and *18 Spacecraft Design, Testing and Performance*. For space suits see *54 Man/System Technology and Life Support*.

20040079350 NASA Ames Research Center, Moffett Field, CA, USA

Using Fuzzy Clustering for Real-time Space Flight Safety

Lee, Charles; Haskell, Richard E.; Hanna, Darrin; Alena, Richard L.; [2004]; 6 pp.; In English; No Copyright; Avail: CASI; A02, Hardcopy

To ensure space flight safety, it is necessary to monitor myriad sensor readings on the ground and in flight. Since a space shuttle has many sensors, monitoring data and drawing conclusions from information contained within the data in real time is challenging. The nature of the information can be critical to the success of the mission and safety of the crew and therefore, must be processed with minimal data-processing time. Data analysis algorithms could be used to synthesize sensor readings and compare data associated with normal operation with the data obtained that contain fault patterns to draw conclusions. Detecting abnormal operation during early stages in the transition from safe to unsafe operation requires a large amount of historical data that can be categorized into different classes (non-risk, risk). Even though the 40 years of shuttle flight program

has accumulated volumes of historical data, these data don t comprehensively represent all possible fault patterns since fault patterns are usually unknown before the fault occurs. This paper presents a method that uses a similarity measure between fuzzy clusters to detect possible faults in real time. A clustering technique based on a fuzzy equivalence relation is used to characterize temporal data. Data collected during an initial time period are separated into clusters. These clusters are characterized by their centroids. Clusters formed during subsequent time periods are either merged with an existing cluster or added to the cluster list. The resulting list of cluster centroids, called a cluster group, characterizes the behavior of a particular set of temporal data. The degree to which new clusters formed in a subsequent time period are similar to the cluster group is characterized by a similarity measure, q. This method is applied to downlink data from Columbia flights. The results show that this technique can detect an unexpected fault that has not been present in the training data set.
Author
Cluster Analysis; Real Time Operation; Space Shuttles; Flight Safety; Data Processing

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*.

20040079783 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA, Massachusetts Inst. of Tech., Cambridge, MA, USA, NASA Goddard Space Flight Center, Greenbelt, MD, USA
Architectural Options for a Future Deep Space Optical Communications Network
Edwards, B. L.; Benjamin, T.; Scozzafava, J.; Khatri, F.; Sharma, J.; Parvin, B.; Liebrecht, P. E.; Fitzgerald, R. J.; 2004; 10 pp.; In English; SpaceOps 2004 Conference, 17-21 May 2004, Montreal, Canada
Contract(s)/Grant(s): F19628-00-C-0002; Copyright; Avail: CASI; A02, Hardcopy

This paper provides an overview of different options at Earth to provide Deep Space optical communication services. It is based mainly on work done for the Mars Laser Communications Demonstration (MLCD) Project, a joint project between NASA's Goddard Space Flight Center (GSFC), the Jet Propulsion Laboratory, California Institute of Technology (JPL), and the Massachusetts Institute of Technology Lincoln Laboratory (MIT/LL). It also reports preliminary conclusions from the Tracking and Data Relay Satellite System Continuation Study at GSFC. A lasercom flight terminal will be flown on the Mars Telecommunications Orbiter (MTO) to be launched by NASA in 2009, and will be the first high rate deep space demonstration of this revolutionary technology.
Author
Space Communication; Optical Communication; Communication Networks

20040079829 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Navigation Accuracy Guidelines for Orbital Formation Flying
Carpenter, J. Russell; Alfriend, Kyle T.; 2004; 18 pp.; In English; No Copyright; Avail: CASI; A03, Hardcopy

Some simple guidelines based on the accuracy in determining a satellite formation s semi-major axis differences are useful in making preliminary assessments of the navigation accuracy needed to support such missions. These guidelines are valid for any elliptical orbit, regardless of eccentricity. Although maneuvers required for formation establishment, reconfiguration, and station-keeping require accurate prediction of the state estimate to the maneuver time, and hence are directly affected by errors in all the orbital elements, experience has shown that determination of orbit plane orientation and orbit shape to acceptable levels is less challenging than the determination of orbital period or semi-major axis. Furthermore, any differences among the member s semi-major axes are undesirable for a satellite formation, since it will lead to differential along-track drift due to period differences. Since inevitable navigation errors prevent these differences from ever being zero, one may use the guidelines this paper presents to determine how much drift will result from a given relative navigation accuracy, or conversely what navigation accuracy is required to limit drift to a given rate. Since the guidelines do not account for non-two-body perturbations, they may be viewed as useful preliminary design tools, rather than as the basis for mission navigation requirements, which should be based on detailed analysis of the mission configuration, including all relevant sources of uncertainty.
Author
Navigation; Accuracy; Errors

20040081113 NASA Goddard Space Flight Center, Greenbelt, MD, USA

NASA Satellite Laser Ranging Network

Carter, David L.; 2004; 1 pp.; In English; The International Laser Ranging Service (ILRS) Workshop, 28-31 Oct. 2003, Koetzting, Germany; No Copyright; Avail: Other Sources; Abstract Only

I will be participating in the International Workshop on Laser Ranging. I will be presenting to the International Laser Ranging Service (ILRS) general body meeting on the recent accomplishments and status of the NASA Satellite Laser Ranging (SLR) Network. The recent accomplishments and NASA's future plans will be outlined and the benefits to the scientific community will be addressed. I am member of the ILRS governing board, the Missions working group, and the Networks & Engineering working group. I am the chairman of the Missions Working and will be hosting a meeting during the week of the workshop. I will also represent the NASA SLR program at the ILRS governing board and other working group meetings. Author

Satellite Laser Ranging; Satellite Networks; NASA Programs

20040081288 Computer Sciences Corp., USA

Adding HDLC Framing to CCSDS Recommendations

Hogie, Keith; Criscuolo, Ed; Parise, Ron; [2004]; 1 pp.; In English; Space Internet Workshop-4, 8-10 Jun. 2004, Hanover, MD, USA

Contract(s)/Grant(s): NASA Order S-43981-G; No Copyright; Avail: Other Sources; Abstract Only

Current Space IP missions use High-Level Data Link Control (HDLC) framing to provide standard serial link interfaces over a space link. HDLC is the standard framing technique used by all routers over clock and data serial lines and is also the basic framing used in all Frame Relay services which are widely deployed in national and international communication networks. In late 2003 a presentation was made to CCSDS committees to initiate discussion on including HDLC in the CCSDS recommendations for space systems. This presentation will summarize the differences between variable length HDLC frames and fixed length CCSDS frames. It will also discuss where and how HDLC framing would fit into the overall CCSDS structures.

Author

Space Communication; Data Links

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*.

20040077375 NASA Ames Research Center, Moffett Field, CA, USA

Transient Region Coverage in the Propulsion IVHM Technology Experiment

Balaban, Edward; Sweet, Adam; Bajwa, Anupa; Maul, William; Fulton, Chris; Chicatelli, amy; 2004; 8 pp.; In English; No Copyright; Avail: CASI; A02, Hardcopy

Over the last several years researchers at NASA Glenn and Ames Research Centers have developed a real-time fault detection and isolation system for propulsion subsystems of future space vehicles. The Propulsion IVHM Technology Experiment (PITEX), as it is called follows the model-based diagnostic methodology and employs Livingstone, developed at NASA Ames, as its reasoning engine. The system has been tested on,flight-like hardware through a series of nominal and fault scenarios. These scenarios have been developed using a highly detailed simulation of the X-34 flight demonstrator main propulsion system and include realistic failures involving valves, regulators, microswitches, and sensors. This paper focuses on one of the recent research and development efforts under PITEX - to provide more complete transient region coverage. It describes the development of the transient monitors, the corresponding modeling methodology, and the interface software responsible for coordinating the flow of information between the quantitative monitors and the qualitative, discrete representation Livingstone.

Author

Computer Systems Programs; Flight Simulators; X-34 Reusable Launch Vehicle; Fault Detection; Propulsion

20040081035 NASA Ames Research Center, Moffett Field, CA, USA, Thermoscience Inst., Moffett Field, CA, USA
A Fast Code for Jupiter Atmospheric Entry Analysis
Yauber, Michael E.; Wercinski, Paul; Yang, Lily; Chen, Yih-Kanq; September 1999; 32 pp.; In English
Contract(s)/Grant(s): NAS2-14031
Report No.(s): NASA/TM-1999-208796; A-99V0038; No Copyright; Avail: CASI; A03, Hardcopy

A fast code was developed to calculate the forebody heating environment and heat shielding that is required for Jupiter atmospheric entry probes. A carbon phenolic heat shield material was assumed and, since computational efficiency was a major goal, analytic expressions were used, primarily, to calculate the heating, ablation and the required insulation. The code was verified by comparison with flight measurements from the Galileo probe's entry. The calculation required 3.5 sec of CPU time on a work station, or three to four orders of magnitude less than for previous Jovian entry heat shields. The computed surface recessions from ablation were compared with the flight values at six body stations. The average, absolute, predicted difference in the recession was 13.7% too high. The forebody's mass loss was overpredicted by 5.3% and the heat shield mass was calculated to be 15% less than the probe's actual heat shield. However, the calculated heat shield mass did not include contingencies for the various uncertainties that must be considered in the design of probes. Therefore, the agreement with the Galileo probe's values was satisfactory in view of the code's fast running time and the methods' approximations.
Author
Forebodies; Atmospheric Entry; Measuring Instruments; Jupiter Atmosphere; Heat Shielding

20040081092 NASA Ames Research Center, Moffett Field, CA, USA
Design by Prototype: Examples from the National Aeronautics and Space Administration
Mulenburg, Gerald M.; Gundo, Daniel P.; [2002]; 8 pp.; In English; 11th International Conferenceon the Management of Technology, 10-14 Mar. 2002, Miami, FL, USA; Original contains black and white illustrations; No Copyright; Avail: CASI; A02, Hardcopy

This paper describes and provides exa.mples of a technique called Design-by-Prototype used in the development of research hardware at the National Aeronautics and Space Administration's (NASA) Ames Research Center. This is not a new idea. Artisans and great masters have used prototyping as a design technique for centuries. They created prototypes to try out their ideas before making the primary artifact they were planning. This abstract is itself a prototype for others to use in determining the value of the paper it describes. At the Ames Research Center Design-by-Prototype is used for developing unique, one-of-a-kind hardware for small, high-risk projects. The need tor this new/old process is the proliferation of computer "design tools" that can result in both excessive time expended in design, and a lack of imbedded reality in the final product. Despite creating beautiful three-dimensional models and detailed computer drawings that can consume hundreds of engineering hours, the resulting designs can be extremely difficult to make, requiring many changes that add to the cost and schedule. Much design time can be saved and expensive rework eliminated using Design-by-Prototype.
Author
NASA Programs; Prototypes; Rapid Prototyping; Three Dimensional Models

20040081112 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Modular, Reconfigurable, and Rapid Response Space Systems: The Remote Sensing Advanced Technology Microsatellite
Esper, Jaime; Andary, Jim; Oberright, John; So, Maria; Wegner, Peter; Hauser, Joe; March 31, 2004; 7 pp.; In English; AIAA 2nd Responsive Space Conference, 19-22 Apr. 2004, El Segundo, CA, USA
Report No.(s): AIAA Paper 2004-3002; No Copyright; Avail: CASI; A02, Hardcopy

Modular, Reconfigurable, and Rapid-response (MR(sup 2)) space systems represent a paradigm shift in the way space assets of all sizes are designed, manufactured, integrated, tested, and flown. This paper will describe the MR(sup 2) paradigm in detail, and will include guidelines for its implementation. The Remote Sensing Advanced Technology microsatellite (RSAT) is a proposed flight system test-bed used for developing and implementing principles and best practices for MR(sup 2) spacecraft, and their supporting infrastructure. The initial goal of this test-bed application is to produce a lightweight (approx. 100 kg), production-minded, cost-effective, and scalable remote sensing micro-satellite capable of high performance and broad applicability. Such applications range from future distributed space systems, to sensor-webs, and rapid-response satellite systems. Architectures will be explored that strike a balance between modularity and integration while preserving the MR(sup 2) paradigm. Modularity versus integration has always been a point of contention when approaching a design: whereas one-of-a-kind missions may require close integration resulting in performance optimization, multiple and flexible application spacecraft benefit &om modularity, resulting in maximum flexibility. The process of building spacecraft rapidly (< 7 days), requires a concerted and methodical look at system integration and test processes and pitfalls. Although the concept of

modularity is not new and was first developed in the 1970s by NASA's Goddard Space Flight Center (Multi-Mission Modular Spacecraft), it was never modernized and was eventually abandoned. Such concepts as the Rapid Spacecraft Development Office (RSDO) became the preferred method for acquiring satellites. Notwithstanding, over the past 30 years technology has advanced considerably, and the time is ripe to reconsider modularity in its own right, as enabler of R(sup 2), and as a key element of transformational systems. The MR2 architecture provides a competitive advantage over the old modular approach in its rapid response to market needs that are difficult to predict both from the perspectives of evolving technology, as well as mission and application requirements.
Author
Spacecraft Design; Microsatellites; Test Stands

20040081137 AI Solutions, Inc., Lanham, MD, USA
Calipso's Mission Design: Sun-Glint Avoidance Strategies
Mailhe, Laurie M.; Schiff, Conrad; Stadler, John H.; [2004]; 19 pp.; In English; AAS/AIAA Space Flight Mechanics Conference, 8-12 Feb. 2004, Maui, HI, USA
Contract(s)/Grant(s): NAS5-01090
Report No.(s): AAS-04-114; No Copyright; Avail: CASI; A03, Hardcopy

CALIPSO will fly in formation with the Aqua spacecraft to obtain a coincident image of a portion of the Aqua/MODIS swath. Since MODIS pixels suffering sun-glint degradation are not processed, it is essential that CALIPSO only co- image the glint h e portion of the MODIS instrument swath. This paper presents sun-glint avoidance strategies for the CALIPSO mission. First, we introduce the Aqua sun-glint geometry and its relation to the CALIPSO-Aqua formation flying parameters. Then, we detail our implementation of the computation and perform a cross-track trade-space analysis. Finally, we analyze the impact of the sun-glint avoidance strategy on the spacecraft power and delta-V budget over the mission lifetime.
Author
Glint; Sun; Satellite Observation; Aerosols; Clouds (Meteorology); Optical Radar; Space Missions; Spacecraft Design

20040081200 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Nonlinear Observers for Gyro Calibration
Thienel, Julie; Sanner, Robert M.; [2003]; 17 pp.; In English; Flight Mechanics Symposium, 28-30 Oct. 2003, Greenbelt, MD, USA; No Copyright; Avail: CASI; A03, Hardcopy

Nonlinear observers for gyro calibration are presented. The first observer estimates a constant gyro bias. The second observer estimates scale factor errors. The third observer estimates the gyro alignment for three orthogonal gyros. The convergence properties of all three observers are discussed. Additionally, all three observers are coupled with a nonlinear control algorithm. The stability of each of the resulting closed loop systems is analyzed. Simulated test results are presented for each system.
Author
Calibrating; Gyroscopes; Nonlinearity; Algorithms; Attitude Control

20040081211 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Autonomous NanoTechnology Swarm (ANTS) Prospecting Asteroid Mission (PAM), Asteroid Proximity Operations
Marr, Greg; Cooley, Steve; Roithmayr, Carlos; Kay-Bunnell, Linda; Williams, Trevor; [2004]; 1 pp.; In English; International Aeronautics Congress, 4-6 Oct. 2004, Vancouver, British Columbia, Canada; No Copyright; Avail: Other Sources; Abstract Only

The Autonomous NanoTechnology Swarm (ANTS) is a generic mission architecture based on spatially distributed spacecraft, autonomous and redundant components, and hierarchical organization. The ANTS Prospecting Asteroid Mission (PAM) is an ANTS application which will nominally use a swarm of 1000 spacecraft. There would be 10 types of "specialists" with common spacecraft buses. There would be 10 subswarms of approximately 100 spacecraft each or approximately 10 of each specialist in each swarm. The ANTS PAM primary objective is the exploration of the asteroid belt in search of resources and material with astrobiologically relevant origins and signatures. The ANTS PAM spacecraft will nominally be released from a station in an Earth-Moon L1 libration point orbit, and they will use Solar sails for propulsion. The sail structure would be highly flexible, capable of changing morphology to change cross-section for capture of sunlight or to form effective "tip vanes" for attitude control. ANTS PAM sails would be capable of full to partial deployment, to change effective sail area and center of pressure, and thus allow attitude control. Results of analysis of a transfer trajectory from Earth to a sample target asteroid will be presented. ANTS PAM will require continuous coverage of

different asteroid locations as close as one to two asteroid "diameters" from the surface of the asteroid for periods of science data collection during asteroid proximity operations. Hovering spacecraft could meet the science data collection objectives. The results of hovering analysis will be presented. There are locations for which hovering is not possible, for example on the illuminated side of the asteroid. For cases where hovering is not possible, the results of utilizing asteroid formations to orbit the asteroid and achieve the desired asteroid viewing will be presented for sample asteroids. The ability of ANTS PAM to reduce the area of the solar sail during asteroid proximity operations is critical to the maintenance of orbiting formations for a period of time. Results of analysis of potential "traffic" problems during asteroid proximity operations will be presented.
Author
Asteroid Missions; Autonomy; Nanotechnology; Proximity; Spacecraft Control

20040081251 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Formation Tetrahedron Design for Phase I of the Magnetospheric Multiscale Mission
Hughes, Steven P.; [2003]; 13 pp.; In English; GSFC Flight Mechanics Symposium, 28-30 Oct. 2003, Greenbelt, MD, USA; No Copyright; Avail: CASI; A03, Hardcopy

The Magnetospheric Multiscale Mission (MMS) is a NASA mission intended to make fundamental advancements in our understanding of the Earth's Magnetosphere. There are three processes that MMS will study including magnetic reconnection, charged particle acceleration, and turbulence. There are four phases in the nominal mission and this work addresses some of the outstanding issues in phase I. The nominal phase I orbit is 1.2 x 12 R(sub e) highly elliptic orbit with four spacecraft nominally forming a regular tetrahedron. In this paper we investigate the relative dynamics of the four MMS spacecraft about an assumed reference orbit. There are several tetrahedron dimensions required in Phase I of the mission and in this work we design optimal tetrahedrons for the 10 km baseline. The performance metric used in the optimization process is directly related to the science return, and is based on an extension of previous work performed by Glassmeier. The optimizer we use is a commercially available Sequential Quadratic Programming (SQP) routine. Multiple optimal solutions are found, and we characterize how the performance of the formation varies between different regions of the reference orbit.
Author
Earth Magnetosphere; Tetrahedrons; Spacecraft Design; NASA Space Programs; Orbital Mechanics

20040081269 AI Solutions, Inc., Lanham, MD, USA
Tetrahedron Formation Control
Guzman, Jose J.; 2003; 11 pp.; In English; Flight Dynamics Symposium, 28-30 Oct. 2003, Greenbelt, MD, USA
Contract(s)/Grant(s): NAS5-01090; No Copyright; Avail: CASI; A03, Hardcopy

Spacecraft flying in tetrahedron formations are excellent instrument platforms for electromagnetic and plasma studies. A minimum of four spacecraft - to establish a volume - is required to study some of the key regions of a planetary magnetic field. The usefulness of the measurements recorded is strongly affected by the tetrahedron orbital evolution. This paper considers the preliminary development of a general optimization procedure for tetrahedron formation control. The maneuvers are assumed to be impulsive and a multi-stage optimization method is employed. The stages include targeting to a fixed tetrahedron orientation, rotating and translating the tetrahedron and/or varying the initial and final times. The number of impulsive maneuvers citn also be varied. As the impulse locations and times change, new arcs are computed using a differential corrections scheme that varies the impulse magnitudes and directions. The result is a continuous trajectory with velocity discontinuities. The velocity discontinuities are then used to formulate the cost function. Direct optimization techniques are employed. The procedure is applied to the Magnetospheric Multiscale Mission (MMS) to compute preliminary formation control fuel requirements.
Author
Tetrahedrons; Formation Flying; Spacecraft Control; Spacecraft Configurations; Optimization

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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*.

20040081311 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Geoscience Laser Altimeter System: Characteristics and Performance of the Altimeter Receiver

Sun, Xiao-Li; Yi, Dong-Hui; Abshire, James B.; [2003]; 4 pp.; In English; 2003 Fall American Geophysical Union Meeting, 8-12 Dec. 2003, San Francisco, CA, USA; No Copyright; Avail: Other Sources; Abstract Only

The Geoscience Laser Altimeter System (GLAS) on board ICESat spacecraft measures the surface height (altimetry) via the time of flight of its 1064 nm laser pulse. The GLAS laser transmitter produces 6 ns wide pulses with 70 mJ energy at 1064 nm at a 40 Hz rate. The altimeter receiver consists of a telescope, aft optics, a silicon avalanche photodiode, and electronic amplifiers. The transmitted and echo pulse waveforms are digitized at 1 GHz rate. The laser pulse time of flight is determined on the ground from the two digitized pulse waveforms and their positions in the full waveform record (about 5.4 ms ong) by computing the pulse centroids or by curve fitting. The GLAS receiver algorithms in on board software selects the two waveform segments containing the transmitted and the echo pulses and sends them to ground. The probability of echo pulse detection and the accuracy of time of flight measurement depend on the received signal level, the background light within the receiver field of view, the inherent detector and amplifier noise, the quantization of the digitizer, and some times by cloud obscurations. A receiver model has been developed to calculate the probability of detection and accuracy of the altimeter measurements with these noise sources. From prelaunch testing, the minimum detectable echo pulse energy for 90% detection probability was about 0.1 fj/pulse onto the detector. Such a receiver sensitivity allows GLAS to measure the surface height through clouds with optical density less than 2. The echo pulse energy required to achieve 10 cm ranging accuracy was found to be about 3 times higher than the minimum detectable signal level. The smallest single shot range measurement error, which was determined by ranging to a fixed target with strong echo pulses and no background light, was 2 to 3cm. The maximum linear response echo pulse energy was 10 fJ/pulse for the strongest echo signals, assuming a Lambertian scattering snow surface, clear sky atmosphere transmission, and no pulse width spreading due to surface slopes. Results from the initial 38 days of GLAS operation on-orbit with Laser 1, showed the echo pulse energies varied, as expected, over a wide dynamic range due to the variability of atmosphere transmission and Earth surface characteristics. The receiver was able to reliably detect the ground surface echoes and measure time of flight under such dynamic conditions, except when there were dense clouds. When over Antarctica, the echo pulse energies were several times stronger than predicted. This suggests that the 1064 nm backscattering from the snow pack and ice-sheet &ce are not completely Lambertian but is somewhat peaked at opposit.ion. With Laser 1, the peak amplitude of the echo pulses from flat ice sheets under clear sky conditions exceeded the linear response range of the receiver, causing some pulse waveform distortion due to saturation. We have characterized the effects of receiver saturation on the time of flight, pulse width, and pulse energy measurements for flat surface by testing a night spare detector in the lab with simulated echo pulses. A data processing algorithm that minimizes the errors due to saturation for these measurements are described.

Author

Laser Altimeters; Geophysics; Transmitter Receivers; Spacecraft Instruments; Airborne/Spaceborne Computers

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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*.

20040070788 NASA Glenn Research Center, Cleveland, OH, USA

Prospects for Breakthrough Propulsion From Physics

Millis, Marc G.; May 2004; 19 pp.; In English; 2004 Conference on Evolvable Hardware, 24-26 Jun. 2004, Seattle, WA, USA

Contract(s)/Grant(s): WBS 2262-949-10-01

Report No.(s): NASA/TM-2004-213082; E-14560; No Copyright; Avail: CASI; A03, Hardcopy

"Space drives", "Warp drives", and "Wormholes:" these concepts may sound like science fiction, but they are being written about in reputable journals. To assess the implications of these emerging prospects

for future spaceflight, NASA supported the Breakthrough Propulsion Physics Project from 1996 through 2002. This Project has three grand challenges: (1) Discover propulsion that eliminates the need for propellant; (2) Discover methods to achieve hyper-fast travel; and (3) Discover breakthrough methods to power spacecraft. Because these challenges are presumably far from fruition, and perhaps even impossible, a special emphasis is placed on selecting incremental and affordable research that addresses the critical issues behind these challenges. Of 16 incremental research tasks completed by the project and from other sponsors, about a third were found not to be viable, a quarter have clear opportunities for sequels, and the rest remain unresolved.
Author
Spacecraft Propulsion; Microgravity; Project Management; Plasmas (Physics); NASA Programs

20040077264 NASA Stennis Space Center, Bay Saint Louis, MS, USA
Advancing Sensor Technology for Aerospace Propulsion
Figueroa, Fernando; Mercer, Carolyn R.; September 2002; 15 pp.; In English; International Mechanical Engineering Congress and Exposition, 17-22 Nov. 2002, New Orleans, LA, USA
Report No.(s): SE-2002-05-00044-SSC; No Copyright; Avail: CASI; A03, Hardcopy

NASA's Stennis Space Center (SSC) and Glenn Research Center (GRC) participate in the development of technologies for propulsion testing and propulsion applications in air and space transportation. Future transportation systems and the test facilities needed to develop and sustain them are becoming increasingly complex. Sensor technology is a fundamental pillar that makes possible development of complex systems that must operate in automatic mode (closed loop systems), or even in assisted-autonomous mode (highly self-sufficient systems such as planetary exploration spacecraft). Hence, a great deal of effort is dedicated to develop new sensors and related technologies to be used in research facilities, test facilities, and in vehicles and equipment. This paper describes sensor technologies being developed and in use at SSC and GRC, including new technologies in integrated health management involving sensors, components, processes, and vehicles.
Author
Air Transportation; Spacecraft Propulsion; Space Exploration; Feedback Control; Autonomy; Complex Systems

20040078789 Air Force Research Lab., Edwards AFB, CA
Small Intercontinental Ballistic Missile (SICBM) Rocket Motor Sympathetic Detonation Study
Schwartz, Daniel F.; Merill, Claude E.; Mar. 26, 2004; 38 pp.; In English
Contract(s)/Grant(s): Proj-4847
Report No.(s): AD-A423229; AFRL-PR-ED-TP-2004-095; No Copyright; Avail: CASI; A03, Hardcopy

The Air Force Research Laboratory (AFRL) Propulsion Directorate at Edwards Air Force Base California utilized two surplus Small Intercontinental Ballistic Missile (SICBM) rocket motors in a sympathetic detonation test with a spacing of 15 feet (4.6 meters) between them (typical max spacing in storage bunkers and transport trailers) to gain technical value from assets deemed undesirable for test firing. The Stage 1 SICBM motor containing 19,200 lbs (8709 kg) of detonable Hazard Division (MD) 1.1 propellant was used as the donor motor and the Stage 3 SICBM motor containing 3040 lbs (1379 kg) of the same propellant formulation was used as the acceptor motor in the test. It was assumed that the propellant and rocket motor community would be interested in observing how large the differential can be between detonation by shock- to-detonation transition (SDT) initiation values and by lesser shocks that might occur with operational scenarios of nearby detonation shocks or flight fallbacks. In addition, observation of fragment throw/impact data from modern, carbon composite, case rocket motors could help determine fragment hazards from such events. Such data might provide the modeling and simulation community information that could be coupled to rocket motor hazard codes for predicting rocket motor responses to shock and fragment stimuli. This paper outlines the sympathetic detonation test conducted at AFRL, to observe interactions between a detonating Stage 1 Small ICBM rocket motor and a nearby Stage 3 Small ICBM rocket motor.
DTIC
Detonation; Hazards; Intercontinental Ballistic Missiles; Rocket Engines; Solid Rocket Propellants

20040081176
Design, Build and Qualification of the ST-5 Nanosat Batteries
Curzon, D.; R. Spurrett; Stewart, K.; Rao, G.; 2004; 22 pp.; In English; 2003 NASA Aerospace Battery Workshop, 18-20 Nov. 2003, Huntsville, AL, USA; Original contains color illustrations
Contract(s)/Grant(s): NAS5-01109; No Copyright; Avail: CASI; A03, Hardcopy

This viewgraph presentation provides information about battery configuration, GSFC performance requirements, unique ST-5 mission requirements, battery design, materials, and testing.
CASI
Spacecraft Power Supplies; Electric Batteries

23
CHEMISTRY AND MATERIALS (GENERAL)

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

20040077319 California Univ., Lawrence Berkeley National Lab., Berkeley, CA, USA
Advanced Duct Sealant Testing
Sherman, M. H.; Walker, I. S.; Aug. 2003; In English
Report No.(s): DE2003-817246; LBNL-53547; No Copyright; Avail: National Technical Information Service (NTIS)

Duct leakage has been identified as a major source of energy loss in residential buildings. Most duct leakage occurs at the connections to registers, plenums or branches in the duct system. At each of these connections a method of sealing the duct system is required. Typical sealing methods include tapes or mastics applied around the joints in the system. Field examinations of duct systems have typically shown that these seals tend to fail over extended periods of time. The Lawrence Berkeley National Laboratory has been testing sealant durability for several years.
NTIS
Ducts; Sealers

20040077348 Lawrence Livermore National Lab., Livermore, CA
Satellite and Opacity Effects on Resonance Line Shapes Produced from Short-pulse Laser Heated Foils
Shepherd, R.; Audeburt, P.; Chen, H. K.; Fournier, K. B.; Peyreusse, O.; Dec. 03, 2002; In English
Report No.(s): DE2003-15005064; UCRL-JC-152454; No Copyright; Avail: National Technical Information Service (NTIS)

We measure the He-like, time-resolved emission from thin foils consisting of 250(angstrom) of carbon-250(angstrom) of aluminum and 500(angstrom) aluminum illuminated with a 150 fs laser pulse at an intensity of 1 x 10(exp 19) W/sq cm. Dielectronic satellite contributions to the 1s(sup 2)-1s2p((sup 1)P), 1s(sup 2)-1s3p((sup 1)P), and 1s(sup 2)1s4p((sup 1)P) line intensities are modeled using the configuration averaged code AVERROES and is found to be significant for all three resonance lines. The contribution of opacity broadening is inferred from the data and found to be significant only in the 1s(sup 2)-1s2p((sup 1)P).
NTIS
Carbon; Foils (Materials); Laser Heating; Opacity

20040078802 Air Force Inst. of Tech., Wright-Patterson AFB, OH
An Evaluation of Formic Acid as an Electron Donor for Palladium (PD) catalyzed Destruction of Nitroaromatic Compounds
Stevens, Mark R.; Mar. 23, 2004; 186 pp.; In English; Original contains color illustrations
Report No.(s): AD-A423244; AFIT/GEM/ENV/04M-19; No Copyright; Avail: CASI; A09, Hardcopy

The Department of Defense is responsible for over 2,000 hazardous waste sites containing nitroaromatic compounds (NACs) such as 2,4,6-TNT, 2,4- and 2,6-DNT that resulted from the production and use of munitions throughout the nation and world, NACs are typically persistent in natural environments, though they can be oxidized or reduced under engineered conditions, NACs and their reduction products are toxic chemicals and suspected human carcinogens, Both TNT and 2,4- DNT are listed as priority pollutants by the U,S EPA, This study investigates the effectiveness of using a palladium (Pd) catalyst in concert with formic acid as an electron donor to reduce NACs, If the reduction reaction is rapid and complete, without producing hazardous daughter products, the process may have application as an in situ treatment technology to remediate NAC-contaminated groundwater,
DTIC
Catalysis; Destruction; Formic Acid; Hazardous Wastes; Nitrogen Compounds; Palladium

20040078806 State Univ. of New York, Stony Brook, NY
Tunneling Characteristics of an Electron-Hole Trilayer in a Parallel Magnetic Field
Lin, Y.; Mendez, E.E.; Abanov, A. G.; Oct. 31, 2003; 5 pp.; In English
Contract(s)/Grant(s): DAAD19-99-1-0270
Report No.(s): AD-A423249; ARO-40070.8-PH; No Copyright; Avail: CASI; A01, Hardcopy

We have studied the tunneling properties of GaSb/AlSb/InAs/AlSb/GaSb heterostructures in which electrons- and boles accumulate in the InAs and GaSb regions respectively under a magnetic field parallel to the interlaces The low- temperature (T=4.2 K) zero-bias magnetoconductance has shown a behavior with field that evidences the two-dimensional character of both electrons and holes and that has allowed us to determine the hole density and the electron-hole separation. The observed field dependence of the current-voltage characteristics is explained by the relative change in parallel momentum of electrons and holes induced by the field.
DTIC
Electric Current; Heterogeneity; Holes (Electron Deficiencies); Magnetic Fields

20040079696 Lockheed Martin Corp., Syracuse, NY, USA
Interface Reactions and Electrical Characteristics of Au/GaSb Contacts
Ehsani, H.; Gutmann, R. J.; Charache, G. W.; Jul. 2000; 42 pp.; In English
Report No.(s): DE2004-821942; LM-00K045; No Copyright; Avail: Department of Energy Information Bridge

The reaction of Au with GaSb occurs at a relatively low temperature (100 C). Upon annealing, a AuSb(sub 2) compound and several Au-Ga phases are produced. Phase transitions occur toward higher Ga concentration with increasing annealing temperatures. Furthermore, the depth of the contact also increases with increased annealing temperature. They found that the AuSb(sub 2) compound forms on the GaSb surface, with the compound crystal partially ordered with respect to the substrate. The transition of Schottky- to ohmic-contact behavior in Au/n-type GaSb occurs simultaneously with the formation of the AuGa compound at about a 250 C annealing temperature. This ohmic contact forms without the segregation of dopants at the metallic compound/GaSb interface. Therefore it is postulated that transition from Schottky- to ohmic-contact behavior is obtained through a series of tunneling transitions of electrons through defects in the depletion region in the Au/n-type GaSb contacts. Contact resistivities of 6-7 x 10(sup -6)(Omega)-cm(sup 2) were obtained with the annealing temperature between 300 and 350 C for 30 seconds. In Au/p-type GaSb contacts, the resistivity was independent of the annealing temperature. This suggested that the carrier transport in p-type contact dominated by thermionic emission.
NTIS
Gallium Antimonides; Tunneling; Electrical Resistivity

20040079722 Environmental Protection Agency, Washington, DC
Toxic Substances Control Act (TSCA): ASCII Text Data, May 2004. PMN Number to EPA Accession Number Link (Raw Data on CD-ROM)
May 2004; In English
Report No.(s): PB2004-500135; No Copyright; Avail: National Technical Information Service (NTIS)

The TSCA Chemical Substance Inventory provides chemical identity information for the 65,168 non-confidential substances on the TSCA Master Inventory File. The datafile contains no TSCA Confidential Business Information. New versions of the TSCA Inventory are issued at approximately six month intervals. The data provided for each chemical substance include the CAS Registry Number, Preferred CA Index Name, molecular formula, and other appropriate information, such as valid chemical names reported by submitters. The entries are in ascending CAS Registry Number order. The PMN Number to EPA Accession Number Link provides a cross-reference of these number for commenced PMNs on the confidential portion of the TSCA Master Inventory FIle. Neither this cross-reference nor the additional information included is TSCA Confidential Business Information.
NTIS
Identities; Cd-Rom; Toxicity

20040079759 Specialized Technology Resources, Inc., Enfield, CT, USA
Development of New Low-Cost High-Performance, PV Module Encapsulant/Packaging Materials. Annual Technical Report, Phase 1. October 22, 2002-September 30, 2003
Agro, S. C.; Tucker, R. T.; Mar. 2004; In English
Report No.(s): DE2004-15006930; NREL/SR-520-35683; No Copyright; Avail: National Technical Information Service (NTIS)

The primary objectives of this subcontract are for Specialized Technology Resources, Inc., to work with U. S.-based PV module manufacturers representing crystalline silicon, polycrystalline silicon, amorphous silicon, copper indium diselenide (CIS), and other state-of-the-art thin-film technologies to develop formulations, production processes, prototype and qualify new low-cost, high-performance photovoltaic module encapsulants/packaging materials. The manufacturers will assist in identifying each materials' deficiencies while undergoing development, and then ultimately in qualifying the final optimized materials designed to specifically meet their requirements. Upon completion of this program, new low-cost, high-performance, PV module encapsulant/packaging materials will be qualified, by one or more end-users, for their specific application. Information gathering on topics related to thin-film module technology, including device performance/failure analysis, glass stability, and de vice encapsulation, has been completed. This information has provided concepts and considerations for module failure analysis, accelerated testing design, and encapsulation formulation strategy for thin-film modules.
NTIS
Amorphous Silicon; Crystallinity; Modules; Packaging; Thin Films

24
COMPOSITE MATERIALS

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

20040078887 Virginia Polytechnic Inst. and State Univ., Blacksburg, VA
Workshop on Nanocomposites
Hyer, M. W.; Apr. 2004; 9 pp.; In English
Contract(s)/Grant(s): F49620-01-1-0480; Proj-2302
Report No.(s): AD-A423417; AFRL-SR-AR-TR-04-0274; No Copyright; Avail: CASI; A02, Hardcopy

This report summaries the workshop held on the campus of Virginia Polytechnic Institute and State University September 12-13, 2001. The report consists of notes taken during the workshop by an appointed scribe that briefly describe the workshop format, and then summaries, in bullet form, the discussions that occurred. A list of attendees concludes this report. In order to facilitate a coherent discussion throughout the workshop and to define Air Force's nanomechanics research needs/goals, the speakers were requested in advance to tailor their presentations to address the following topics/categories 1. Value and benefits of nanocomposites (observed and expected potential), 2. Modeling at the nano level (benefits, limits, and new technologies/ techniques requirements), 3. Testing at the nano level (benefits, limits, and new technologies/techniques requirements), 4. Materials to explore in near term, long term, and 5. Strategy for the mechanics/composites community.
DTIC
Composite Materials; Nanocomposites; Nanotechnology

20040078917 Wisconsin Univ., Madison, WI
Nanostructured Shape Memory Alloys: Composite Materials with Shape Memory Alloy Constituents
Crone, Wendy C.; Ellis, Arhur B.; Perepezko, John H.; Mar. 2004; 18 pp.; In English
Contract(s)/Grant(s): F49620-01-1-0146
Report No.(s): AD-A423479; AFRL-SR-AR-TR-04-0275; No Copyright; Avail: CASI; A03, Hardcopy

Composite materials are critical for many engineering applications because of the resultant properties that arise from the combination of dissimilar constituent materials. A particularly exciting class of constituent materials is shape memory alloys (SMAs), which continue to be explored because of their unique superelastic capabilities. These alloys already have wide ranging applications in the aerospace, biomedical, and microelectronics industries. For example, control of flight using SMAs has been demonstrated with microelectromechanical systems (MEMS) to change the fluid dynamics on a wing. Miniature aeronautic vehicles have also been conceived that utilize SMAs and other active materials in a number of different functions. As the dimensions of these devices become smaller and the demands on their performance grow, the need for materials that function optimally in these environments becomes critical. Combining the properties of SMAs with other materials in composite structures will create opportunities for making multifunctional components and components capable of performing in ways that surpass the constituent materials.
DTIC
Composite Materials; Nanostructures (Devices); Shape Memory Alloys; Shapes

20040081084 NASA Ames Research Center, Moffett Field, CA, USA, Eloret Corp., Moffett Field, CA, USA, California Univ., Santa Cruz, CA, USA

Thermal Conductivity of Carbon Nanotube Composite Films

Ngo, Quoc; Cruden, Brett A.; Cassell, Alan M.; Walker, Megan D.; Koehne, Jessica E.; Meyyappan, M.; Li, Jun; Yang, Cary Y.; April 02, 2004; 6 pp.; In English; Materials Research Society Spring Meeting 2004, 11-15 Apr. 2004, San Francisco, CA, USA; Original contains black and white illustrations

Contract(s)/Grant(s): NAS2-03144; No Copyright; Avail: CASI; A02, Hardcopy

State-of-the-art ICs for microprocessors routinely dissipate power densities on the order of 50 W/sq cm. This large power is due to the localized heating of ICs operating at high frequencies, and must be managed for future high-frequency microelectronic applications. Our approach involves finding new and efficient thermally conductive materials. Exploiting carbon nanotube (CNT) films and composites for their superior axial thermal conductance properties has the potential for such an application requiring efficient heat transfer. In this work, we present thermal contact resistance measurement results for CNT and CNT-Cu composite films. It is shown that Cu-filled CNT arrays enhance thermal conductance when compared to as-grown CNT arrays. Furthermore, the CNT-Cu composite material provides a mechanically robust alternative to current IC packaging technology.

Author

Carbon Nanotubes; Thermal Conductivity; Composite Materials

20040081128 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Surface Figure Measurement at 20K: Silicon Carbide and Cesic Mirrors

Blake, Peter; Mink, Ronald G.; Content, David; Davila, Pamela; Chambers, John; Robinson, F. David; 2004; 1 pp.; In English; SPIE Astronomical Telescopes and Instrumentation, 21-25 Jun. 2004, Glasgow, Scotland, UK; No Copyright; Avail: Other Sources; Abstract Only

This report presents the facility, methods, and results of testing cryogenically-cooled spherical mirrors, using standard phase-shifting interferometry, at the Goddard Space Flight Center (GSFC). Two mirrors were supplied to GSFC by the European Space Technology Center, so that GSFC could render a second, independent cryo-measurement of their surface figures at 20K. These mirrors, produced by Galileo Avionica and its partners, demonstrate the technology of silicon carbide and SiC-composite lightweighted mirrors, designed for high accuracy (10 nm rms surface figure error) at both room temperature and 20K. The two mirrors provided for testing at GSFC include one made of sintered silicon carbide (mirror blank by Bettini), and a second made of the C/Si/SiC composite known as Cesic (supplied by ECM). Both mirrors are f/2 spheres with 150 mm clear aperture, and with integral mounts. At GSFC, the mirrors will be measured first at at room temperature, making use of standard techniques, with a predicted uncertainty of 2 nm. Then each mirror will be tested in the cryostat, down to 20K: first freely supported and, second, mounted to a Cesic plate that models a Cesic optical bench. The uncertainty of the resultant surface figure error is predicted to be about 5 nm rms. Details of the uncertainty budget are discussed in a related poster. GSFC's techniques and results can be usefully compared to the measurements performed on the same two mirrors by and for Galileo Avionica, who used a somewhat different test configuration and alignment approach.

Author

Mirrors; Silicon Carbides; Spheres; Cryogenics; Composite Materials; Surface Properties; Temperature Dependence

20040081234 NASA Langley Research Center, Hampton, VA, USA

Modeling and Characterization of a Graphite Nanoplatelet/Epoxy Composite

Odegard, Gregory M.; Chasiotis, I.; Chen, Q.; Gates, T. S.; [2004]; 7 pp.; In English; SEM X International Congress and Exposition on Experimental and Applied Mechanics, 7-10 Jun. 2004, Costa Mesa, CA, USA

Contract(s)/Grant(s): 23-762-55-LC; No Copyright; Avail: CASI; A02, Hardcopy

A micromechanical modeling procedure is developed to predict the viscoelastic properties of a graphite nanoplatelet/epoxy composite as a function of volume fraction and nanoplatelet diameter. The predicted storage and loss moduli from the model are compared to measured values from the same material using Dynamical Mechanical Analysis, nanoindentation, and tensile tests. In most cases, the model and experiments indicate that for increasing volume fractions of nanoplatelets, both the storage and loss moduli increase. Also, in most cases, the model and experiments indicate that as the nanoplatelet diameter is increased, the storage and loss moduli decrease and increase, respectively.

Author

Graphite-Epoxy Composites; Micromechanics; Nanotechnology; Mathematical Models; Viscoelasticity; Mechanical Properties

20040081301 NASA Goddard Space Flight Center, Greenbelt, MD, USA, Swales Aerospace, Greenbelt, MD, USA
Design/Analysis of Metal/Composite Bonded Joints for Survivability at Cryogenic Temperatures
Bartoszyk, Andrew E.; [2004]; 9 pp.; In English; NASA/GSFC FEMCI Workshop, 5-6 May 2004, Greenbelt, MD, USA; No Copyright; Avail: Other Sources; Abstract Only

A major design and analysis challenge for the JWST ISM structure is the metal/composite bonded joints that will be required to survive down to an operational ultra-low temperature of 30K (-405 F). The initial and current baseline design for the plug-type joint consists of a titanium thin walled fitting (1-3mm thick) bonded to the interior surface of an M555/954-6 composite truss square tube with an axially stiff biased lay-up. Metallic fittings are required at various nodes of the truss structure to accommodate instrument and lift-point bolted interfaces. Analytical experience and design work done on metal/composite bonded joints at temperatures below liquid nitrogen are limited and important analysis tools, material properties, and failure criteria for composites at cryogenic temperatures are virtually nonexistent. Increasing the challenge is the difficulty in testing for these required tools and parameters at 30K. A preliminary finite element analysis shows that failure due to CTE mismatch between the biased composite and titanium or aluminum is likely. Failure is less likely with Invar, however an initial mass estimate of Invar fittings demonstrates that Invar is not an automatic alternative. In order to gain confidence in analyzing and designing the ISM joints, a comprehensive joint development testing program has been planned and is currently running. The test program is designed for the correlation of the analysis methodology, including tuning finite element model parameters, and developing a composite failure criterion for the effect of multi-axial composite stresses on the strength of a bonded joint at 30K. The testing program will also consider stress mitigation using compliant composite layers and potential strength degradation due to multiple thermal cycles. Not only will the finite element analysis be correlated to the test data, but the FEA will be used to guide the design of the test. The first phase of the test program has been completed and the preliminary analysis has been revisited based on the test data In this work, we present an overview of the test plan, results today, and resulting design improvements.
Author
Aluminum; Composite Structures; Cryogenic Temperature; Metal Joints; Nickel Alloys

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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*.

20040077284 Lockheed Martin Corp., Syracuse, NY, USA
Thermodynamic Analysis of Thermophotovoltaic Efficiency and Power Density Tradeoffs
Baldasara, P. F.; Reynolds, J. E.; Charache, G. W.; DePoy, D. M.; Ballinger, C. T.; Feb. 2000; 38 pp.; In English
Report No.(s): DE2004-821296; LM-00K013; No Copyright; Avail: Department of Energy Information Bridge

This report presents an assessment of the efficiency and power density limitations of thermophotovoltaic (TPV) energy conversion systems for both ideal (radiative-limited) and practical (defect-limited) systems. Thermodynamics is integrated into the unique process physics of TPV conversion, and used to define the intrinsic tradeoff between power density and efficiency. The results of the analysis reveal that the selection of diode bandgap sets a limit on achievable efficiency well below the traditional Carnot level. In addition it is shown that filter performance dominates diode performance in any practical TPV system and determines the optimum bandgap for a given radiator temperature. It is demonstrated that for a given radiator temperature, lower bandgap diodes enable both higher efficiency and power density when spectral control limitations are included. The goal of this work is to provide a better understanding of the basic system limitations that will enable successful long-term development of TPV energy conversion technology.
NTIS
Thermodynamic Efficiency; Thermodynamics; Thermophotovoltaic Conversion; Energy Gaps (Solid State)

20040077286 Lockheed Martin Corp., Syracuse, NY, USA
Dynamics of Bubbles Rising in Finite and Infinite Media
Maneri, C. C.; Vassallo, P. F.; Oct. 2000; 36 pp.; In English
Report No.(s): DE2004-821300; LM-00K048; No Copyright; Avail: Department of Energy Information Bridge

The dynamic behavior of single bubbles rising in quiescent liquid Suva (R134a) in a duct has been examined through the use of a high speed video system. Size, shape and velocity measurements obtained with the video system reveal a wide variety

of characteristics for the bubbles as they rise in both finite and infinite media. This data, coupled with previously published data for other working fluids, has been used to assess and extend a rise velocity model given by Fan and Tsuchiya. As a result of this assessment, a new rise velocity model has been developed which maintains the physically consistent characteristics of the surface tension in the distorted bubbly regime. In addition, the model is unique in that it covers the entire range of bubble sizes contained in the spherical, distorted and planar slug regimes.
NTIS
Bubbles; Dynamic Characteristics

20040077290 Du Pont de Nemours (E. I.) and Co., Aiken, SC, USA
Hydrogen Transport in Copper
Caskey, G. R.; Dexter, A. H.; Holzworth, M. L.; Louthan, M. R.; Derrick, R. G.; 1975; 26 pp.; In English
Report No.(s): DE2004-787928; DP-MS-75-6; No Copyright; Avail: Department of Energy Information Bridge
Hydrogen interaction with oxygen in copper exerts a significant influence on the apparent hydrogen diffusivity and the quantity of hydrogen absorbed. Correlation of the amount of absorbed tritium with oxygen content and dependence of permeation transients on both oxygen content and prior treatment indicate that both reversible and irreversible interactions occur between hydrogen and dissolved oxygen. This paper discusses results of that study.
NTIS
Copper; Tritium; Hydrogen Embrittlement

20040077346 Lockheed Martin Corp., Syracuse, NY, USA
Measurement and Calculation of Electrochemical Potentials in Hydrogenated High Temperature Water, including an Evaluation of the Yttria-Stabilized Zirconia/Iron-Iron Oxide (Fe/Fe3O4) Probe as a Reference Electrode
Attanasio, S. A.; Morton, D. S.; Ando, M. A.; Oct. 2001; 36 pp.; In English
Report No.(s): DE2004-821313; LM-01K103; No Copyright; Avail: Department of Energy Information Bridge
The importance of knowing the electrochemical corrosion potential (ECP, also referred to as E(sub con)) of nickel-base alloys in hydrogenated water is related to the need to understand the effects of dissolved (i.e., aqueous) hydrogen concentration ((H(sub 2))) on primary water stress corrosion cracking (PWSCC). Also, the use of a reference electrode (RE) can improve test quality by heightening the ability to detect instances of out-of-specification or unexpected chemistry. Three methods are used to measure and calculate the ECP of nickel-based alloys in hydrogenated water containing(approx) 1 to 150 scc/kg H(sub 2) (0.1 to 13. 6 ppm H(sub 2)) at 260 to 360 C. The three methods are referred to as the specimen/component method, the platinum (Pt) method, and the yttria-stabilized zirconia/iron-iron oxide (YSZ/Fe-Fe(sub 3)O(sub 4)) RE method. The specimen/component method relies upon the assumption that the specimen or component behaves as a hydrogen electrode, and its E(sub corr) is calculated using the Nernst equation. The present work shows that this method is valid for aqueous H(sub 2) levels(ge)(approx) 5 to 10 scc/kg H(sub 2). The Pt method uses a voltage measurement between the specimen or component and a Pt electrode, with the Pt assumed to behave as a hydrogen electrode; this method is valid as long as the aqueous H(sub 2)level is known. The YSZ/Fe-Fe(sub 3)O(sub 4), which represents a relatively new approach for measuring E(sub corr) in this environment, can be used even if the aqueous H(sub 2) level is unknown.
NTIS
Electrochemical Synthesis; Electrodes; Stress Corrosion Cracking

20040077347 Lawrence Livermore National Lab., Livermore, CA
Investigation of Shock-Induced Chemical Reactions in Mo-Si Powder Mixtures using Instrumented Experiments with PVDF Stress Gauges
Vandersall, K. S.; Thadhani, N. N.; May 29, 2001; In English
Report No.(s): DE2003-15005322; UCRL-JC-142012; No Copyright; Avail: National Technical Information Service (NTIS)
Shock-induced chemical reactions in(approx)58% dense Mo+2Si powder mixtures were investigated using time-resolved instrumented experiments, employing PVDF-piezoelectric stress gauges placed at the front and rear surfaces of the powders to measure the input and propagated stresses, and wave speed through the powder mixture. Experiments performed on the powders at input stresses less than 4 GPa, showed characteristics of powder densification and dispersed propagated wave stress profiles with rise time > approx. 40 nanoseconds. At input stress between 4-6 GPa, the powder mixtures showed a sharp rise time (<(approx)10 ns) of propagated wave profile and an expanded state of products revealing evidence of shock-induced chemical reaction. At input stresses greater than 6 GPa, the powder mixtures showed a slower propagated-stress-wave rise time and transition to a low-compressibility (melt) state indicating lack of shock-induced reaction. The results

illustrate that premature melting of Si, at input stresses less than the crush-strength of the powder mixtures, restricts mixing between reactants and inhibits 'shock-induced' reaction initiation
NTIS
Chemical Reactions; Stresses; Powder (Particles)

20040078820 Army Cold Regions Research and Engineering Lab., Hanover, NH
Field Screening Method for Perchlorate in Water and Soil
Thorne, Philip G.; Apr. 2004; 36 pp.; In English; Original contains color illustrations
Report No.(s): AD-A423276; ERDC/CRREL-TR-04-8; No Copyright; Avail: CASI; A03, Hardcopy

Low concennations (microgram/L of the perchlorate anion ClO4 have been measured in drinking water supplies in many states throughout the USA. Federal and state regulatory agencies are concerned about the possible adverse effects of perchlorate contamination as the anion is known to target the human thyroid gland and its metabolic-hormone- producing function. The provisional aenon level for drinking water established by the EPA and adopted by several states is 18 microgram/L (18 ppb) perchlorate; however other states have set levels as low as 1-4 microgram/L. The major sources of perchlorate contamination in surface and ground waters are propellant manufacturers, military installations defense connactors and agriculture.
DTIC
Perchlorates; Potable Water; Soils; Water; Water Pollution

20040078853 Civil Aeromedical Inst., Oklahoma City, OK
Analysis of Cocaine, Its Metabolites, Pyrolysis Products, and Ethanol Adducts in Postmortem Fluids and Tissues Using Zymark Automated Solid-Phase Extraction and Gas Chromatography-Mass Spectrometry
Lewis, Russell J.; Johnson, Robert D.; Angier, Michael K.; Ritter, Roxane M.; Drilling, Holly S.; Dec. 2003; 17 pp.; In English
Report No.(s): AD-A423349; DOT-FAA-AM-03-23; No Copyright; Avail: CASI; A03, Hardcopy

Cocaine (COC) is one of the most widely abused illicit drugs in America. COC abuse transcends all social, racial, and economic boundaries. Following the introduction in the mid-1980s of a new form of cocaine called crack, cocaine use has been on the rise. Because of its intense high, crack smoking has become very popular. Despite its popularity, crack smoking is a particularly dangerous form of COC use. Additionally, COC and ethanol are frequently used together, resulting in the formation of a biologically active molecule that is nearly as psycoactive as COC but produces a longer lasting and toxic effect. Demonstrating the presence or absence of COC and COC-related molecules in postmortem fluids and/or tissues can have serious legal consequences and may help determine the cause of impairment and/or death. We have developed a simple method for the simultaneous determination of COC and the COC metabolites benzoylecgonine, norbenzoylecgonine, ecgonine methyl ester, ecgonine, and norcocaine, as well as anhydroecgonine methyl ester (a unique byproduct of COC smoking), cocaethylene (a molecule formed by the concurrent use of COC and ethanol) and their related metabolites, anhydroecgonine, norcocaethylene, and ecgonine ethyl ester. This method incorporates a Zymark RapidTrace automated solid-phase extraction system, gas chromatography/mass spectrometry, and PFP/PFPA derivatives. The lower limits of detection ranged from 0.78 - 12.5 ng/mL, and the linear dynamic range for most analytes was 0.78 3200 ng/mL. The extraction efficiencies were from 26 -84%, with the exception of anhydroecgonine and ecgonine, which were from 1 - 4%. We applied this method to 5 aviation fatalities. This method has proven to be simple, robust, and accurate for the simultaneous determination of COC and 11 COC metabolites in postmortem fluids and tissues.
DTIC
Adducts; Drugs; Ethyl Alcohol; Extraction; Gas Chromatography; Mass Spectroscopy; Metabolites; Narcotics; Pyrolysis; Solid Phases

20040078855 Arkansas Univ., Fayetteville, AR
Optoelectronic Devices Based on Novel Semiconductor Structures
Ding, Yujie J.; Dec. 31, 2002; 9 pp.; In English
Contract(s)/Grant(s): F49620-01-1-0471; Proj-2305
Report No.(s): AD-A423352; AFRL-SR-AR-TR-04-0283; No Copyright; Avail: CASI; A02, Hardcopy

During the funding period, the group lead by Prof. Yujie J. Ding at Lehigh University and (formerly at Univ. of Arkansas) has investigated one class of the most important nonostructures; quantum-well dots. This class of the nanostructures serves as the first steps for eventually developing THz emitters and detectors that can be operated at room temperatures. For our effort

on quantum-well dots, we have designed and grown InGaAs/GaAs quantum wells strained by InAs quantum dots. In order to compare the quantum-well dots with quantum dots, we have also grown InAs quantum dots on the top of GaAs layers. We have used photoluminescence spectrum as an effective technique to characterize these structures - We have found tat quantum-well dots have much narrower FL linewidths for all the pump intensities. Indeed, the linewidth for the quantum-well dots can be narrower by the amount as large as 25 meV. In addition, the intensity for the wavelength- integrated PL for the quantum-well dots is enhanced by a factor of about 2 or more.
DTIC
Electro-Optics; Gallium Arsenides; Nanostructures (Devices); Optoelectronic Devices; Photoluminescence; Quantum Dots; Quantum Wells; Semiconductor Devices; Semiconductors (Materials)

20040078882 Naval Research Lab., Bay Saint Louis, MS
Expert Consensus on MIC: Prevention and Monitoring, Part 1
Scott, P. J.; Borenstein, Sue; Blackburn, Freeman; Cookingham, Bruce; Demarco, Dan; Mar. 2004; 6 pp.; In English
Report No.(s): AD-A423408; NRL/JA/7303/03/0151; No Copyright; Avail: CASI; A02, Hardcopy

This article, produced by NACE International Task Group 304, discusses the general industrial practice currently recommended by experts in the field of microbiologically influenced corrosion (MIC). Part 1 of two parts, the article discusses where MIC problems are likely to occur (e.g., pipelines, the chemical process industry, cooling water systems, fire protection systems, docks, piers, oil platforms, other quatic structures, pulp and paper machinery, power generation plants, and desalination equipment); how to prevent MIC; detecting MIC problems; monitoring bacteria and chemicals in bulk waters and liquids; monitoring equipment; bacterial counts; culture techniques; monitoring devices; and new monitoring techniques. The article also gives published references where detailed descriptions of useful techniques may be found. Part 2 will address failure analysis and control. (10 refs.)
DTIC
Biological Effects; Chemical Analysis; Corrosion; Detection; Microorganisms; Prevention

20040078884 Materials Research Society, Warrendale, PA
Materials Research Society Symposium Proceedings. Volume 743. Held in Boston, Massachusetts, December 2-6 2002. GaN and Related Alloys
Dec. 2002; 861 pp.; In English
Contract(s)/Grant(s): F49620-01-1-0121; N00014-02-1-0882
Report No.(s): AD-A423413; AFRL-SR-AR-TR-04-0102; No Copyright; Avail: CASI; A99, Hardcopy

Symposium L, "GaN and Related Alloys-2002," was held December 2-6 at the 2002 MRS Fall Meeting in Boston, Massachusetts. During nine half-day oral sessions, nine invited talks and 55 contributed talks were given. In three poster sessions, 161 posters were presented. This year's nitride symposium again was characterized by a wide scope of nitride related advances spanning from basic materials physics over process technology to high performance devices. Strong development was reported in bulk growth of GaN and AIN, growth on various substrates and substrate orientations, optical properties of InN, defect and doping analysis of p-doped GaN, and full consideration of polarization properties. These led to new performance records in visible light emitter technology, i.e., higher efficiency/ higher brightness, UV emitters with shorter wavelength, and UV and photo detectors. A strong development is also seen in nitride-based electronic devices with new heterostructure FET designs for RF power applications including such on Si substrates and wafer fusion. These symposium proceedings capture a crosscut of the exciting developments in this rapidly progressing and commercializing field. This volume will be useful for researchers working in the field of nitrides, and for students who seek entry into the subject.
DTIC
Conferences; Gallium Nitrides

20040078891 State Univ. of New York, Buffalo, NY
New Generation Photonics Materials: Design, Development, Characterization and Applications
Prasad, Paras N.; May 2004; 10 pp.; In English
Contract(s)/Grant(s): F49620-03-1-0103
Report No.(s): AD-A423441; AFRL-SR-AR-TR-04-0264; No Copyright; Avail: CASI; A02, Hardcopy

A significant amount of research was accomplished in the design, development, characterization and applications of two types of photonic materials: Multiphoton absorbing materials and hybrid nanocomposites for photorefractivity. We synthesized a new class of two-photon dyes which are pyridinum- based inner salts (covalently bonded) and achieved two- photon lasing.

Another accomplishment was to produce two-photon active liquid dyes with enhanced number density. In collaboration with AFRL at Dayton who synthesized 1, 3,5 triazine-based octupolar molecules, we characterized their two- photon properties using our newly developed femtosecond white light continuum transient absorption method. This method was also utilized to characterize the two-photon absorption spectrum of a series of highly two-photon active chromophores synthesized by the AFRL at Dayton. We also successfully synthesized a number of highly efficient three-photon materials.
DTIC
Characterization; Nanotechnology; Optical Materials; Photonics; Photons

20040078932 Engineering Research and Consulting, Inc., Edwards AFB, CA
Microstructural Studies of In-Situ Mesophase Transformation in the Fabrication of Carbon-Carbon Composites
Chioujones, K. M.; Ho, W.; Chau, P. C.; Fathollahi, B.; Wapner, P. G.; Apr. 29, 2004; 9 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F04611-99-C-0025; Proj-2306
Report No.(s): AD-A423502; No Copyright; Avail: CASI; A02, Hardcopy

Injection of a low viscosity mesophase pitch into CVD-rigidized preforms can be an effective approach for fabrication of carbon-carbon composites. Here flow-induced microstructures are stabilized by oxidation such that upon carbonization the fibrous carbon needles running through the flow channels are retained. While the injection method is effective in making highly densified materials with controlled microstructure it is not without limitations. The method is best applied to well-defined geometries such as aircraft brakes and the use of rigidized preforms is preferred to resist compaction under injection pressure. The Air Force Research Laboratory has developed a rapid, low-cost impregnation process that can be used to rigidize preforms or for further densification of C/C composites. The Air Force impregnation method is based on the mesophase pitch synthesis process advanced by Mochida and co-workers. The principle behind the impregnation strategy is that pure wetting monomer mixed with a catalyst can easily penetrate a fiber bundle or pore space in a preform by capillary forces. Once the preform is completely filled, in-situ polymerization of the monomer leads to formation of mesophase and hardening to coke. In this paper, the microstructures of mesophase formation in bulk and within preforms were examined at various stages in the temperature range critical to mesophase formation and hardening. Results of multiple cycle in-situ transformation also are compared with impregnation using fully transformed mesophase pitch and will be presented at the conference. (1 table, 3 figures, 10 refs.)
DTIC
Carbon-Carbon Composites; Fabrication; Fiber Composites; Impregnating; Injection; Microstructure

20040079662 Lawrence Livermore National Lab., Livermore, CA
Structures of High Density Molecular Fluids
Baer, B. J.; Cynn, H.; Iota, V.; Yoo, C. S.; Feb. 01, 2002; In English
Report No.(s): DE2004-15002345; UCRL-ID-146987; No Copyright; Avail: National Technical Information Service (NTIS)

The goal of this proposal is to develop an in-situ probe for high density molecular fluids. We will, therefore, use Coherent Anti-Stokes Raman Spectroscopy (CARS) applied to laser heated samples in a diamond-anvil cell (DAC) to investigate molecular fluids at simultaneous conditions of high temperatures and high pressures. Temperatures sufficient to populate vibrational levels above the ground state will allow the vibrational potential to be mapped by CARS. A system capable of heating and probing these samples will be constructed. Furthermore, the techniques that enable a sample to be sufficiently heated and probed while held at static high pressure in a diamond-anvil-cell will be developed. This will be an in-situ investigation of simple molecules under conditions relevant to the study of detonation chemistry and the Jovain planet interiors using state of the art non-linear spectroscopy, diamond-anvil-cells, and laser heating technology.
NTIS
Density (Mass/Volume); Molecular Flow; In Situ Measurement

20040079702 Lockheed Martin Corp., Syracuse, NY, USA
Phase Stability of Chromium(III) Oxide Hydroxide in Alkaline Sodium Phosphate Solutions
Ziemniak, S. E.; Opalka, E. P.; Jul. 2003; 24 pp.; In English
Report No.(s): DE2004-821873; LM-03K071; No Copyright; Avail: Department of Energy Information Bridge

Grimaldiite ((alpha)-CrOOH) is shown to transform to a sodium-chromium (III)-hydroxyphosphate compound (SCHP) in alkaline sodiumphosphate solutions at elevated temperatures via CrOOH(s)+ 4Na(sup+)+ 2HPO(sub 4)(sup 2-)= Na(sub 4)Cr(OH)(PO(sub 4))(sub 2)(s)+ H(sub 2)O. X-ray diffraction analyses indicate that SCHP possesses an orthorhombic lattice

having the same space group symmetry (Ibam, No.72) as sodium ferric hydroxyphosphate. A structurally-consistent designation for SCHP is Na(sub 3)Cr(PO(sub 4))(sub 2)(center-dot) NaOH; the molar volume of SCHP is estimated to be 1552 cm(sup 3). The thermodynamic equilibrium for the above reaction was defined in the system Na(sub 2)O-P(sub 2)O(sub 5)-Cr(sub 2)O(sub 3)-H(sub 2)O for Na/P molar ratios between 2.0and 2.4. On the basis of observed reaction threshold values for sodium phosphate concentration and temperature, the standard molar entropy (S(sup o)), heat capacity (C(sub p)(sup o)) and free energy of formation((Delta)G(sub f)(sup o)) for SCHP were calculated to be 690 J/(mol-K), 622 J/(mol-K) and -3509.97 kJ/mol, respectively.
NTIS
Hydroxides; Chromium Oxides; Stability; Thermodynamic Equilibrium; Entropy

20040079773 Brookhaven National Lab., Upton, NY
Status of Radioactive Elements in the Atomic Weights Table
Holden, N. E.; 2003; 10 pp.; In English
Report No.(s): DE2004-15006608; BNL-71594-2003-CP; No Copyright; Avail: Department of Energy Information Bridge
During discussions within the Inorganic Chemistry Division Committee, that dealt with the Periodic Table of the Chemical Elements and the official IUPAC position on its presentation, the following question was raised. When the various chemical elements are presented, each with their appropriate atomic weight value, how should the radioactive elements be presented. The Atomic Weights Commission has treated this question in a number of different ways during the past century, almost in a random manner. This report reviews the position that the Commission has taken as a function of time, as a prelude to a discussion in Ottawa about how the Commission should resolve this question for the future.
NTIS
Atomic Weights; Radioactive Isotopes; Time Dependence; Inorganic Chemistry

20040079777 Brookhaven National Lab., Upton, NY, USA
Chemically Bonded Cements from Boiler Ash and Sludge Wastes
Sugama, T.; Yager, K. A.; Aug. 1999; 48 pp.; In English
Report No.(s): DE2004-15006606; BNL-71596-2003-IR; No Copyright; Avail: Department of Energy Information Bridge
Based upon the previous Phase I research program aimed at looking for ways of recycling the KeySpan-generated wastes, such as waste water treatment sludge (WWTS) and bottom ash (BA), into the potentially useful cementitious materials called chemically bonded cement (CBC) materials, the emphasis of this Phase II program done at Brookhaven National Laboratory, in a period of September 1998 through July 1999, was directed towards the two major subjects: One was to assess the technical feasibility of WWTS-based CBC material for use as Pb-exchange adsorbent (PEA) which remediates Pb-contaminated soils in the field; and the other was related to the establishment of the optimum-packaging storage system of dry BA-based CBC components that make it a promising matrix material for the steam-cured concrete products containing sand and coarse aggregate.
NTIS
Water Treatment; Sludge; Cements; Chemical Bonds

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METALS AND METALLIC MATERIALS

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

20040077283 Lockheed Martin Corp., Syracuse, NY, USA
Primary Water SCC Understanding and Characterization through Fundamental Testing in the Vicinity of the Nickel/Nickel Oxide Phase Transition
Morton, D. S.; Attanasio, S. A.; Young, G. A.; May 2001; 16 pp.; In English
Report No.(s): DE2004-821310; LM-01K038; No Copyright; Avail: Department of Energy Information Bridge
This paper quantifies the nickel alloy stress corrosion crack growth rate (SCCGR) dissolved hydrogen level functionality. SCCGR has been observed to exhibit a maximum in proximity to the nickel/nickel oxide phase transition. The dissolved hydrogen level SCCGR dependency has been quantified in a phenomenological model in terms of the stability of nickel oxide not the dissolved hydrogen level. The observed SCCGR dependency has been extended to lower temperatures through the developed model and Contact Electrical Resistance (CER) measurements of the nickel/nickel oxide phase transition. Understanding obtained from this hydrogen level SCC functionality and complementary SCC subprocesses test results is

discussed. Specifically, the possible SCC fundamental subprocesses of corrosion kinetics, hydrogen permeation and pickup have also been measured for nickel alloys. Secondary Ion Mass Spectroscopy (SIMS) analysis has been performed on SCCGR specimens tested in heavy water (D(sub 2)O).
NTIS
Stress Corrosion; Crack Propagation; Phase Transformations

20040077285 Lockheed Martin Corp., Syracuse, NY, USA
Test to Determine Margin-to-Failure for HY-100 Steel with Undermatched Welds
Arpin, K. R.; Trimble, T. F.; Apr. 2003; 70 pp.; In English
Report No.(s): DE2004-815198; LM-03K013; TDA-19196; No Copyright; Avail: Department of Energy Information Bridge
This test program was undertaken to determine the flaw tolerance and to quantify the strength margin-to-failure of high yield strength steel fillet welded specimens. The tests demonstrate adequate margin-to-failure for HY-100 specimens fabricated with matched welding systems. In the use of high yield (HY) steel materials in designs required to accommodate rapidly applied dynamic loads, the concern was raised where the possibility of decreased flaw tolerance and premature failure by unstable ductile tearing could limit their use. Tests were developed and conducted to demonstrate adequate margin-to-failure in HY-100 fillet and partial penetration welded structures. In addition, inelastic analytical predictions were performed to assess the accuracy of such predictive tools compared to actual test data. Results showed that adequate margin-to-failure exists when using matched welding systems.
NTIS
High Strength Steels; Welded Structures

20040077289 Lockheed Martin Corp., Syracuse, NY, USA
Material Properties Test to Determine Ultimate Strain and True Stress-True Strain Curves for High Yield Steels
Arpin, K. R.; Trimble, T. F.; Apr. 2003; 100 pp.; In English
Report No.(s): DE2004-815195; LM-03K012; TDA-19194; No Copyright; Avail: Department of Energy Information Bridge
This testing was undertaken to develop material true stress-true strain curves for elastic-plastic material behavior for use in performing transient analysis. Based on the conclusions of this test, the true stress-true strain curves derived herein are valid for use in elastic-plastic finite element analysis for structures fabricated from these materials. In addition, for the materials tested herein, the ultimate strain values are greater than those values cited as the limits for the elastic-plastic strain acceptance criteria for transient analysis.
NTIS
Steels; Plastic Properties; Elastic Properties

20040077342 Lockheed Martin Corp., Syracuse, NY, USA
Effect of pH on Nickel Alloy SCC and Corrosion Performance
Morton, D. S.; Hansen, M.; Oct. 2002; In English
Report No.(s): DE2004-821960; LM-02K093; No Copyright; Avail: National Technical Information Service (NTIS)
Alloy X-750 condition HTH stress corrosion crack growth rate (SCCGR) tests have been conducted at 360 C (680 F) with 50 cc/kg hydrogen as a function of coolant pH. Results indicate no appreciable influence of pH on crack growth in the pH (at 360 C) range of(approx) 6.2 to 8.7, consistent with previous alloy 600 findings. These intermediate pH results suggest that pH is not a key variable which must be accounted for when modeling pressurized water reactor (PWR) primary water SCC. In this study, however, a nearly three fold reduction in X-750 crack growth rate was observed in reduced pH environments (pH 3.8 through HCl addition and pH 4-5.3 through H(sub 2)SO(sub 4) addition). Crack growth rates did not directly correlate with corrosion film thickness. In fact, 10x thicker corrosion films were observed in the reduced pH environments.
NTIS
Ph; Nickel Alloys; Stress Corrosion Cracking; Crack Propagation

20040077351 Lawrence Livermore National Lab., Livermore, CA
Anodic Behavior of Alloy 22 in Calcium Chloride and in Calcium Chloride plus Calcium Nitrate Brines
Evans, K. J.; Day, S. D.; Llevbare, G. O.; Whalen, M. T.; King, K. J.; May 13, 2003; In English
Report No.(s): DE2003-15005081; UCRL-JC-153056; No Copyright; Avail: National Technical Information Service (NTIS)
Alloy 22 (UNS N60622) is a nickel-based alloy, which is extensively used in aggressive industrial applications, especially due to its resistance to localized corrosion and stress corrosion cracking in high chloride environments. The purpose of this

work was to characterize the anodic behavior of Alloy 22 in concentrated calcium chloride (CaCl(sub 2)) brines and to evaluate the inhibitive effect of nitrate, especially to localized corrosion. Standard electrochemical tests such as polarization resistance and cyclic polarization were used. Results show that the corrosion potential of Alloy 22 was approximately -360 mV in the silver-silver chloride (SSC) scale and independent of the tested temperature. Cyclic polarization tests showed that Alloy 22 was mainly susceptible to localized attack in 5 M CaCl(sub 2) at 75 C and higher temperatures. The addition of nitrate in a molar ratio of chloride to nitrate equal to 10 increased the onset of localized corrosion to approximately 105 C. The addition of nitrate to the solution also decreased the uniform corrosion rate and the passive current of the alloy.
NTIS
Nickel Alloys; Calcium Chlorides; Brines; Nitrates

20040078896 Naval Research Lab., Bay Saint Louis, MS
An Evaluation of Carbon Steel Corrosion Under Stagnant Seawater Conditions
Lee, Jason S.; Ray, Richard I.; Lemeiux, Edward J.; Little, Brenda J.; May 2004; 17 pp.; In English
Report No.(s): AD-A423448; NRL/PP/7303/04/0002; No Copyright; Avail: CASI; A03, Hardcopy

Corrosion, of 1020 carbon steel coupons in, natural seawater over a six-month period was more aggressive under stagnant anaerobic conditions than stagnant aerobic conditions as measured by weight loss and instantaneous corrosion rate (polarization resistance) tinder oxygenated conditions, a two-tiered oxide layer. formed. The outer oxide layer was reddish-brown and contained numerous filamentous bacteria. The inner oxide was extreme tenacious and resistant to acid-cleaning . Under anaerobic conditions, a non-tenacious sulfur-rich corrosion product wub enmeshed bacteria formed on carbon steel surfaces. In both aerobic and anaerobic exposures, corrosion was more aggressive on horizontally oriented coupons compared to vertically oriented samples. Bulk water chemistry and microbial populations were measured as a function of rime. Despite the stagnant conditions, both were dynamic.
DTIC
Carbon Steels; Corrosion; Sea Water

20040078950 California Polytechnic State Univ., San Luis Obispo, CA
Investigation of Subcritical Fatigue Crack Growth in Gamma Titanium Aluminides
London, Blair; May 26, 2004; 19 pp.; In English
Contract(s)/Grant(s): N00014-98-1-0390
Report No.(s): AD-A423542; GDO-96-102; No Copyright; Avail: CASI; A03, Hardcopy

Our titanium aluminide alloy was readily heat treated to a fully lamellar state by holding at 1345C for 1.5 hours and furnace cooling resulting in a grain size of 330 muon m. The yield stress, ultimate stress, and total elongation were 315MPa, 465MPa, and 0.46% respectively. The fully lamellar microstructure shows significant work hardening. No long cracks initiated at R=0.1 and variation max=300MPa with up to 1.4 million cycles.
DTIC
Crack Propagation; Fatigue (Materials); Titanium Aluminides

20040079768 Lockheed Martin Corp., Syracuse, NY, USA
Growth of Uniform Ga(1-x)In(x)Sb Bulk Crystals by Self-Solute Feeding Technique
Dutta, P. S.; Rajagopalan, G.; Gutmann, R. J.; Nichols, G.; Aug. 2002; 20 pp.; In English
Report No.(s): DE2004-821861; LM-02K074; No Copyright; Avail: Department of Energy Information Bridge

Compositionally homogeneous, crack-free bulk crystals of Ga(sub 1-x)In(sub x)Sb with x as high as 0.4 has been grown for the first time using a self-solute feeding method. A balance between the growth rate and the spacing between the solute and the growth interface has been found to be crucial in maintaining uniform alloy composition.
NTIS
Crystal Growth; Gallium Alloys; Microstructure

27
NONMETALLIC MATERIALS

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

20040077277 NASA Ames Research Center, Moffett Field, CA, USA
Surface Characterization of LMMS Molybdenum Disilicide Coated HTP-8 Using Arc- Jet Hypersonic Flow
Stewart, David A.; March 2000; 19 pp.; In English
Contract(s)/Grant(s): 242-33-01
Report No.(s): NASA/TM-2000-209588; A-00V0010; No Copyright; Avail: CASI; A03, Hardcopy

Surface properties for an advanced Lockheed Martin Missile and Space (LMMS) molybdenum disilicide coated insulation (HTP-8) were determined using arc-jet flow to simulate Earth entry at hypersonic speeds. The catalytic efficiency (atom recombination coefficients) for this advanced thermal protection system was determined from arc-jet data taken in both oxygen and nitrogen streams at temperatures ranging from 1255 K to roughly 1600 K. In addition, optical and chemical stability data were obtained from these test samples.
Author
Molybdenum; Disilicides; Hypersonic Flow; Jet Flow; Recombination Coefficient; Thermal Protection; Surface Properties

20040078818 Army Research Lab., Aberdeen Proving Ground, MD
Review of Soviet/Russian Literature on Residual Stress Development in Filament- Wound Polymer-Matrix Composites
Wetzel, Eric D.; White, Scott R.; May 2004; 41 pp.; In English
Contract(s)/Grant(s): Proj-AH84
Report No.(s): AD-A423273; ARL-TR-3191; No Copyright; Avail: CASI; A03, Hardcopy

This report provides a review of select Soviet and Russian (SIR) literature from the mid 1960s to the mid 199Os related to residual stresses in wound composite articles. Through a compilation of SIR review articles. a historical overview of the development of this SIR knowledge base is first provided. This overview is then followed by detailed compilations of the following topics: experimental measurement of residual stress development in wound composites. cure shrinkage in neat polymers. residual microsstress development. modeling residual macrostress development. and manufacturing methods for controlling residual macrosnesses in wound composites. This study though not a comprehensive review of SIR residual stress literature. provides a general survey which should prove useful for identifying published sources of SIR technical expertise.
DTIC
Filament Winding; Matrix Materials; Polymer Matrix Composites; Residual Stress

20040078906 Pennsylvania Univ., Philadelphia, PA
Nanotube/Polymer Composites: Materials Selection and Process Design
Winey, Karen I; Fischer, John E.; May 19, 2004; 5 pp.; In English
Contract(s)/Grant(s): N00014-00-1-0720
Report No.(s): AD-A423465; No Copyright; Avail: CASI; A01, Hardcopy

The objectives of this project were (1) establish proof of principle by demonstrating enhanced polymer properties by the addition of single walled nanotubes (SWNTs), (2) provide guidelines for materials selection that give improved mechanical, electrical and/or thermal properties, and (3) define processing methods most appropriate for the materials identified. Our study of SWNT-polymer composites focuses on thermoplastics, because these materials can be readily drawn into fibers. As we have shown previously, the extensional flow exerted on the composite during fiber spinning aligns the SWNT to an unprecedented level. The anisotropic orientation of SWNT in these composite fibers provides an advantage when bolting for changes in macroscopic properties, particularly tensile strength. Composite processing and composite characterization received comparable effort in this project. Processing efforts include our coagulation method as well as in situ polymerization of nylon in the presence of well-dispersed SWNT. In addition to mechanical testing of the SWNT-thermoplastic fibers, we established methods for testing the electrical and thermal conductivity of these highly anisotropic materials. We used scattering methods for quantifying the extent of dispersion within the composites, a widely appreciated and long standing question in nanocomposites.
DTIC
Carbon Nanotubes; Composite Materials; Materials Selection; Nanotubes

20040079467 Lawrence Livermore National Lab., Livermore, CA
Review of Cathodic Arc Deposition Technology at the Start of the New Millennium
Sanders, D. M.; Anders, A.; Feb. 24, 2000; 40 pp.; In English
Report No.(s): DE2004-15006372; UCRL-CONF-137750; No Copyright; Avail: Department of Energy Information Bridge

The vacuum cathodic arc has been known to provide a means of producing coatings since the second half of the 19th century. This makes it one of the oldest known means for making coatings in a vacuum. In the last century it has been recognized that the copious quantities of ions produced by the process offers certain advantages in terms of coating properties. Specifically, ions can be steered and/or accelerated toward the parts to be coated. This, in turn, can provide enhanced adhesion, film density, and composition stoichiometry in the case of compound coatings. The ions generated by the cathodic arc have high 'natural' kinetic energy values in the range 20-200 eV, leading to enhanced surface mobility during the deposition process and even ion subplantation. In many cases, dense coatings are achieved even when non-normal arrival angles are involved. The ion energy can further manipulated by the plasma immersion biasing technique. The issue of macroparticle contamination has been addressed by a variety of novel plasma filters. In spite of all of these advantages, this deposition technique has not been widely adopted in the western nations for commercial coating except in the case of enhancing the performance of cutting tools. The purpose of the this review is to explore reasons for this lack of general use of the technology and to point out some encouraging recent developments which may lead to its accelerated adoption for a much wider variety of applications in the near future.
NTIS
Stoichiometry; Ions; Kinetic Energy

20040081040 NASA Ames Research Center, Moffett Field, CA, USA
Using Proteins to Build Nanocomputers
Laufenberg, Larry; November 13, 2003; 2 pp.; In English; Original contains black and white illustrations
Contract(s)/Grant(s): UPN 704-00-00; No Copyright; Avail: CASI; A01, Hardcopy

How low can we go? This is the question challenging scientists who want to build ever-smaller electronic components. As famed physicist Richard Feynmann said in 1959, 'there is plenty of room at the bottom,' meaning at the atomic or nanometric scale. But even Feynmann could only guess at how we might eventually build things 'down there.' As current lithographic techniques for etching semiconductor circuits rapidly approach their physical limits, scientists are looking for new and less expensive ways to fabricate circuits at infinitesimally small scales. NASA scientists have discovered a new tool that may help accomplish this goal - proteins. The basic building blocks of life may be harnessed to build computers and sensors on the nanoscale. Proteins provide self-assembling structures that can be engineered to build ordered arrays of quantum dots. Author (revised)
Nanofabrication; Nanostructure Growth; Proteins; Self Assembly

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*.

20040078821 Naval Facilities Engineering Service Center, Port Hueneme, CA
Cost and Performance Report; In-Situ Remediation of MTBE Contaminated Aquifers Using Propane Biosparging
Dec. 2003; 58 pp.; In English; Original contains color illustrations
Report No.(s): AD-A423277; NFESC-TR-2230-ENV; No Copyright; Avail: CASI; A04, Hardcopy

The objective of this ESTCP-funded project was to demonstrate application of propane biosparging (biostimulation) for in situ remediation of MTBE-contaminated aquifers. The primary objectives of this ESTCP-funded project were: 1) to demonstrate the safe application of propane biosparging (i.e., biostimulation) for in situ remediation of MTBE; and 2) evaluate the ability of propane biosparging to reduce MTBE concentrations in a contaminated aquifers to below California Department of Health Services regulatory limit of 5 microg/L. To meet this objective, several secondary objectives were identified as follows: 1) perform microcosm testing to evaluate the ability of indigenous propane oxidizing bacteria and/or other microorganisms to degrade MTBE; 2)select and characterize a field demonstration site; 3) use field characterization and microcosm study data to design, construct and operate a field demonstration system; 4) evaluate performance of the treatment system during a 10-month treatment period; and 5) evaluate the cost of applying the technology at full scale. The project

compared MTBE biodegradation in a Test Plot that was amended with propane oxidizing bacteria and treated with oxygen and propane to a Control Plot that received only oxygen. The technology also was evaluated under the USEPA SITE Program, as part of the USEPA's MTBE Treatment Technology Verification Program.
DTIC
Additives; Aquifers; Contamination; Costs; Gasoline; Propane; Water Pollution

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*.

20040078865 Black River Systems Co., Inc., Utica, NY
Signal Collection Processing Enhancements
Welchons, David; Apr. 2004; 63 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F30602-03-C-0205; Proj-558B
Report No.(s): AD-A423379; AFRL-IF-RS-TR-2004-108; No Copyright; Avail: CASI; A04, Hardcopy

The objective of this effort was to develop a Signal Collection Processing (SOP) software testbed that would provide a user with the capability to rapidly prototype and evaluate signal processing systems starting with MATLAB algorithms or portions of a MATLAB algorithm, and then transitioning the systems to an embedded real-time processing architecture. This testbed allows for automated signal analysis and data collection. An Air Force Research Laboratory (AFRL) algorithm, Polyphase Filter Channelizer ((PFC) and reconstruction algorithm application were selected for validating the Signal Collection Processing Testbed Polyphase Filter Channelization and reconstruction has uses in many signal processing applications.
DTIC
Algorithms; Augmentation; Signal Processing; Test Stands

20040078874 Army War Coll., Carlisle Barracks, PA
Transformation of Army Test and Evaluation
Brown, Robert L.; May 3, 2004; 36 pp.; In English
Report No.(s): AD-A423393; No Copyright; Avail: CASI; A03, Hardcopy

In the late 1990's the U.S. Army implemented significant organizational and procedural changes in the conduct of "independent evaluations" of Army developmental systems. While these changes significantly improved the planning and conduct of independent evaluations in support of the materiel acquisition process disconnects and inefficiencies persist within and between the Army's test and evaluation and analysis communities. This Strategy Research Project will describe the recent evolution of the organizations and processes currently involved in Army evaluation and will then propose additional changes that will further streamline Army weapon systems analysis and evaluation.
DTIC
Evaluation; System Effectiveness

20040078931 Hicks and Associates, Inc., McLean, VA
The Use of Modeling & Simulation (M&S) Tools in Acquisition Program Offices: Results of a Survey
Hillegas, Anne; Backschies, John; Donley, Michael; Duncan, R. C.; Edgar, William; Jan. 31, 2001; 30 pp.; In English; Original contains color illustrations
Report No.(s): AD-A423500; No Copyright; Avail: CASI; A03, Hardcopy

The DoD Deputy Director, Operational Test and Evaluation / Live Fire Testing (DDOT&E/LFT) through the DOT&E, tasked Hicks & Associates (HA&I) to conduct a survey of models and simulations (M&S) being used in support of defense acquisition programs. The tasking came as the direct result of issues first raised in an article which was published in DSMC's Program Manager (PM) magazine in their March - April 1999 issue entitled "Meet MASTER: Modeling & Simulation Test & Evaluation Reform: Energizing the M&S Support Structure". The MASTER concept includes a number of proposals including the formation of an M&S Consortium and the possibility of finding this Consortium by tapping into the budgets of the acquisition systems which would benefit from M&S. However, when the question of how much is currently being spent in support of M&S, and related questions as to who is spending it and for what, there was little, if any, comprehensive data upon which to base a response. The purpose, then of

the Hicks tasking was to identify, characterize, and determine the extent of M&S applications across a range of program office activities -- from concept exploration and engineering development through production and logistical support to systems in the field.
DTIC
Computerized Simulation; Simulation; Surveys

20040078939 Defense Acquisition Univ., Alexandria, VA
Why the "T" in Smart: A Constructive Synergy
Proctor, Michael D.; Posey-Macalintal, Amy; Kulonda, Dennis; Jan. 2003; 17 pp.; In English
Report No.(s): AD-A423523; No Copyright; Avail: CASI; A03, Hardcopy

Department of Defense (DOD) simulation-based acquisition (SBA) is widely discussed in literature. The Army offers a broad vision of SBA concept in the form of Simulation and Modeling for Acquisition Requirements and Training (SMART) accenting not only the Acquisition process but also essential contributions from the Requirements and Training communities. This research highlights how organizational training simulation has significantly helped the acquisition process beyond the confines of post-acquisition training.
DTIC
Education; Simulation

20040079296 Naval Research Advisory Committee, Arlington, VA
Science and Technology Community in Crisis
Bachkosky, J. M.; Erickson, J. B.; Grant, J. E.; Herrera, G. V.; Johnson, J. A.; May 2002; 136 pp.; In English; Original contains color illustrations
Report No.(s): AD-A423395; NRAC-02-03; No Copyright; Avail: CASI; A07, Hardcopy

This study requested by the Director, Defense Research and Engineering was motivated by concerns over the continuing difficulties the Department of Defense laboratories are experiencing to recrutiting and retaining world-class scientists and engineers.
DTIC
Military Technology; Research and Development; Research Facilities; Technologies

20040081110 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Nanotechnology: A Vast Field for the Creative Mind
Benavides, Jeannette; [2003]; 32 pp.; In English; No Copyright; Avail: CASI; A03, Hardcopy

Nanotechnology is a rapidly developing field worldwide. Nanotechnology is the development of smart systems for many different applications by building from the molecular level up. Current research, sponsored by The National Nanotechnology Alliance in the US will be described. Future needs in manpower of different disciplines will be discussed. Nanotechnology is a field of research that could allow developing countries to establish a technological infrastructure. The nature of nanotechnology requires professionals in many areas, such as engineers, chemists, physicists, mathematicians, computer scientists, materials scientists, etc. One of the materials that provide unique properties for nanotechnology is carbon nanotubes. At Goddard we have develop a process to produce nanotubes at lower costs and without metal catalysts which will be of great importance for the development of new materials for space applications and others outside NASA. Nanotechnology in general is a very broad and exciting field that will provide the technologies of tomorrow including biomedical applications for the betterment of mankind. There is room in this area for many researchers all over the world. The key is collaboration, nationally and internationally.
Author
Technology Utilization; Nanotechnology

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*.

20040077313 Helsinki Univ. of Technology, Espoo, Finland
Helsinki University of Technology Networking Laboratory
Hanninen, A.; Ilvesmaki, M.; Karvo, J.; Nyberg, E.; Palnman, I.; 2003; In English
Report No.(s): PB2004-105814; No Copyright; Avail: National Technical Information Service (NTIS)

The research and teaching area of the Networking laboratory focuses on communication networks, including upper layer issues, and on teletrafc theory. Currently the central research problem of the field is leveraging the Internet into a service network. This requires providing Quality of Service to data transfer with new protocols, improved security features and easy-to-use service platforms. The teaching curriculum of the Networking laboratory includes courses on IP technology, circuit-switched networking, teletrafc theory and on service and protocol development. In 2002, the laboratory staff published two patents, 3 international journal papers and 17 papers in conferences. In 2002, one Doctor dissertation, 4 Licentiate theses and 50 M. Sc theses were achieved by the students of our laboratory. In August 2002, the Networking Laboratory hosted the 16th Nordic Teletraffic Seminar gathering experts representing twelve nationalities in a three-day meeting. In 2002, the laboratory obtained several new multi-year research contracts. In the TEKES NETS Future Networks research program the Intelligent Routing Network project group was selected as one of the NETS spear head groups with a three year contract. A group of companies also joined in supporting the initiative. Another example of a multi-year project is the MobileMan Project on ad hoc networking supported by the EU.
NTIS
Computer Networks; Communication Networks; Research Projects

20040077320 Helsinki Univ. of Technology, Espoo
R&DNet Final Report. Process Innovation in Collaboration R&D Lessons Learnt from the Telecommunications Industry
Hirvensalo, A.; Evokari, J.; Feller, J.; Pekkola, K.; Turunen, P.; 2003; In English
Report No.(s): PB2004-105813; No Copyright; Avail: National Technical Information Service (NTIS)

;Table of Contents: Preface; Introduction; Action Research in the R&DNet project; Inter-project Learning; Common Understanding as a basis for Co-operation; Change management; Decision making; Creating a Collaborative Environment; A Matrix Tool for Collaborative Project Management; Transferring Research Results through an Interactive Workshop Method; International Survey; References; List of Figures and List of Tables.
NTIS
Telecommunication; Industries; Research and Development

20040077321 Helsinki Univ. of Technology, Espoo
Analysis of Quality of Service Routing Approaches and Algorithms
Juva, I.; 2003; In English
Report No.(s): PB2004-105792; No Copyright; Avail: National Technical Information Service (NTIS)

So far the Internet has offered only best effort service. All traffic is processed as quickly as possible and no preferences are given to any type of traffic. Today there are more and more applications that need service guarantees in order to function properly. These kinds of applications include for instance IP telephony, video-conference applications or video on-demand services. One important part of the QoS framework is the ability to find the paths that have sufficient resources to support the QoS requirements of a traffic flow. Current Internet routing protocols always forward packets to the shortest path based on hop count. This can cause problems for flows with a need for performance requirements, if the shortest path does not have the resources needed to meet these requirements. Quality of Service routing is a routing scheme that considers the quality of service requirements of a flow when making routing decisions. As opposed to traditional shortest path routing, which only considers the hop count, QoS routing is designed to find feasible paths that satisfy multiple constraints. This thesis is a survey on QoS routing. It presents the most important problems in QoS routing concerning path selection algorithms, cost of QoS routing, and different approaches. Routing problems for cases with one or two metric are formalized as optimization problems, and solutions algorithms are presented. For the most complex problems heuristic approximation algorithms and their evaluations found in literature are discussed. Algorithms for the important special case where available bandwidth and hop

count are used as metrics are considered in detail. The cost of QoS routing, and the factors contributing to the cost, are evaluated based on simulation and implementation study results found in literature. Different approaches concerning algorithm classes, link state information and timing of path computation are discussed. While providing paths that satisfy the QoS guarantees of traffic flows, QoS routing can cause inter-class effects that may lead to congestion or even starvation of low priority traffic. The authors own contribution consists of a simple Markov-model to study the effects of a bandwidth reservation scheme that sets aside some portion of a link's bandwidth for low priority traffic only, in order to prevent the starvation.
NTIS
Algorithms; Protocol (Computers); Simulation

20040077337 National Telecommunications and Information Administration, Washington, DC
Impact of Monitor Resolution and Type on Subjective Video Quality Testing
Pinson, M. H.; Wolf, S.; 2004; In English
Report No.(s): PB2004-105653; NTIA-TM-04-412; No Copyright; Avail: National Technical Information Service (NTIS)
This memorandum compares subjective video quality test results from a professional cathode ray tube (CRT) television monitor with that of a consumer liquid crystal display (LCD) video phone monitor. The CRT monitor supported the full ITU-R Recommendation BT.601 resolution (720 x 486) while the LCD monitor only supported Common Intermediate Format (CIF) resolution (352 x 288). The subjective results from the two tests are very similar, with the only significant difference being that the CIF monitor masks impairments that appear in only one of the two interlaced fields.
NTIS
Video Equipment; Monitors; Resolution

20040077340 General Accounting Office, Washington, DC
File Sharing: Selected Universities Report Taking Action to Reduce Copyright Infringement
May 2004; 48 pp.; In English
Report No.(s): PB2004-105541; GAO-04-503; No Copyright; Avail: CASI; A03, Hardcopy
File sharing--the use of peer-to-peer networks to distribute computer files among millions of users--has dramatically changed the way copyrighted materials, including digital music, videos, software, and images can be distributed. By permitting fast, cheap, and easy production of identical copies, file-sharing applications have facilitated both the legitimate distribution of copyrighted materials by the copyright holder and the illegal copyright infringement (piracy) and distribution by unauthorized users. According to a coalition of intellectual property owners in the recording industry, an increasing number of students are using fast Internet connections offered by college and university networks to infringe copyrights by illegally downloading and sharing massive volumes of copyrighted songs, movies, and video games on peer-to-peer networks.
NTIS
Copyrights; Computer Storage Devices

20040078746 NASA Ames Research Center, Moffett Field, CA, USA
Design of Hybrid Mobile Communication Networks for Planetary Exploration
Alena, Richard L.; Ossenfort, John; Lee, Charles; Walker, Edward; Stone, Thom; 2004; 19 pp.; In English; IEEE Aerospace Conference, 6 Mar. 2004; No Copyright; Avail: CASI; A03, Hardcopy
The Mobile Exploration System Project (MEX) at NASA Ames Research Center has been conducting studies into hybrid communication networks for future planetary missions. These networks consist of space-based communication assets connected to ground-based Internets and planetary surface-based mobile wireless networks. These hybrid mobile networks have been deployed in rugged field locations in the American desert and the Canadian arctic for support of science and simulation activities on at least six occasions. This work has been conducted over the past five years resulting in evolving architectural complexity, improved component characteristics and better analysis and test methods. A rich set of data and techniques have resulted from the development and field testing of the communication network during field expeditions such as the Haughton Mars Project and NASA Mobile Agents Project.
Author
Communication Networks; Deployment; Evaluation; Field Tests

20040078888 Army Research Lab., Adelphi, MD
Direct-Sequence Communication Systems
Torrieri, Don; Mar. 2004; 207 pp.; In English
Report No.(s): AD-A423421; ARL-TR-3175; No Copyright; Avail: CASI; A10, Hardcopy

This report presents a comprehensive review of the state of the art of direct-sequence communication systems. Although it is largely self-contained mathematically, the report presumes a thorough understanding of modern digital communications. To limit the report to approximately 200 pages. Only the most vital aspects of the theory are emphasized. but the cited references provide many details and minor topics.
DTIC
Pulse Communication; Telecommunication

20040078895 Sytronics, Inc., Dayton, OH
An Evaluation of Speech Controls for AWACS Weapons Directors
Vidulich, Michael A.; Nelson, W. T.; Bolia, Robert S.; Guilliams, Nicole M.; McLaughlin, Annie B.; May 2004; 53 pp.; In English
Contract(s)/Grant(s): Proj-7184
Report No.(s): AD-A423447; AFRL-HE-WP-TR-2004-0019; No Copyright; Avail: CASI; A04, Hardcopy
The objective of the current experiment was to evaluate speech recognition controls as a possible aid for AWACS operators. The research was carried out in the Multi- sensory Overview Large Scale Tactical Knowledge Environment (MOLTKE) facility at the Air Force Research Laboratory, Wright- Patterson Air Force Base, Ohio. The participants, trained Air Force air battle managers, were required to track a package of fighter aircraft, receive verbal target changes, and pass the verbal changes to the lead fighter aircraft in a simulated battlefield air interdiction (BAI) mission environment. The results of this research strongly supported the application of speech recognition to the TDF/PAD interface for use in AWACS applications.
DTIC
Awacs Aircraft; Speech Recognition

20040079294 Naval Research Advisory Committee, Arlington, VA
Command Center of the Future
Hegmann, K. C.; Brancati, T. A.; Bachkosky, J. M.; Douglass, J. W.; Fratarangelo, P. A.; Mar. 2001; 130 pp.; In English; Original contains color illustrations
Report No.(s): AD-A423401; NRAC-2001-01; No Copyright; Avail: CASI; A07, Hardcopy
In January 2000 the Naval Research Advisory Committee (NRAC) was tasked by the Honorable H. Lee Buchanan, Assistant Secretary of the Navy (Research, Development and Acquisition) ASN(RD&A) to assess Department of the Navy (DON) strategy for developing a next generation Maritime Command and Control (C2) Capability that would ensure that the associated Command, Control, Communications, Computers, Intelligence, Surveillance and Reconnaissance (C4ISR) functions are capable of providing embarked Joint Force Commanders with capabilities to receive, process and analyze information and to communicate and direct subordinate forces to achieve mission success. The tasking included a review of Joint Command organizations, potential operational missions and employment practices, communications support infrastructures, and related technologies. The panel was asked to review the Joint Maritime and Command Control Capability of the Future JCC(X) mission needs statement and requirements in order to comment upon and evaluate materiel alternatives and identify applicable emerging and existing technologies. To address the tasking, a panel of nine NRAC members and associates was augmented with four experts from industry and three retired flag/general officers with extensive C2 experience. NRAC assessed DON strategy for developing a next generation Maritime C2 Capability to ensure that JTFC can receive, process and analyze information, and communicate and direct forces for mission success. The JMCC must provide secure, robust communications and up-to-date decision support and display capabilities, and achieve net-centric connectivity with command centers and area outside the AOR. The technical complexity is geometrically related to force size.
DTIC
Command and Control; Interoperability; Military Operations

20040079298 Naval Postgraduate School, Monterey, CA
ASOCC Capabilities to Meet MTAC Current and Future Requirements
Schacher, Gordon; Gallup, Shelley P.; Jul. 20, 2003; 88 pp.; In English; Original contains color illustrations
Report No.(s): AD-A423382; NPS-97-03-007; No Copyright; Avail: CASI; A05, Hardcopy
The Area Security Command and Control System (ASOCC) has been designed to support Command and Control information and decision making during a terrorist event. It is being installed in a number of DoD facilities, including the

Multi-Threat Alert Center in NCIS. This work has determined the support ASOCC can provide for current and possible future MTAC missions.
DTIC
Command and Control; Information Systems

20040079391 NASA Ames Research Center, Moffett Field, CA, USA
Spacecraft Will Communicate "on the Fly"
Laufenberg, Lawrence; October 27, 2003; 2 pp.; In English; Original contains black and white illustrations
Contract(s)/Grant(s): UPN 704-00-00; No Copyright; Avail: CASI; A01, Hardcopy

As NASA probes deeper into space, the distance between sensor and scientist increases, as does the time delay. NASA needs to close that gap, while integrating more spacecraft types and missions-from near-Earth orbit to deep space. To speed and integrate communications from space missions to scientists on Earth and back again. NASA needs a comprehensive, high-performance communications network. To this end, the CICT Programs Space Communications (SC) Project is providing technologies for building the Space Internet which will consist of large backbone network, mid-size access networks linked to the backbones, and smaller, ad-hoc network linked to the access network. A key component will be mobile, wireless networks for spacecraft flying in different configurations.
Derived from text
Communication Networks; Space Communication

20040079634 Swedish Defence Research Establishment, Stockholm, Sweden
FoRMA Network; Summary 2002
Carling, C.; Hamrin, M.; Mossberg, K.; Tofte, J.; Aug. 2003; 74 pp.; In Swedish
Report No.(s): PB2004-104629; FOI-R-0943-SE; No Copyright; Avail: CASI; A04, Hardcopy

The report describes the work performed in the network group within the FoRMA-project during 2002. The first part of the report discusses the network idea and different aspects of a network centric warfare such as doctrine, methodology, organization, personnel and technology. Different hypotheses for investments in networks are presented together with a background analysis. A comprehensive description of methods for assessing networks structures is also given. In the end of the report different technology areas are described generally both from the research trends that are available and from the system perspectives that now exist in the current processes.
NTIS
Trends; Computer Networks; Command and Control

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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*.

20040077349 Lawrence Livermore National Lab., Livermore, CA
Solid-State Kicker Pulser for DARHT-2
Cook, E. G.; Lee, B. S.; Hawkins, S. A.; Allen, F. V.; Hickman, B. C.; Jun. 07, 2001; In English
Report No.(s): DE2003-15005324; UCRL-JC-141945; No Copyright; Avail: National Technical Information Service (NTIS)

To replace a hard tube design, a solid-state kicker pulser for the Dual-Axis Radiographic Hydrodynamic Test facility (DARHT-2) has been designed and tested. This kicker modulator uses multiple solid-state modules stacked in an inductive-adder configuration where the energy is switched into each section of the adder by a parallel array of MOSFETs. The modulator features very fast rise and fall times, pulse width agility and a high pulse-repetition rate in burst mode. The modulator can drive a 50(Omega) load with voltages up to 20 kV and can be easily configured for either positive or negative polarity. The presentation will include test and operational data.
NTIS
Electric Potential; Field Effect Transistors; Metal Oxide Semiconductors

20040078799 Naval Research Lab., Washington, DC

Long Wavelength Video-Based Event Detection, Preliminary Results from the CVNX and VS1 Test Series, Ex-USS SHADWELL, April 7-25, 2003

Steinhurst, Daniel A.; Minor, Christian P.; Owrutsky, Jeffrey C.; Rose-Pehrsson, Susan L.; Gottuk, Daniel T.; Dec. 30, 2003; 50 pp.; In English; Original contains color illustrations

Report No.(s): AD-A423240; NRL/MR-MM/6110--03-8733; No Copyright; Avail: CASI; A03, Hardcopy

This report documents results from long wavelength- response, or night vision video detection (LWVD) of fire, smoke, and hot objects obtained during the CVNX and VS1 Test Series. The cameras demonstrated thermal imaging capabilities and an enhanced sensitivity to flaming fires and other hot objects when compared to co-located regular video cameras. Video event detection with long wavelength cameras is discussed and compared with the results of video event detection systems using regular cameras. For quantitative comparison to the commercial video-based fire detection systems, a simple luminosity-based algorithm was developed and used to evaluate camera/filter combinations for fire, smoke, and nuisance (false) event detection and response times. The LWVD system provides higher detection sensitivity but also more false alarms when compared to regular video detection systems. The thermal imaging capabilities of the LWVD system are evaluated based on comparison with temperature measurements of a fire-heated bulkhead and a laboratory blackbody emitter. Good agreement is obtained for hot objects at temperatures above 400 deg C.

DTIC

Detection; Fires; Remote Sensors; Video Signals

20040078819 Naval Postgraduate School, Monterey, CA

Optimizing Electric Grid Design Under Asymmetric Threat (II)

Salmeron, Javier; Wood, Kevin; Baldick, Ross; Mar. 2004; 46 pp.; In English; Original contains color illustrations

Report No.(s): AD-A423274; NPS-OR-04-001; No Copyright; Avail: CASI; A03, Hardcopy

This research extends our earlier work to improve the security of electric power grids subject to disruptions caused by terrorist attacks. To identify critical system components (e.g.. transmission lines. generators. transformers). we devise bilevel optimization models that identify maximally disruptive attack plans for terrorists. who are assumed to have limited offensive resources. A new model captures the dynamics of system operation as a network is repaired after an attack. and we adapt an earlier heuristic for that model's solution. We also develop a new. mixed- integer programming model (MIP) for the problem; a model that can be solved exactly using standard optimization software. at least in theory. Preliminary testing shows that optimal solutions are readily achieved for certain standard test problems. although not for the largest ones. which the heuristic seems to handle well. However. optimal solutions do provide a benchmark to measure the accuracy of the heuristic: The heuristic typically achieves optimality gaps of less than l0% but occasionally the gap reaches 25%. Research will continue to refine the heuristic algorithm, the MIP formulation. and the algorithms to solve it. We also demonstrate progress made towards a graphical user interface that allows performing our interdiction analysis in a friendly environment.

DTIC

Asymmetry; Graphical User Interface; Security

20040078868 Naval Research Lab., Washington, DC

Comparison of the Frequency Response and Voltage Tuning Characteristics of a FFP and a MEMS Fiber Optic Tunable Filter

Bucholtz, Frank; Seaver, Mark; Todd, Michael D.; May 12, 2004; 27 pp.; In English

Report No.(s): AD-A423385; No Copyright; Avail: CASI; A03, Hardcopy

Tunable optical filters based on a Fabry-Perot element are a critical component in many wavelength based fiber optic sensor systems. This report compares the performance of two fiber-pigtailed tunable optical filters, the fiber Fabry-Perot (FFP) filter from Micron Optics and a recently developed type of tunable filter based on Micro Electro-Mechanical System (MEMS) technology from Nortel. The findings indicate that while both filters have similar bandpass characteristics, the FFP scans one free spectral range with a linear 0-10 volt signal while the MEMS system displays a voltage squared response and requires up to 35 volts to scan one free spectral range. The small signal response of both filters suggests that they can operate at frequencies up to 20kHz and possibly as high as 100kHz.

DTIC

Electric Potential; Fiber Optics; Frequency Response; Microelectromechanical Systems; Tunable Filters; Tuning

20040078877 Industrial Coll. of the Armed Forces, Washington, DC
A Projection of Moore's Law and Recommended Approaches to Manage and Mitigate Risks
Burns, Greg; Marks, William C.; Apr. 2003; 34 pp.; In English
Report No.(s): AD-A423400; No Copyright; Avail: CASI; A03, Hardcopy

Moore's Law: The number of transistors that can be placed on a micro-circuit doubles every 18-24 months, resulting in a rapid turnover in generations of microcircuits. There are almost as many opinions about how long Moore's Law will be applicable as there have been technological advances since the Law was first annunciated in 1965. The majority of industry experts however believe that the physical limits of silicon based advancements will be reached by the end of the decade. Microelectronics obsolescence will remain a challenge as industry and academia alike are hard at work on marketing post-silicon applications. New atomic compounds such as gallenium arsenide and ferritin may replace silicon substrates within integrated circuits while entirely new technologies like quantum computing may transform the entire industry. The point is that while Moore's Law will end relatively soon innovation will not--and DoD program managers (PM) will still have to manage obsolescence.
DTIC
Microelectronics; Risk; Silicon; Transistors

20040078894 Clemson Univ., SC
Development of Transparent LSCO and LSCNO Conductors for Optical Shutter Systems
Schwartz, R. W.; Sebastian, M. T.; Charoenwongsa, M.; Dobberstein, H. D.; Jan. 2001; 7 pp.; In English
Contract(s)/Grant(s): DAAD19-00-1-0002
Report No.(s): AD-A423446; UMR-2; ARO-40422.83-MS; No Copyright; Avail: CASI; A02, Hardcopy

We have prepared lanthanum strontium cobalt oxide La(0.50)50Sr(0.50)Co(0. 50)Ni(0.50)O3; LSCNO 50/50 and lanthanum strontium cobalt nickel oxide La(0.50) Sr(0.50)Co(0. 50)Ni(0.50)O3; LSCNO as candidate transparent electrodes for use in a shutter-based infrared sensor protection device. The shutter device requires that the electrode be transparent (80% transmission) and have moderate sheet resistance (300 ohms/sq.). Because of the effects of film thickness on intrinsic material properties, such as resistivity and extinction coefficient, and simple engineering issues (i.e., the relationship between film thickness, resistance and transmission), films of various thicknesses were prepared to achieve an optimal balance of electrical and optical performance. van der Pauw measurements and FTIR spectroscopy were used to study thin film properties. The best LSCO films prepared demonstrated electrical (438 ohms/sq.) and optical (68% transmission at 8 micrometers) properties that did not meet the target property goals for this application. However, the LSCNO films (of optimal thickness) offered performance (323 ohms/sq. and 73% transmission) close to the device requirements.
DTIC
Conductors; Electrodes; Infrared Detectors; Intermetallics; Lanthanum; Metal Films; Transparence

20040078922 Materials Research Society, Warrendale, PA
Symposium Y: GaN and Related Alloys
Wraback, Michael; Ng, Hock M.; Hiramatsu, Kazumasa; Grandjean, Nicolas; May 17, 2004; 53 pp.; In English
Contract(s)/Grant(s): F49620-03-1-0400
Report No.(s): AD-A423484; AFRL-SR-AR-TR-04-0282; AFRL-SR-AR-TR-04-0282; No Copyright; Avail: CASI; A04, Hardcopy

No abstract available
Conferences; Gallium Nitrides; Semiconductors (Materials)

20040078940 Defense Acquisition Univ., Alexandria, VA
Lessons Learned from the Early Stages of Development of the Guardrail Common Sensor for the Radical Reduction of Cycle Time
Sherman, J. D.; Jan. 2003; 16 pp.; In English
Report No.(s): AD-A423524; No Copyright; Avail: CASI; A03, Hardcopy

Nine key participants from the government and prime contractor were interviewed to identify important lessons learned from the early stages of development of the Guardrail Common Sensor. In addition to in-depth interviews U. S. Army Communications and Electronics Command (CECOM) historical documents unclassified government reports and other public sources were reviewed for information regarding the system development. The management of the system development deviated from normal acquisition processes in several important ways. These are presented and the implications for flexibility

in the acquisition process are discussed. The historical development of the Guardrail program summarized in this case suggests that this evolution of advanced airbone communications and electronic intelligence systems represented one of the most successful defense systems developed during the last third of the twentieth century. Based on measures of program cost, schedule, and technical performance, the sequence of Guardrail systems was exceptional.
DTIC
Communication Equipment; Radicals

20040078952 Aerospace Corp., El Segundo, CA
Cavity-Q Aging Observed via an Atomic-Candle Signal
Coffer, John G.; Sickmiller, Brett; Camparo, James C.; Apr. 30, 2004; 12 pp.; In English
Contract(s)/Grant(s): FA8802-04-C-0001
Report No.(s): AD-A423550; TR-2004-8555-4; SMC-TR-04-14; No Copyright; Avail: CASI; A03, Hardcopy

Slow variations in cavity-Q and microwave power are thought to play a role in the long-term frequency stability of gas-cell atomic clocks. Here, we use an atomic- candle method to study the aging of a TE(sub 011) microwave cavity's resonant frequency and quality factor when a glass resonance cell containing Rb87 loads the cavity. Our results suggest that the alkali vapor coats the inside glass surface of the resonance cell with a thin metallic film; and that, as this film evolves, the quality factor degrades. (In our experiments, the quality factor changed by 30% over a timescale of months.) More generally, the pre- sent work demonstrates the efficacy of the atomic-candle method for investigating cavity resonances. In particular, we show that, when used in conjunction with more traditional methods, the atomic-candle method has the potential to reveal information on a cavity mode's spatial profile.
DTIC
Atomic Clocks; Atoms; Cavities; Cavity Resonators; Resonant Frequencies; Rubidium

20040079711 Lockheed Martin Corp., Syracuse, NY, USA
Wafer Bonding and Epitaxial Transfer of GaSb-Based Epitaxy to GaAs for Monolithic Interconnection of Thermophotovoltaic Devices
Wang, C. A.; Shiau, D. A.; Murphy, P. G.; O'Brien, P. W.; Huang, R. K.; Jun. 2003; 24 pp.; In English
Report No.(s): DE2004-821870; LM-03K061; No Copyright; Avail: Department of Energy Information Bridge

GaInAsSb/AlGaAsSb/InAsSb/GaSb epitaxial layers were bonded to semi-insulating GaAs handle wafers with SiO(sub x)/Ti/Au as the adhesion layer for monolithic interconnection of thermophotovoltaic (TPV) devices. Epitaxial transfer was completed by removal of the GaSb substrate, GaSb buffer, and InAsSb etch-stop layer by selective chemical etching. The SiO(sub x)/TiAu provides not only electrical isolation, but also high reflectivity and is used as an internal back-surface reflector. Characterization of wafer-bonded epitaxy by high-resolution x-ray diffraction and time-decay photoluminescence indicates minimal residual stress and enhancement in optical quality. 0.54-eV GaInAsSb cells were fabricated and monolithically interconnected in series. A 10-junction device exhibited linear voltage building with an open-circuit voltage of 1.8 V.
NTIS
Wafers; Bonding; Photoluminescence

20040079712 Lawrence Livermore National Lab., Livermore, CA
Performance of Multiple Pulse Multiple Delay UWB Modulation
Nekoogar, F.; Dowla, F. U.; May 23, 2003; In English
Report No.(s): DE2003-15005367; UCRL-JC-153531; No Copyright; Avail: National Technical Information Service (NTIS)

Multiple access (MA) in UWB communication is an area of active research. In this paper we introduce and study the performance of a new MA scheme in the context of multiple transmitted-reference short duration (nsec) chirp pulses in the presence of additive white Gaussian noise (AWGN). The transmitted-reference (T-R) receiver is extended using multiple orthogonal pulses. The proposed UWB receiver samples the receiver autocorrelation function (ACF) at both zero- and non-zero lags, thus sampling and matching the shape of ACFs rather than just the shape of the received pulses. Sampling of non-zero ACF lags is a significant new approach. The scheme proposed in this paper is a step towards combining the multi-pulse approach and T-R modulation in a multiple access ultra wideband (MA-UWB) communications system. Improved bit error rate performance over a conventional zerolag receiver (i.e. energy detection receiver) is demonstrated by simulation.

Analytical expressions for the system BER are also derived and confirmed through simulations for the system.
NTIS
Pulse Modulation; Multiple Access; Random Noise

20040079763 Lockheed Martin Technology Services Group, Mesa, AZ, USA
Study of Capacity and Voltage Degradation in Nickel-Hydrogen Cells
Vaidyanathan, Hari; Rao, Gopalakrishna M.; 2004; 27 pp.; In English; Space Power Workshop, 19-22 Apr. 2004, Manhattan Beach, CA, USA; Original contains color illustrations; No Copyright; Avail: CASI; A03, Hardcopy

The objective of this study is to understand the causes of the nickel hydrogen (NiH2) cell degradetion: storage, cycling, and reversal.
Derived from text
Degradation; Capacity; Nickel Hydrogen Batteries; Electric Potential

20040081165 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Cryogenic Characterization and Testing of Magnetically-Actuated Microshutter Arrays for the James Webb Space Telescope
King, T. T.; Kletetschka, G.; Jah, M. A.; Li, M. J.; Jhabvala, M. D.; Wang, L. L.; Beamesderfer, M. A.; Kutyrev, A. S.; Silverberg, R. F.; Rapchun, D.; Schwinger, D. S., et al.; [2004]; 5 pp.; In English; Solid-State Sensors, Actuators and Microsystems Workshop, 6-10 Jun. 2004, Hilton Head, SC, USA; Original contains color and black and white illustrations; Copyright; Avail: CASI; A01, Hardcopy

Two-dimensional MEMS microshutter arrays (MSA) have been fabricated at the NASA Goddard Space Flight Center (GSFC) for the James Webb Space Telescope (JWST) to enable cryogenic (approximately 35 K) spectrographic astronomy measurements in the near-infrared region. Functioning as a focal plane object selection device, the MSA is a 2-D programmable aperture mask with fine resolution, high efficiency and high contrast. The MSA are close- packed silicon nitride shutters (cell size of 100 x 200 microns) patterned with a torsion flexure to allow opening to 90 degrees. A layer of magnetic material is deposited onto each shutter to permit magnetic actuation. Two electrodes are deposited, one onto each shutter and another onto the support structure side-wall, permitting electrostatic latching and 2-D addressing. New techniques were developed to test MSA under mission-similar conditions (8 K less than or equal to T less than 300K). The magnetic rotisserie has proven to be an excellent tool for rapid characterization of MSA. Tests conducted with the magnetic rotisserie method include accelerated cryogenic lifetesting of unpackaged 128 x 64 MSA and parallel measurement of the magneto-mechanical stiffness of shutters in pathfinder test samples containing multiple MSA designs. Lifetest results indicate a logarithmic failure rate out to approximately 10(exp 6) shutter actuations. These results have increased our understanding of failure mechanisms and provide a means to predict the overall reliability of MSA devices.
Author
Actuation; Cryogenics; James Webb Space Telescope; Microelectromechanical Systems; Fabrication; Magnetic Materials; Focal Plane Devices

20040081216 NASA Langley Research Center, Hampton, VA, USA
Synchronized Electronic Shutter System and Method for Thermal Nondestructive Evaluation
Zalameda, Joseph N., Inventor; Winfree, William P., Inventor; March 30, 2004; 28 pp.; In English
Patent Info.: Filed 10 Apr. 2002; US-Patent-6,712,502; US-Patent-Appl-SN-120225; NASA-Case-LAR-16126-1; No Copyright; Avail: CASI; A03, Hardcopy

The invention is a synchronized electronic shutter system (SESS) and method for same side and through transmission thermal analysis and inspection of a material for finding defects, corrosion, disbond defects, integrity of a weld and determination of paint thickness. The system comprises an infrared detector that acquires background images of the sample. A shutter then covers the detector and lamps rapidly heat the sample above ambient temperature. Shutters cover all lamps at the same time the shutter over the infrared detector is opened. The infrared detector acquires a series of temperature images over time radiated from the sample a s the sample cools down. After collecting a series of temperature images taken by the SESS, a processed image is developed using one of the group comprising time derivative calculation, temperature normalization data reduction routine, thermal diffusivity curve fitting and averaging the series of temperature images.
Author
Synchronizers; Shutters; Nondestructive Tests; Thermal Analysis

20040081231 NASA Ames Research Center, Moffett Field, CA, USA

Ultrasensitive Label-free Electronic Chip for DNA Analysis Using Carbon Nanotube Nanoelectrode Arrays

Li, Jun; Koehne, Jessica; Chen, Hua; Cassell, Alan; Ng, Hou Tee; Ye, Qi; Han, Jie; Meyyappan, M.; 2004; 18 pp.; In English; Oak Ridge Conference of AACC, 29-30 Apr. 2004, San Jose, CA, USA

Contract(s)/Grant(s): NAS2-99092; No Copyright; Avail: CASI; A03, Hardcopy

There is a strong need for faster, cheaper, and simpler methods for nucleic acid analysis in today s clinical tests. Nanotechnologies can potentially provide solutions to these requirements by integrating nanomaterials with biofunctionalities. Dramatic improvement in the sensitivity and multiplexing can be achieved through the high-degree miniaturization. Here, we present our study in the development of an ultrasensitive label-free electronic chip for DNA/RNA analysis based on carbon nanotube nanoelectrode arrays. A reliable nanoelectrode array based on vertically aligned multi-walled carbon nanotubes (MWNTs) embedded in a SiO2 matrix is fabricated using a bottom-up approach. Characteristic nanoelectrode behavior is observed with a low-density MWNT nanoelectrode array in measuring both the bulk and surface immobilized redox species. The open-end of MWNTs are found to present similar properties as graphite edge-plane electrodes, with a wide potential window, flexible chemical functionalities, and good biocompatibility. A BRCA1 related oligonucleotide probe with 18 bases is covalently functionalized at the open ends of the MWNTs and specifically hybridized with an oligonucleotide target as well as a PCR amplicon. The guanine bases in the target molecules are employed as the signal moieties for the electrochemical measurements. Ru(bpy)3(2+) mediator is used to further amplify the guanine oxidation signal. This technique has been employed for direct electrochemical detection of label-free PCR amplicon through specific hybridization with the BRCAl probe. The detection limit is estimated to be less than approximately 1000 DNA molecules, approaching the limit of the sensitivity by laser-based fluorescence techniques in DNA microarray. This system provides a general electronic platform for rapid molecular diagnostics in applications requiring ultrahigh sensitivity, high-degree of miniaturization, simple sample preparation, and low- cost operation.

Author

Carbon Nanotubes; Deoxyribonucleic Acid; Electrodes; Nanotechnology; Sensitivity; Chips (Electronics); Arrays; Fabrication

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*.

20040077282 Lockheed Martin Corp., Syracuse, NY, USA

Subcooled Boiling Near a Heated Wall

Trabold, T. A.; Maneri, C. C.; Vassallo, P. F.; Considine, D. M.; Oct. 2000; 30 pp.; In English

Report No.(s): DE2004-821308; LM-00K084; No Copyright; Avail: Department of Energy Information Bridge

Experimental measurements of void fraction, bubble frequency, and velocity are obtained in subcooled R-134a flowing over a heated flat plate near an unheated wall and compared to analytical predictions. The measurements were obtained for a fixed system pressure and mass flow rate (P= 2.4 MPa and w= 106 kg/hr) at various inlet liquid temperatures. During the experiments, electrical power was applied at a constant rate to one side of the test section. The local void fraction data, acquired with a hot-film anemometer probe, showed the existence of a significant peak near the heated wall and a smaller secondary peak near the unheated wall for the larger inlet subcoolings. Local vapor velocity data, taken with the hot-film probe and a laser Doppler velocimeter, showed broad maxima near the centerline between the heated and unheated plates. Significant temperature gradients near the heated wall were observed for large inlet subcooling. Bubble size data, inferred from measurements of void fraction, bubble frequency and vapor velocity, when combined with the measured bubble chord length distributions illustrate the transition from pure three dimensional spherical to two-dimensional planar bubble flow, the latter being initiated when the bubbles fill the gap between the plates. These various two-phase flow measurements were used for development of a multidimensional, four-field calculational method; comparisons of the data to the calculations show reasonable agreement.

NTIS

Boiling; Liquid-Gas Mixtures; Prediction Analysis Techniques; Test Chambers

20040077300 Lawrence Livermore National Lab., Livermore, CA

Progress in Gyrokinetic Simulations of Toroidal ITG Turbulence

Dimits, A. M.; Cohen, B. I.; Nevins, W. M.; Shumaker, D. E.; Oct. 12, 2000; 12 pp.; In English

Report No.(s): DE2004-15006486; UCRL-JC-137297; No Copyright; Avail: Department of Energy Information Bridge

The 3-D nonlinear toroidal gyrokinetic simulation code PG3EQ is used to study toroidal ion temperature gradient (ITG) driven turbulence--a key cause of the anomalous transport that limits tokamak plasma performance. Systematic studies of the dependence of ion thermal transport on various parameters and effects are presented, including dependence on(rvec E) x(rvec B) and toroidal velocity shear, sensitivity to the force balance in simulations with radial temperature gradient variation, and the dependences on magnetic shear and ion temperature gradient.
NTIS
Turbulence; Computerized Simulation

20040077343 Lockheed Martin Corp., Syracuse, NY, USA
Flow Tones in a Pipeline-Cavity System: Effect of Pipe Asymmetry, 2002
Erdem, D.; Rockwell, D.; Oshkai, P.; Pollack, M.; May 2002; In English
Report No.(s): DE2004-821958; LM-02K041; No Copyright; Avail: National Technical Information Service (NTIS)

Flow tones in a pipeline-cavity system are characterized in terms of unsteady pressure within the cavity and along the pipe. The reference case corresponds to equal lengths of pipe connected to the inlet and outlet ends of the cavity. Varying degrees of asymmetry of this pipe arrangement are investigated. The asymmetry is achieved by an extension of variable length, which is added to the pipe at the cavity outlet. An extension length as small as a few percent of the acoustic wavelength of the resonant mode can yield a substantial reduction in the pressure amplitude of the flow tone. This amplitude decrease occurs in a similar fashion within both the cavity and the pipe resonator, which indicates that it is a global phenomenon. Furthermore, the decrease of pressure amplitude is closely correlated with a decrease of the Q (quality)-factor of the predominant spectral component of pressure. At a sufficiently large value of extension length, however, the overall form of the pressure spectrum recovers to the form that exists at zero length of the extension. Further insight is provided by variation of the inflow velocity at selected values of extension length. Irrespective of its value, both the magnitude and frequency of the peak pressure exhibit a sequence of resonant-like states. Moreover, the maximum attainable magnitude of the peak pressure decreases with increasing extension length.
NTIS
Acoustics; Pipelines; Asymmetry

20040077344 Lockheed Martin Corp., Syracuse, NY, USA
Flow Tones in a Pipeline-Cavity System: Effect of Pipe Asymmetry
Erdem, D.; Rockwell, D.; Oshkai, P.; Pollack, M.; 2001; In English
Report No.(s): DE2004-821955; LM-01K024; No Copyright; Avail: National Technical Information Service (NTIS)

Flow tones in a pipeline-cavity system are characterized in terms of unsteady pressure within the cavity and along the pipe. The reference case corresponds to equal lengths of pipe connected to the inlet and outlet ends of the cavity. Varying degrees of asymmetry of this pipe arrangement are investigated. The asymmetry is achieved by an extension of variable length, which is added to the pipe at the cavity outlet. An extension length as small as a few percent of the acoustic wavelength of the resonant mode can yield a substantial reduction in the pressure amplitude of the flow tone. This amplitude decrease occurs in a similar fashion within both the cavity and the pipe resonator, which indicates that it is a global phenomenon. Furthermore, the decrease of pressure amplitude is closely correlated with a decrease of the Q (quality)-factor of the predominant spectral component of pressure. At a sufficiently large value of extension length, however, the overall form of the pressure spectrum recovers to the form that exists at zero length of the extension. Further insight is provided by variation of the inflow velocity at selected values of extension length. Irrespective of its value, both the magnitude and frequency of the peak pressure exhibit a sequence of resonant-like states. Moreover, the maximum attainable magnitude of the peak pressure decreases with increasing extension length.
NTIS
Cavity Resonators; Pipe Flow; Pipelines

20040077345 Lockheed Martin Corp., Syracuse, NY, USA
Shallow Cavity Flow Tone Experiments: Onset of Locked-On States
Rockwell, D.; Lin, J. C.; Oshkai, P.; Reiss, M.; Pollack, M.; Sep. 2000; In English
Report No.(s): DE2004-821945; LM-00K072; No Copyright; Avail: National Technical Information Service (NTIS)

Fully turbulent inflow past a shallow cavity is investigated for the configuration of an axisymmetric cavity mounted in a pipe. Emphasis is on conditions giving rise to coherent oscillations, which can lead to locked-on states of flow tones in the pipe-cavity system. Unsteady surface pressure measurements are interpreted using three-dimensional representations of

amplitude-frequency-inflow velocity; these representations are constructed for a range of cavity depth. Assessment of these data involves a variety of approaches. Evaluation of pressure gradients on plan views of the three-dimensional representations allows extraction of the frequencies of the instability (Strouhal) modes of the cavity oscillation. These frequency components are correlated with traditional models originally formulated for cavities in a free-stream. In addition, they are normalized using two length scales; inflow boundary-layer thickness and pipe diameter. These scales are consistent with those employed for the hydrodynamic instability of the separated shear layer, and are linked to the large-scale mode of the shear layer oscillation, which occurs at relatively long cavity length. In fact, a simple scaling based on pipe diameter can correlate the frequencies of the dominant peaks over a range of cavity depth. The foregoing considerations provide evidence that pronounced flow tones can be generated from a fully-turbulent inflow at very low Mach number, including the limiting case of fully-developed turbulent flow in a pipe. These tones can arise even for the extreme case of a cavity having a length over an order of magnitude longer than its depth. Suppression of tones is generally achieved if the cavity is sufficiently shallow.
NTIS
Boundary Layers; Cavity Flow; Free Flow

20040078831 Naval Research Lab., Bay Saint Louis, MS
Seafloor Topography and Ocean Circulation
Gille, Sarah T.; Metzger, E. J.; Tokmakian, Robin; Mar. 2004; 11 pp.; In English; Original contains color illustrations
Report No.(s): AD-A423293; NRL/JA/7320/03/0123; No Copyright; Avail: CASI; A03, Hardcopy

Seafloor topography influences ocean circulation in two basic ways. First, it steers ocean flows. Second, it provides barriers that prevent deep waters from mixing, except within deep passageways that connect ocean basins or in hydraulically controlled overflow regions. This paper explores the impact of both of these processes on ocean circulation. The examples highlighted here were among the broad range of topics explored at a workshop on "Ocean Circulation, Bathymetry, and Climate," held at Scripps Institution of Oceanography in October 2002. (8 figures, 27 refs.)
DTIC
Bathymeters; Ocean Bottom; Ocean Currents; Sea Water; Topography; Water Flow

20040078929 Army Engineer Research and Development Center, Vicksburg, MS
Jetty Spurs at Coastal Inlets for Reduction of Navigation Channel Shoaling
Seabergh, William C.; Krock, Jennifer; Dec. 2003; 15 pp.; In English; Original contains color illustrations
Report No.(s): AD-A423498; ERDC/CHL-CHETN-IV-61; No Copyright; Avail: CASI; A03, Hardcopy

The Coastal and Hydraulics Engineering Technical Note (CHETN) herein provides information on the effect of a jetty spur on the beachside circulation near a coastal inlet jetty and discusses introductory design considerations relating to alteration of water and sediment circulation near the beach side of jetties. Examples are presented from field and laboratory studies. A jetty spur may be defined as a short structure added to a jetty that flanks a navigation channel through an inlet. The spur will typically be nearly perpendicular to the jetty, but may be oriented at some angle with respect to the jetty in the range of 45 to 90 degrees. The spur may be added on the beach side of a jetty to prevent sediment from entering the inlet or may be placed on the channel side to divert the tidal current away from the jetty to reduce scour and possible jetty instability. This CHETN examines the design and performance of jetty spurs at Bakers Haulover Inlet, Florida, Fort Pierce Inlet, Florida, Siuslaw River Inlet, Oregon, Shark River, New Jersey, and Gray's Harbor, Washington. The report also includes results from a pilot study of spurs that was conducted at the Coastal Inlet Research Program's physical inlet model. The physical model facility is a large experimental basin (46 meters wide by 99 meters long) with an idealized inlet and smooth offshore contours. Short-period waves and tidal currents can be simulated in this facility. (1 table, 13 figures, 7 refs.)
DTIC
Breakwaters; Coasts; Design Analysis; Navigation; Sediment Transport; Waterways

20040081025 Rensselaer Polytechnic Inst., Troy, NY, USA
Investigation of the Flow-Induced Vibration in the E2 Test Facility
Castillo, Luciano; August 17, 2001; 16 pp.; In English; Original contains black and white illustrations
Report No.(s): NP-2002-02-00006-SSC; No Copyright; Avail: CASI; A03, Hardcopy

An investigation of flow induced vibration due to coupling between the fluid flow and the propellants lines (LOX and RP-1) was performed. Various flow rate conditions were studied to check whether flow induced vibration was possible due to vortex shedding in both valves and pipe lines. Resonances test was conducted for all segments of the LOX-feedline for the preburner under test. In addition, critical values of frequency and velocity are calculated using a mass damping model. A

simple chart characterizing the relation between frequency and velocity is developed for each component; i.e. propellant lines, valves and flow meters. It was found that flow induced vibration occurs for various segments with flow rates of 113 1b/s, 275 lb/s and 40 lb/s. Even more interesting using critical conditions for buckling, it was found that the valve or pipe may collapse for a flow rate of 275 lb/s and valve height of 10% of pipe diameter. Furthermore, two models for the acoustic pressure acting on the segments particularly for the valve are proposed.
Author
Fluid Flow; Propellants; Test Facilities; Mathematical Models; Feed Systems; Vibration Tests

20040081214 NASA Kennedy Space Center, Cocoa Beach, FL, USA
Apparatus and Method for Thermal Performance Testing of Pipelines and Piping Systems
Fesmire, James E., Inventor; Nagy, Zeltan F., Inventor; Augustynowicz, Stanislaw D., Inventor; April 06, 2004; 8 pp.; In English
Patent Info.: Filed 26 Jun. 2002; US-Patent-6,715,914; US-Patent-Appl-SN-185378; NASA-Case-KSC-12205; No Copyright; Avail: CASI; A02, Hardcopy

A test apparatus and method of its use for evaluating various performance aspects of a piping segment locates a piping segment between two cold boxes. A first cold box conditions test fluid before providing the fluid into the piping segment- The first and second cold boxes both significantly reduce, if not eliminate, any heat transfer from the ends of the piping so that accurate measurements of heat leak rates from the sides of the piping segment may be determined.
Author
Performance Tests; Pipelines; Heat Transfer

20040081215 NASA Langley Research Center, Hampton, VA, USA
Self-Activating System and Method for Alerting When an Object or a Person is Left Unattended
Edwards, William Christopher, Inventor; Mack, Terry L., Inventor; Modlin, Edward A., Inventor; March 30, 2004; 22 pp.; In English
Patent Info.: Filed 27 Nov. 2001; US-Patent-6,714,132; US-Patent-Appl-SN-011229; US-Patent-Appl-SN-329692; NASA-Case-LAR-16324-1; No Copyright; Avail: CASI; A03, Hardcopy

A system and method uses a wireless tether comprising a transmitter and a receiver to alert a caregiver that an object or person has been left unattended. A detector Senses the presence of the object, usually a child, located in a position such as a safety seat. The detector couples to the transmitter, which is located near the object. The transmitter transmits at least one wireless signal when the object is in the position. The receiver, which is remotely located from the transmitter, senses the at least one signal as long as the receiver is within a prescribed range of transmission. By performing a timing function, the receiver monitors the proximity of the caregiver, who maintains possession of the receiver, to the transmitter. The system communicates an alarm to the caregiver when the caregiver ventures outside the range of transmission without having removed the object/child from the position.
Author
Warning Systems; Monitors; Safety

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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*.

20040077274 NASA Goddard Space Flight Center, Greenbelt, MD, USA
A Novel Method of High Accuracy, Wavefront Phase and Amplitude Correction for Coronagraphy
Bowers, Charles W.; Woodgate, Bruce E.; Lyon, Richard G.; 2003; 1 pp.; In English; Terrestrial Planet Finder (TPF) Expo, Oct. 2003, Pasadena, CA, USA; No Copyright; Avail: Other Sources; Abstract Only

Detection of extra-solar, and especially terrestrial-like planets, using coronagraphy requires an extremely high level of wavefront correction. For example, the study of Woodruff et al. (2002) has shown that phase uniformity of order approximately 1e-4 waves(rms) must be achieved over the critical range of spatial frequencies to produce the approximately le10 contrast needed for the Terrestrial Planet Finder (TPF) mission. Correction of wavefront phase errors to this level may be accomplished by using a very high precision deformable mirror (DM). However, not only phase but also amplitude

uniformity of the same scale (le-4) and over the same spatial frequency range must be simultaneously obtained to remove all residual speckle in the image plane. We present a design for producing simultaneous wavefront phase and amplitude uniformity to high levels from an input wavefront of lower quality. The design uses a dual Michelson interferometer arrangement incorporating two DMs and a single, fixed mirror (all at pupils) and two beamsplitters: one with unequal (asymmetric) beam splitting and one with symmetric beam splitting. This design allows high precision correction of both phase and amplitude using DMs with relatively coarse steps, and permits a simple correction algorithm.
Author
Amplitudes; Coronagraphs; Wave Fronts; Accuracy; Methodology; Correction

20040077332 NASA Wallops Flight Center, Wallops Island, VA, USA
TOPEX Radar Altimeter Engineering Assessment Report Update: Side B Turn-On to January 1, 2004
Hancock, David W., III; Lockwood, D. W.; Hayne, G. S.; Brooks, R. L.; April 2004; 149 pp.; In English
Report No.(s): NASA/TM-2004-212236/VOL18; Rept-2004-01795-0/VOL18; No Copyright; Avail: CASI; A07, Hardcopy

This is the eleventh in a series of TOPEX Radar Engineering Assessment Reports, The initial TOPEX Radar Altimeter Engineering Assessment Report, in February 1994, presented performance results for the NASA Radar Altimeter on the TOPEX/POSEIDON spacecraft, from the time of its launch in August 1992 to February 1994. Since the time of that initial report and prior to this report, there have been nine interim supplemental Engineering Assessment Reports, issued in March 1995, May 1996, March 1997, June 1998, August 1999, September 2000, June 2001, March 2002 and again in May 2003.The sixth supplement in September 2000 was the first assessment report that addressed Side B performance, and presented the altimeter performance from the turn-on of Side B until the end of calendar year 1999. This report extends the performance assessment of Side B to the end of calendar year 2003 and includes the performance assessment of Jason-1, the TOPEX follow-on mission, launched on December 7, 2001.
Author
Poseidon Satellite; Topex; Performance Prediction; Noise Measurement; Radio Altimeters

20040077376 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Implications of Version 8 TOMS and SBUV Data for Long-Term Trend Analysis
Frith, Stacey M.; 2004; 1 pp.; In English; International Quadrennial Ozone Symposium (QOS 2004), 1-8 Jun. 2004, Kos, Greece; No Copyright; Avail: Other Sources; Abstract Only

Total ozone data from the Total Ozone Mapping Spectrometer (TOMS) and profile/total ozone data from the Solar Backscatter Ultraviolet (SBUV; SBW/2) series of instruments have recently been reprocessed using new retrieval algorithms (referred to as Version 8 for both) and updated calibrations. In this paper, we incorporate the Version 8 data into a TOMS/SBW merged total ozone data set and an S B W merged profile ozone data set. The Total Merged Ozone Data (Total MOD) combines data from multiple TOMS and SBW instruments to form an internally consistent global data set with virtually complete time coverage from October 1978 through December 2003. Calibration differences between instruments are accounted for using external adjustments based on instrument intercomparisons during overlap periods. Previous results showed errors due to aerosol loading and sea glint are significantly reduced in the V8 TOMS retrievals. Using SBW as a transfer standard, calibration differences between V8 Nimbus 7 and Earth Probe TOMS data are approx. 1.3%, suggesting small errors in calibration remain. We will present updated total ozone long-term trends based on the Version 8 data. The Profile Merged Ozone Data (Profile MOD) data set is constructed using data from the SBUV series of instruments. In previous versions, SAGE data were used to establish the long-term external calibration of the combined data set. The SBW Version 8 we assess the V8 profile data through comparisons with SAGE and between SBW instruments in overlap periods. We then construct a consistently-calibrated long term time series. Updated zonal mean trends as a function of altitude and season from the new profile data set will be shown, and uncertainties in determining the best long-term calibration will be discussed.
Author
Data Acquisition; Ozone; Nimbus 7 Satellite; Annual Variations

20040078862 Air Force Research Lab., Detachment 15, Kihei Maui, HI
Thermal Conditioning of the AEOS Telescope
Roberts, Lewis C., Jr.; Figgis, Paul D.; Jan. 2002; 10 pp.; In English
Contract(s)/Grant(s): F29601-00-D-0204; Proj-4868/4983
Report No.(s): AD-A423369; AFRL/DET-15-0226; No Copyright; Avail: CASI; A02, Hardcopy

The AEOS telescope facility was designed for high angular resolution imagery. Part of that design is the inclusion of

several air handling systems to maximize dome seeing. Four air conditioning units chill the telescope and dome air to the predicted nighttime temperature. There is a mirror purge system, which prevents moisture from condensing on the mirror by blowing desiccated air into the mirror cell. A laminar air system counteracts the seeing degradation effects of a warm mirror by blowing air across the face of the primary. An hour before sunset the dome is partially opened and outside air is pulled through the telescope truss structure in an effort to remove any thermal differences caused by incorrect cooling. Finally a fan pulls air through the coude tube in order to remove rising air cells. We present details of each system and the beginnings of our experiments to determine their efficacy. Finally, lessons learned from the systems on the AEOS telescope are presented.
DTIC
Adaptive Optics; Telescopes; Temperature Control

20040078869 Ohio State Univ., Columbus, OH
Simulations of Radar Scattering Over a Rough Sea Surface
Jamil, Khalid; Burkholder, Robert J.; Mar. 2004; 46 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): N00014-03-1-0128
Report No.(s): AD-A423387; FR-743971-1; No Copyright; Avail: CASI; A03, Hardcopy

Forward scattering from a 2D rough sea surface is simulated using the Generalized Forward-Backward (GFB) method in a Monte Carlo fashion. Measurements were performed using a sealed ocean model in the NSWC Carderock Maneuvering and Sea- Keeping (MASK) wavetank facility. The mean, standard deviation and probability density function (PDF) of the computational and experimental data is compared and good agreement is found. Backscattering from a floating target on the rough sea surface is also computed. Results of a new hybrid approach are presented for computing the backscatter from a target on a rough sea surface by decoupling the target from the surface.
DTIC
Forward Scattering; Ocean Surface; Radar Cross Sections; Radar Scattering; Simulation

20040078879 Naval Research Lab., Bay Saint Louis, MS
Absorption Spectrum of Phytoplankton Pigments Derived from Hyperspectral Remote-Sensing Reflectance
Lee, ZhongPing; Carder, Kendall L.; Jan. 2004; 11 pp.; In English
Contract(s)/Grant(s): N00014-96-I-5013
Report No.(s): AD-A423405; NRL/JA/7330/03/0016; No Copyright; Avail: CASI; A03, Hardcopy

For a data set collected around Baja California with chlorophyll-a concentration ((chl-a)) ranging from 0.16 to 11.3 mg/cubic meter, hyperspectral absorption spectra of phytoplankton pigments were independently inverted from hyperspectral remote-sensing reflectance using a newly developed ocean-color algorithm. The derived spectra were then compared with those measured from water samples using the filter-pad technique, and an average difference of 21.4% was obtained. These results demonstrate that the inversion algorithm worked quite well for the coastal waters observed, and suggest a potential of using hyperspectral remote sensing to retrieve both chlorophyll-a and other accessory pigments. (7 figures, 47 refs.)
DTIC
Absorption Spectra; Detection; Imagery; Phytoplankton; Pigments; Reflectance; Remote Sensing

20040078880 Naval Research Lab., Bay Saint Louis, MS
Uniqueness in Remote Sensing of the Inherent Optical Properties of Ocean Water
Sydor, Michael; Gould, Richard W.; Arnone, Robert A.; Haltrin, Vladimir I.; Goode, Wesley; Apr. 2004; 8 pp.; In English
Report No.(s): AD-A423406; NRL/JA/7330/03/0038; No Copyright; Avail: CASI; A02, Hardcopy

This study examines the problem of uniqueness in the relationship between the remote-sensing reflectance (Rrs) and the inherent optical properties (IOPs) of ocean water. The results show that diffuse reflectance of plane irradiance from ocean water is inherently ambiguous. Furthermore, in the 400 < lambda < 750 nanometer region of the spectrum, Rrs(lambda) also suffers from ambiguity caused by the similarity in wavelength dependence of the coefficients of absorption by particulate matter and of absorption by colored dissolved organic matter (CDOM). The absorption coefficients have overlapping exponential responses that lead to the fact that more than one combination of IOPs can produce nearly the same Rrs spectrum. This ambiguity in absorption parameters demands that one identify the regions of the Rrs spectrum where one can isolate the effects that are due only to scattering by particulates and to absorption by pure water. The results indicate that the spectral shape of the absorption coefficient of phytoplankton, alpha(sub ph)(lambda), cannot be derived from a multiparameter fit to Rrs(lambda). However, the magnitude and the spectral dependence of the absorption coefficient can be estimated from the

difference between the measured Rrs(lambda) and the best fit to Rrs(lambda) in terms of IOPs that exclude alpha(sub ph)(lambda). (10 figures, 13 refs.)
DTIC
Absorptivity; Backscattering; Coasts; Detection; Oceans; Optical Properties; Organic Materials; Phytoplankton; Reflectance; Remote Sensing; Uniqueness; Water

20040078899 Applied Research Associates, Inc., South Royaltan, VT
Point-Source Energetics Detection: Initial Sensor Evaluation
Van Wyck, Neal E.; Thorne, Philip G.; Apr. 2004; 28 pp.; In English
Report No.(s): AD-A423453; 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 Detection

20040079396 Meteorological Satellite Center, Kiyose, Japan
Meteorological Satellite Center Technical Note
March 2004; ISSN 0388-9653; 62 pp.; In English; In Japanese; See also 20040079397 - 20040079397; Copyright; Avail: Other Sources

This study investigates intercalibration between the GOES-9 Imager and GMS-5 VISSR infrared channels. Observed and simulated brightness temperatures from GOES-9 and GMS-5 are used for this purpose. The observed brightness temperatures are obtained from images observed just before the switchover from GMS-5 to GOES-9; the simulated brightness temperatures are computed by MODTRAN 3.7. In the comparison of the horizontal images, a difference between GOES-9 and GMS-5 is recognized, as expected from their spectral response functions and each radiative path. Further, as the result of the statistical comparison of observed brightness temperatures with the same radiative path length from the satellites within the cloud-free ocean area, discrepancies inconsistent with simulations are detected. The averages of the discrepancies between GOES-9 and GMS-5 with respect to residuals of the observed from simulated brightness temperatures are 0.7 K for the infrared window channel 1 (IR1), 0.28 K for the infrared window channel 2 (IR2) and 2.4 K for the water vapor channel (WV). Potential sources of the differences are inaccurate calibration, the unveiled degradation of the sensors and the satellites, systematic error in the simulated brightness temperatures, etc. In order to identify the source, further research is necessary. Despite the fact that the sources are unconfirmed, the result of this study may be of help to revise the algorithms of GOES-9 applications. For instance, a linear relationship is found between GOES-9 and GMS-5 with respect to difference between the IR1 and IR2 brightness temperatures. This technical note also includes the following Japanese language articles: 'Development Pattern of Depressions in Mid-Latitudes on Satellite Images (Comma Cloud)'; 'Tropical Cyclone Analysis System'; 'Channel Imagery and its Applications'.
Author
Goes 9; Intercalibration; Visible Infrared Spin Scan Radiometer; Infrared Windows

20040079749 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Large Format Arrays for Far Infrared and Millimeter Astronomy
Moseley, Harvey; 2004; 1 pp.; In English; National Radio Science Meeting, 5-8 Jan. 2004, Boulder, CO, USA; No Copyright; Avail: Other Sources; Abstract Only

Some of the most compelling questions in modem astronomy are best addressed with submillimeter and millimeter observations. The question of the role of inflation in the early evolution of the universe is best addressed with large sensitive arrays of millimeter polarimeters. The study of the first generations of galaxies requires sensitive submillimeter imaging,

which can help us to understand the history of energy release and nucleosynthesis in the universe. Our ability to address these questions is dramatically increasing, driven by dramatic steps in the sensitivity and size of available detector arrays. While the MIPS instrument on the SIRTF mission will revolutionize far infrared astronomy with its 1024 element array of photoconductors, thermal detectors remain the dominant technology for submillimeter and millimeter imaging and polarimetry. The last decade has seen the deployment of increasingly large arrays of bolometers, ranging from the 48 element arrays deployed on the KAO in the late 198Os, to the SHARC and SCUBA arrays in the 1990s. The past years have seen the deployment of a new generation of larger detector arrays in SHARC II (384 channels) and Bolocam (144 channels). These detectors are in operation and are beginning to make significant impacts on the field. Arrays of sensitive submillimeter bolometers on the SPIRE instrument on Herschel will allow the first large areas surveys of the sky, providing important insight into the evolution of galaxies. The next generation of detectors, led by SCUBA II, will increase the focal scale of these instruments by an order of magnitude. Two major missions are being planned by NASA for which further development of long wavelength detectors is essential, The SAFlR mission, a 10-m class telescope with large arrays of background limited detectors, will extend our reach into the epoch of initial galaxy formation. A major goal of modem cosmology is to test the inflationary paradigm in the early evolution of the universe. To this end, a mission is planned to detect the imprint of inflation on the CMB by precision measurement of its polarization. This work requires very large arrays of sensitive detectors which can provide unprecedented control of a wide range of systematic errors, given the small amplitude of the signal of interest. We will describe the current state of large format detector arrays, the performance requirements set by the new missions, and the different approaches being developed in the community to meet these requirements. We are confident that within a decade, these developments will lead to dramatic advances in our understanding of the evolution of the universe.
Author
Arrays; Far Infrared Radiation; Millimeter Waves; Infrared Astronomy

20040079781 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Introduction to AIRS and CrIS
Susskind, Joel; [2004]; 34 pp.; In English; Original contains color illustrations; No Copyright; Avail: CASI; A03, Hardcopy
"Introduction to AIRS and CrIS" is a chapter in a book dealing with various aspects of remote sensing. AIRS and CrIS are both high spectral resolution IR sounding instruments, which were recently launched (AIRS) or will soon be launched (CrIS). The chapter explains the general principles of infra-red remote sensing, and explains the significance and information content of high spectral resolution IR measurements. The chapter shows results obtained using AIRS observations, and explains why similar quality results should be obtainable from CrIS data.
Author
Remote Sensing; Infrared Instruments

20040079816 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Design and Performance Measurement of the Mercury Laser Altimeter
Sun, Xiao-Li; Cavanaugh, John F.; Smith, James C.; Bartels, Arlin E.; [2004]; 2 pp.; In English; Conference on Lasers and Electro-Optical International Quantum Electronics, 2004, San Francisco, CA, USA; No Copyright; Avail: CASI; A01, Hardcopy
We report the design and test results of the Mercury Laser Altimeter on MESSENGER mission to be launched in May 2004. The altimeter will provide planet surface topography measurements via laser pulse time of flight.
Author
Laser Altimeters; Spacecraft Instruments; Geophysics; Systems Engineering; Topography; Mercury Surface

20040079817 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Cloud and Aerosol Lidar Channel Design and Performance of the Geoscience Laser Altimeter System on the ICESat Mission
Sun, Xiaoli; Abshire, James B.; Krainak, Michael A.; Spinhirne, James D.; Palm, Steve S.; Lancaster, Redgie S.; Allan, Graham R.; 2004; 2 pp.; In English; CLEO: Conference on Lasers and Electro-Optics, 2004, San Francisco, CA, USA; Original contains black and white illustrations; Copyright; Avail: CASI; A01, Hardcopy
The design of the 532 and 1064nm wavelength atmosphere lidar channels of the Geoscience Laser Altimeter System on the ICESat spacecraft is described. The lidar channel performance per on orbit measurements data will be presented.
Author
Aerosols; Geophysics; Ice, Cloud and Land Elevation Satellite; Optical Radar; Laser Altimeters; Systems Engineering

20040079828 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Swift Burst Alert Telescope (BAT) Instrument Response

Parsons, A.; Hullinger, D.; Markwardt, C.; Barthelmy, S.; Cummings, J.; Gehrels, N.; Krimm, H.; Tueller, J.; Fenimore, E.; Palmer, D., et al.; 2004; 1 pp.; In English; GRB Physics before Swift Workshop, 8-10 Apr. 2004, State College, PA, USA; Copyright; Avail: Other Sources; Abstract Only

The Burst Alert Telescope (BAT), a large coded aperture instrument with a wide field-of-view (FOV), provides the gamma-ray burst triggers and locations for the Swift Gamma-Ray Burst Explorer. In addition to providing this imaging information, BAT will perform a 15 keV - 150 keV all-sky hard x-ray survey based on the serendipitous pointings resulting from the study of gamma-ray bursts and will also monitor the sky for transient hard x-ray sources. For BAT to provide spectral and photometric information for the gamma-ray bursts, the transient sources and the all-sky survey, the BAT instrument response must be determined to an increasingly greater accuracy. In this talk, we describe the BAT instrument response as determined to an accuracy suitable for gamma-ray burst studies. We will also discuss the public data analysis tools developed to calculate the BAT response to sources at different energies and locations in the FOV. The level of accuracy required for the BAT instrument response used for the hard x-ray survey is significantly higher because this response must be used in the iterative clean algorithm for finding fainter sources. Because the bright sources add a lot of coding noise to the BAT sky image, fainter sources can be seen only after the counts due to the bright sources are removed. The better we know the BAT response, the lower the noise in the cleaned spectrum and thus the more sensitive the survey. Since the BAT detector plane consists of 32768 individual, 4 mm square CZT gamma-ray detectors, the most accurate BAT response would include 32768 individual detector response functions to separate mask modulation effects from differences in detector efficiencies! We describe OUT continuing work to improve the accuracy of the BAT instrument response and will present the current results of Monte Carlo simulations as well as BAT ground calibration data.

Author

Telescopes; Gamma Ray Bursts; Apertures; X Ray Astronomy

20040079832 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Comparison of the Proton-Induced Dark Current and Charge Transfer Efficiency Responses of N- and P-Channel CCDs

Marshall, Cheryl; Marshall, Paul; Wacynski, Augustyn; Polidan, Elizabeth; Johnson, Scott; Campbell, Art; June 22, 2004; 8 pp.; In English; SPIE Europea International Symposium Astronomical Telescopes, 21-25 Jun. 2004, Glasgow, Scotland, UK; No Copyright; Avail: CASI; A02, Hardcopy

The proton-induced CTE behavior for the Lawrence Berkeley National Laboratory (LBNL) p-CCD (being developed for the Supernovae Acceleration Project (SNAP) and Hubble Space Telescope (HST) Wide Field Camera 3 (WFC3) n-CCDs were compared using 55Fe, EPER and FPR techniques. CTE performance of the p-CCD is about an order of magnitude better after a 63 MeV fluence of 2.5 x 10(sup 9)/sq cm, which is equivalent to 2.5 years in the shielded HST orbit. Notched n- and p-CCDs yielded factor of two improvement in CTE performance as compared to their un-notched versions. The introduction rate of hot pixels was greater in p-CCD as compared to n-CCD, and also greater in notched than un-notched devices.

Derived from text

Charge Coupled Devices; Charge Transfer; Dark Current

20040081085 NASA Ames Research Center, Moffett Field, CA, USA

Virtual Sensors: Using Data Mining Techniques to Efficiently Estimate Remote Sensing Spectra

Srivastava, Ashok N.; Oza, Nikunj; Stroeve, Julienne; March 12, 2004; 9 pp.; In English; Original contains black and white illustrations; No Copyright; Avail: CASI; A02, Hardcopy

Various instruments are used to create images of the Earth and other objects in the universe in a diverse set of wavelength bands with the aim of understanding natural phenomena. These instruments are sometimes built in a phased approach, with some measurement capabilities being added in later phases. In other cases, there may not be a planned increase in measurement capability, but technology may mature to the point that it offers new measurement capabilities that were not available before. In still other cases, detailed spectral measurements may be too costly to perform on a large sample. Thus, lower resolution instruments with lower associated cost may be used to take the majority of measurements. Higher resolution instruments, with a higher associated cost may be used to take only a small fraction of the measurements in a given area. Many applied science questions that are relevant to the remote sensing community need to be addressed by analyzing enormous amounts of data that were generated from instruments with disparate measurement capability. This paper addresses this problem by demonstrating methods to produce high accuracy estimates of spectra with an associated measure of uncertainty from data that is perhaps nonlinearly correlated with the spectra. In particular, we demonstrate multi-layer perceptrons

(MLPs), Support Vector Machines (SVMs) with Radial Basis Function (RBF) kernels, and SVMs with Mixture Density Mercer Kernels (MDMK). We call this type of an estimator a Virtual Sensor because it predicts, with a measure of uncertainty, unmeasured spectral phenomena.
Author
Remote Sensing; Spectra; Spectrum Analysis

20040081129 NASA Goddard Space Flight Center, Greenbelt, MD, USA
NASA's Far-Infrared/Submillimeter Roadmap Missions
Leisawitz, David; 2003; 1 pp.; In English; European Space Research and Technology Center Seminar, 30-31 Jan. 2003, Noordwijk, Netherlands; No Copyright; Avail: Other Sources; Abstract Only

Information vital to the attainment of the major scientific objectives of NASA s Origins and Structure and Evolution of the Universe themes is uniquely available in the far-IR and submillimeter (FIR/SMM). NASA is studying concepts and investing in technologies for FIF/SMM telescopes that could fly in the decade 201 0 - 2020 and provide enormous increases in measurement capabilities to extend the legacy of the next-generation missions SlRTF and Herschel. Future FIR/SMM space observatories will have the sensitivity needed to reach back in time to the formation epoch of the first luminous objects, the angular resolution needed to image proto-planetary systems and distinguish the emissions of individual galaxies, and the spectral resolution needed to probe the physical conditions and measure the flows of interstellar gas in young galaxies, nascent stars, and the dust-enshrouded nuclei of galaxies that harbor massive black holes. NASA s infrared roadmap includes the JWST-class Single Aperture Far-IR (SAFIR) telescope and FIR/SMM interferometers. The talk will give the scientific motivation for these missions, describe mission concepts and telescope measurement capabilities, and compare these capabilities with those of the next-generation IR telescopes and with the complementary JWST and ALMA.
Derived from text
Far Infrared Radiation; Interferometers; Spectral Resolution; Cosmology; Black Holes (Astronomy); Mission Planning; Galaxies

20040081157 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Absolute Measurement of Tilts via Fourier Analysis of Interferograms
Toland, Ronald W.; [2004]; 1 pp.; In English; SPIE-Optical Science and Technology Annual Meeting, 2-6 Aug. 2004, Denver, CO, USA; No Copyright; Avail: Other Sources; Abstract Only

The Fourier method of interferogram analysis requires the introduction of a constant tilt into the inteferogram to serve as a 'carrier signal' for information on the figure of the surface under test. This tilt is usually removed in the first steps of analysis and ignored thereafter. However, in the problem of aligning optical components and systems, knowledge of part orientation is crucial to proper instrument performance. This paper outlines an algorithm which uses the normally ignored carrier signal in Fourier analysis to compute an absolute tilt (orientation) of the test surface. We also provide a brief outline of how this technique, incorporated in a rotating Twyman-Green interferometer, can be used in alignment and metrology of optical systems.
Author
Fourier Analysis; Interferometry; Attitude (Inclination); Algorithms

20040081206 NASA Goddard Space Flight Center, Greenbelt, MD, USA
NASA's Far-Infrared/Submillimeter Roadmap Missions
Leisawitz, David; [2003]; 1 pp.; In English; European Space Research and Technology Center Seminar, 30-31 Jan. 2003, Noordwijk, Netherlands; No Copyright; Avail: Other Sources; Abstract Only

Information vital to the attainment of the major scientific objectives of NASA's Origins and Structure and Evolution of the Universe themes is uniquely available in the far-IR and submillimeter (FIR/SMM). NASA is studying concepts and investing in technologies for FIR/SMM telescopes that could fly in the decade 2010 - 2020 and provide enormous increases in measurement capabilities to extend the legacy of the next-generation missions SIRTF and Herschel. Future FIR/SMM space observatories will have the sensitivity needed to reach back in time to the formation epoch of the first luminous objects, the angular resolution needed to image proto-planetary systems and distinguish the emissions of individual galaxies, and the spectral resolution needed to probe the physical conditions and measure the flows of interstellar gas in young galaxies, nascent stars, and the dust-enshrouded nuclei of galaxies that harbor massive black holes. NASA's infrared roadmap includes the JWST-class Single Aperture Far-IR (SAFIR) telescope and FIR/SMM interferometers. The talk will give the scientific motivation for these missions, describe mission concepts and telescope measurement capabilities, and compare these

capabilities with those of the next-generation IR telescopes and with the complementary JWST and ALMA.
Author
Far Infrared Radiation; Submillimeter Waves; Spectral Resolution; Telescopes; Mission Planning

20040081208 NASA Goddard Space Flight Center, Greenbelt, MD, USA
MODIS Solar Diffuser Attenuation Screen Modeling Results
Waluschka, Eugene; Xuong, Xiaoxiong; Guenther, Bruce; Barnes, William; [2004]; 1 pp.; In English; Washington Academy of Science, 20-21 Mar. 2004, Washington, DC, USA; No Copyright; Avail: Other Sources; Abstract Only

On-orbit calibration of the reflected solar bands on the EOS Moderate Resolution Imaging Spectroradiometer (MODIS) is accomplished by have the instrument view a high reflectance diffuse surface illuminated by the sun. For some of the spectral bands this proves to be much too bright a signal that results in the saturation of detectors designed for measuring low reflectance (ocean) surfaces signals. A mechanical attenuation device in the form of a pin hole screen is used to reduce the signals to calibrate these bands. The sensor response to solar illumination of the SD with and without the attenuation screen in place will be presented. The MODIS detector response to the solar diffuser is smooth when the attenuation screen is absent, but has structures up to a few percent when the attenuation screen is present. This structure corresponds to non-uniform illumination from the solar diffuser. Each pin hole produces a pin-hole image of the sun on the solar diffuser, and there are very many pin hole images of the sun on the solar diffuser for each MODIS detector. Even though there are very many pin-hole images of the sun on the solar diffuser, it is no longer perfectly uniformly illuminated. This non-uniformly illuminated solar diffuser produces intensity variation on the focal planes. The results of a very detailed simulation will be discussed which show how the illumination of the focal plane changes as a result of the attenuation, and the impacts on the calibration will be discussed.
Author
Calibrating; Imaging Spectrometers; MODIS (Radiometry)

20040081224 NASA Goddard Space Flight Center, Greenbelt, MD, USA
X-ray Spectrometer
Porter, F. Scott; 2004; 1 pp.; In English; High Temperature Plasma Diagnostics 2004, 18-22 Apr. 2004, San Diego, CA, USA; No Copyright; Avail: Other Sources; Abstract Only

The X-ray Spectrometer (XRS) instrument is a revolutionary non-dispersive spectrometer that will form the basis for the Astro-E2 observatory to be launched in 2005. We have recently installed a flight spare X R S microcalorimeter spectrometer at the EBIT-I facility at LLNL replacing the XRS from the earlier Astro-E mission and providing twice the resolution. The X R S microcalorimeter is an x-ray detector that senses the heat deposited by the incident photon. It achieves a high energy resolution by operating at 0.06K and by carefully controlling the heat capacity and thermal conductance. The XRS/EBIT instrument has 32 pixels in a square geometry and achieves an energy resolution of 6 eV at 6 keV, with a bandpass from 0.1 to 12 keV (or more at higher operating temperature). The instrument allows detailed studies of the x-ray line emission of laboratory plasmas. The XRS/EBIT also provides an extensive calibration "library" for the Astro-E2 observatory.
Author
X Ray Spectrometers; X Ray Detectors

20040081272 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Initial Validation and Results of Geoscience Laser Altimeter System Optical Properties Retrievals
Hlavka, Dennis L.; Hart, W. D.; Pal, S. P.; McGill, M.; Spinhirne, J. D.; 2004; 1 pp.; In English; IGARRS Meeting, 20-24 Sep. 2004, Anchorage, AK, USA; No Copyright; Avail: Other Sources; Abstract Only

Verification of Geoscience Laser Altimeter System (GLAS) optical retrievals is . problematic in that passage over ground sites is both instantaneous and sparse plus space-borne passive sensors such as MODIS are too frequently out of sync with the GLAS position. In October 2003, the GLAS Validation Experiment was executed from NASA Dryden Research Center, California to greatly increase validation possibilities. The high-altitude NASA ER-2 aircraft and onboard instrumentation of Cloud Physics Lidar (CPL), MODIS Airborne Simulator (MAS), and/or MODIS/ASTER Airborne Simulator (MASTER) under-flew seven orbit tracks of GLAS for cirrus, smoke, and urban pollution optical properties inter-comparisons. These highly calibrated suite of instruments are the best data set yet to validate GLAS atmospheric parameters. In this presentation, we will focus on the inter-comparison with GLAS and CPL and draw preliminary conclusions about the accuracies of the GLAS 532nm retrievals of optical depth, extinction, backscatter cross section, and calculated extinction-to-backscatter ratio.

Comparisons to an AERONET/MPL ground-based site at Monterey, California will be attempted. Examples of GLAS operational optical data products will be shown.
Author
Geophysics; Laser Altimeters; Optical Properties; Airborne Equipment

20040081290 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Hubble Space Telescope Fine Guidance Sensor Post-Flight Bearing Inspection
Pellicciotti, Joseph; Loewenthal, Stu; Jones, William, Jr.; Jumper, Mike; [2004]; 14 pp.; In English; 37th Aerospace Mechanisms Symposium, 15-17 May 2004, Houston, TX, USA; Copyright; Avail: CASI; A03, Hardcopy

Aerospace mechanism engineering success stories often, if not always, consist of overcoming developmental, test and flight anomalies. Many times it is these anomalies that stimulate technology growth and more reliable future systems. However, one must learn from these to achieve an ultimately successful mission. It is not often that a spacecraft engineer is able to inspect hardware that has flown in orbit for several years. However, in February 1997, the Fine Guidance Sensor-I (FGS-1) was removed from the Hubble Space Telescope (HST) and returned to NASA Goddard Space Flight Center (GSFC) during the second Servicing Mission (SM2). At the time of removal, FGS-1 had nearly 7 years of service and the bearings in the Star Selector Servos (SSS) had accumulated approximately 25 million Coarse Track (CT) cycles. The main reason for its replacement was due to a bearing torque anomaly leading to stalling of the B Star Selector Servo (SSS-B) when reversing direction during a vehicle offset maneuver, referred to herein as a Reversal Bump (RB). The returned HST FGS SSS bearings were disassembled for post-service condition assessment to better understand the actual cause of the torque spikes, identify potential process/design improvements, and provide information for remedial on-orbit operation modifications. The methods and technology utilized for this inspection are not unique to this system and can be adapted to most investigation ai varying stages of the mechanism life from development, through testing, io post night evaluation. The systematic methods used for the HST Fine Guidance Sensor (FGS) SSS and specific findings are the subjects presented in this paper. The lessons learned include the importance of cleanliness and handling for precision instrument bearings and the potential effects from contamination. The paper describes in detail, the analytical techniques used for the SSS and their importance in this investigation. Inspection analytical data and photographs are included throughout the paper.
Author
Hubble Space Telescope; Anomalies; Guidance Sensors; Servomotors

20040081291 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Position Sensitive Microcalorimeters
Sadleir, J. E.; Hammock, C.; Figueroa-Feliciano, E.; Stahle, C. K.; Bandler, S.; Saab, T.; Lindeman, M.; Porter, F. S.; Chervenak, J.; Brown, G., et al.; [2004]; 1 pp.; In English; SPIE Meeting, 21-25 Jun. 2004, Glasgow, Scotland, UK; No Copyright; Avail: Other Sources; Abstract Only

A Position Sensitive Transition-Edge Sensor (PoST) is a microcalorimeter device capable of one-dimensional imaging spectroscopy. The device consists of two Transition-Edge Sensors (TESs) connected to the ends of a long X-ray absorbing strip. The energy of a photon hitting the absorber and the position of the absorption event along the strip is measured from the response in the two sensors by analyzing the relative signal sizes, pulse rise times, and the sum of the pulses measured at each sensor, We report on the recent PoST effort at Goddard for applications to large field of view, high-energy- resolution, X-ray astrophysics.
Author
Sensors; X Ray Sources; Spectroscopy; Calorimeters

20040081295 NASA Goddard Space Flight Center, Greenbelt, MD, USA
An Acquisition Control for the Laser Interferometer Space Antenna
Maghami, Peiman G.; Hyde, T. Tupper; Kim, Jinho; [2004]; 1 pp.; In English; 5th International LISA Symposium, 12-16 Jul. 2004, Noordwijk, Netherlands; No Copyright; Avail: Other Sources; Abstract Only

The Laser Interferometer Space Antenna (LISA) mission is a planned gravitational wave detector consisting of three spacecraft in heliocentric orbit. Laser interferometry is used to measure distance fluctuations between test masses aboard each spacecraft to the picometer level over a 5 million kilometer separation. Each spacecraft has two incoming and two outgoing laser beams for a total of six laser links. These links will have to be established sequentially at the start of the mission, and the spacecraft control systems must aim their lasers at each other with pointing motions less than 8 nanoradians per root Hertz in the frequency band 0.1-100 mHz. This paper presents a strategy for the laser acquisition process. The outgoing beam on

one spacecraft is spoiled to provide a wide beam that encompasses the accuracy (noise and mounting bias) of the star tracker. The control system then takes advantage of an array of sensors with increasing sensitivity to quiet the receiving spacecraft and lock the laser. This process is carried out for each of the six links of LISA. A complete analysis and simulation of the acquisition process are presented.
Author
Laser Interferometry; Antennas; Gravitational Waves; Detectors; Lisa (Observatory)

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*.

20040078791 Army Research Lab., Adelphi, MD
Design and Fabrication of 850 and 980 nm Vertical Cavity Surface Emitting Laser
Das, N. C.; Hsen, H.; Newman, P.; Lara, M. T.; Chang, W.; Mar. 2004; 22 pp.; In English; Original contains color illustrations
Report No.(s): AD-A423231; ARL-TR-3187; No Copyright; Avail: CASI; A03, Hardcopy

Vertical-cavity surface-emitting lasers (VCSEL) are the most suitable light sources for certain optoelectronic applications because of their planner nature of light emission. VCSELs on GaAs substrates were grown by the molecular beam epitaxy technique. In this report we present detailed procedures to design and fabricate 850-nm top-emitting and 980- nm bottom-emitting VCSELs. First a test structure was grown by the molecular-beam epitaxy (MBE) technique and was characterized by reflectance and photoluminescence techniques. We used a wet oxidation process for current confinement in the laser structure. The VCSELs have low threshold current, low voltage drop and hence are suitable for hybridization onto silicon MOS circuits.
DTIC
Fabrication; Laser Cavities; Surface Emitting Lasers

20040079713 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Qualification of Laser Diode Arrays for Mercury Laser Altimeter Mission
Stephen, Mark; Vasilyev, Aleksey; Schafer, John; Allan, Graham R.; [2004]; 3 pp.; In English; Conference on Lasers and Electro-Optics, May 2004, San Francisco, CA, USA; Original contains color illustrations; No Copyright; Avail: CASI; A01, Hardcopy

NASA's requirements for high reliability, high performance satellite laser instruments have driven the investigation of many critical components; specifically, 808 nm laser diode array (LDA) pump devices. The MESSENGER mission is flying the Mercury Laser Altimeter (MLA) which is a diode-pumped Nd:YAG laser instrument designed to map the topography of Mercury. The environment imposed on the instrument by the orbital dynamics places special requirements on the laser diode arrays. In order to limit the radiative heating of the satellite from the surface of Mercury, the satellite is designed to have a highly elliptical orbit. The satellite will heat near perigee and cool near apogee. The laser power is cycled during these orbits so that the laser is on for only 30 minutes (perigee) in a 12 hour orbit. The laser heats 10 C while powered up and cools while powered down. In order to simulate these operational conditions, we designed a test to measure the LDA performance while being temperature and power cycled. Though the mission requirements are specific to NASA and performance requirements are derived from unique operating conditions, the results are general and widely applicable. We present results on the performance of twelve LDAs operating for several hundred million pulses. The arrays are 100 watt, quasi-CW, conductively-cooled, 808 nm devices. Prior to testing, we fully characterize each device to establish a baseline for individual array performance and status. Details of this characterization can be found in reference. Arrays are divided into four groups and subjected to the temperature and power cycling matrix are shown.
Author
Diodes; Laser Altimeters; Arrays

20040081123 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Laser Sounder Approach for Measuring Atmospheric CO2 from Orbit
Krainak, Michael A.; Andrews, Arlyn E.; Allan, Graham R.; Burris, John F.; Collatz, G. James; Riris, Harris; Stephen, Mark A.; Sun, Xiao-Li; Abshire, James B.; [2004]; 3 pp.; In English; Laser Applications to Chemical and Environmental Analysis, 9-11 Feb. 2004, Annapolis, MD, USA; Copyright; Avail: CASI; A01, Hardcopy

We report on an active remote sensing approach using an erbium fiber amplifier based transmitter for atmospheric CO2 measurements in an overtone band near 1.57 microns and initial horizontal path measurements to less than 1% precision.
Author
Carbon Dioxide Concentration; Remote Sensing; Sounding; Atmospheric Composition; Semiconductor Lasers

37
MECHANICAL ENGINEERING

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

20040077262 Ohio Aerospace Inst., Brook Park, OH, USA
Elasto-Plastic Analysis of Tee Joints Using HOT-SMAC
Arnold, Steve M., Technical Monitor; Bednarcyk, Brett A.; Yarrington, Phillip W.; May 2004; 32 pp.; In English
Contract(s)/Grant(s): NCC3-650; NCC3-878; WBS 22-708-87-07
Report No.(s): NASA/CR-2004-213067; E-14543; No Copyright; Avail: CASI; A03, Hardcopy

The Higher Order Theory - Structural/Micro Analysis Code (HOT-SMAC) software package is applied to analyze the linearly elastic and elasto-plastic response of adhesively bonded tee joints. Joints of this type are finding an increasing number of applications with the increased use of composite materials within advanced aerospace vehicles, and improved tools for the design and analysis of these joints are needed. The linearly elastic results of the code are validated vs. finite element analysis results from the literature under different loading and boundary conditions, and new results are generated to investigate the inelastic behavior of the tee joint. The comparison with the finite element results indicates that HOT-SMAC is an efficient and accurate alternative to the finite element method and has a great deal of potential as an analysis tool for a wide range of bonded joints.
Author
Bonded Joints; Elastoplasticity; Stress Analysis; Adhesive Bonding

20040079742 Swedish Water and Air Pollution Research Lab., Stockholm, Sweden
Methods for Measurements of Emissions from Heavy-Duty Vehicles
Ekstrom, M.; Sjodin, A.; 2004; In Swedish; In English
Report No.(s): PB2004-105950; IVL-B-1540; No Copyright; Avail: National Technical Information Service (NTIS)

A survey of available methods for emission measurements of heavy-duty vehicles (HDVs) has been peformed. The primary focus has been on measurements of real-world emissions. Each method has been evaluated with respect to its applicability for emission factor determination and with respect to in-use conformity testing of HDVs. Most of the investigated real-world methods are rather ill suited to deliver results in brake specific emissions, which is the unit used for HDV engine certification tests. A breakthrough for real-world methods with respect to emission factor determination would therefore require emission inventory data for HDVs to be based on some other unit e.g. grams per litre fuel burned or grams per ton-kilometre.
NTIS
Exhaust Flow Simulation; Remote Sensing; Evaluation

20040081041 Smithsonian Astrophysical Observatory, Cambridge, MA, USA
Constellation-X Microcalorimeter Development
Kelly, Richard, Technical Monitor; Silver, Eric; June 2004; 32 pp.; In English
Contract(s)/Grant(s): NAG5-11893; No Copyright; Avail: CASI; A03, Hardcopy

Discussion topics: Review concept for NTD array construction. Tested revised fabrication tique: simpler construction; more rugged; and easier to control thermal properties. Development status. Related cryogenic infrastructure.
Derived from text
Calorimeters; Fabrication; Performance Tests

38
QUALITY ASSURANCE AND RELIABILITY

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

20040081029 NASA Marshall Space Flight Center, Huntsville, AL, USA
The Need for Traceability
Schramm, Fred; [2004]; 51 pp.; In English; AIAG 2004 Auto-ID Showcase, 20 May 2004, Detroit, MI, USA; No Copyright; Avail: CASI; A04, Hardcopy

The purpose of this viewgraph presentation is to promote higher standards among the automotive industry for the traceability of critical parts. The presentation compares and contrasts the traceability requirements of the aerospace and automotive industries, and gives examples of how traceability can be integrated into the manufacture of automotive vehicle parts.
CASI
Aerospace Industry; Automobiles; Components; Identifying

20040081248 NASA Kennedy Space Center, Cocoa Beach, FL, USA
Methods of Testing Thermal Insulation and Associated Test Apparatus
June 1, 2004; 15 pp.; In English
Patent Info.: Filed 10 Jul. 2001; US-Patent-6,742,926; US-Patent-Appl-SN-217121; NASA-Case-KSC-12107; No Copyright; Avail: CASI; A03, Hardcopy

The system and method for testing thermal insulation uses a cryostatic insulation tester having a vacuum chamber and a cold mass including a test chamber and upper and lower guard chambers adjacent thereto. The thermal insulation is positioned within the vacuum chamber and adjacent the cold mass. Cryogenic liquid is supplied to the test chamber, upper guard and lower guard to create a first gas layer in an upper portion of the lower guard chamber and a second gas layer in an upper portion of the test chamber. Temperature are sensed within the vacuum chamber to test the thermal insulation.
Author
Thermal Insulation; Cryogenics

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*.

20040077265 NASA Glenn Research Center, Cleveland, OH, USA
LINFLUX-AE: A Turbomachinery Aeroelastic Code Based on a 3[0016]D Linearized Euler Solver
Reddy, T. S. R.; Bakhle, M. A.; Trudell, J. J.; Mehmed, O.; Stefko, G. L.; May 2004; 42 pp.; In English
Contract(s)/Grant(s): WBS-22-78F-30-10
Report No.(s): NASA/TM-2004-212978; NAS 15:2004212978; E-14454; No Copyright; Avail: CASI; A03, Hardcopy

This report describes the development and validation of LINFLUX-AE, a turbomachinery aeroelastic code based on the linearized unsteady 3-D Euler solver, LINFLUX. A helical fan with flat plate geometry is selected as the test case for numerical validation. The steady solution required by LINFLUX is obtained from the nonlinear Euler/Navier Stokes solver TURBO-AE. The report briefly describes the salient features of LINFLUX and the details of the aeroelastic extension. The aeroelastic formulation is based on a modal approach. An eigenvalue formulation is used for flutter analysis. The unsteady aerodynamic forces required for flutter are obtained by running LINFLUX for each mode, interblade phase angle and frequency of interest. The unsteady aerodynamic forces for forced response analysis are obtained from LINFLUX for the prescribed excitation, interblade phase angle, and frequency. The forced response amplitude is calculated from the modal summation of the generalized displacements. The unsteady pressures, work done per cycle, eigenvalues and forced response amplitudes obtained from LINFLUX are compared with those obtained from LINSUB, TURBO-AE, ASTROP2, and ANSYS.
Author
Aeroelasticity; Turbomachinery; Unsteady Aerodynamics; Flutter; Flutter Analysis; Aerodynamic Forces

20040077276 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Iterative Magnetic/Structural Simulation of a MEMS Micro-shutter

Khaskia, Abed M.; Power, David J.; Loughlin, James P.; 2004; 7 pp.; In English; 2004 ANYS International Conference, 24-26 May 2004, Pittsburgh, PA, USA; Original contains black and white illustrations; No Copyright; Avail: CASI; A02, Hardcopy

A finite element model has been created that simulates the magnetic actuation of a cobalt-iron covered, 0.5micron thick, silicon nitride micro-shutter. The micro-shutter will be used as a transmissible filter in a space-based Multi-object Spectrograph (MOS). A laminated tri-pole permanent magnet is scanned across an array of shutters. The applied magnetic force twists the shutter's torsion hinge and actuates the shutter from the closed, 0 degree position, to the open, 90 degree position. A sequential analysis method was selected. This method uses the interaction between the magnetic and structural fields and is accomplished via the load vectors. The simulation results are compared to experimental measurements of fabricated micro-shutter devices.

Author

Sequential Analysis; Silicon Nitrides; Finite Element Method; Microelectromechanical Systems; Cobalt; Magnetic Fields

20040078948 Naval Postgraduate School, Monterey, CA

A Study on the Transient Response of a Stepped Column Subjected to an Impact Load

Park, Tae-hak; Shin, Young S.; Jun. 2004; 61 pp.; In English; Original contains color illustrations

Report No.(s): AD-A423540; NPS-MAE-04-004; No Copyright; Avail: CASI; A04, Hardcopy

Dynamic buckling of structures has been studied in the fields of naval architecture and aerospace and civil engineering. Transient or impulsive loads that may exceed the critical static Euler limit also can be an important design consideration in these fields. In the case of warships and submarines, the design of structures to resist shock loads from hostile weapons or missile launching is important for the protection of the crew and the vessel. Because of that, many people have researched dynamic buckling of structures. There are many studies of a continuous beam or cylinder under axial shock load, but it is not easy to find studies on stiffness variation, an important factor in the preliminary design stage of ships, aircraft, and missiles. Generally, the body section stiffness of these structures differs because of access doors, stiffeners, and other skin cutouts. Therefore, the costs of trial and error can be reduced if the structure design process considers the stiffness distribution of a system in the preliminary design stages. This study investigates the effect of stiffness variation on a stepped, simply supported beam under an axial impact load and a stepped, cantilever beam under a vertical impact load. The study also investigates the effects of a vertical impact load on a cylindrical shell, and of frequency variation of an impact load on the response of structures. Finite element modeling and numerical analysis were performed using the MSC/PATRAN and MSC/NASTRAN programs. (4 tables, 42 figures, 11 refs.)

DTIC

Axial Loads; Beams (Supports); Buckling; Impact Loads; Stiffness; Transient Response

42
GEOSCIENCES (GENERAL)

Includes general research topics related to the Earth sciences, and the specific areas of petrology, mineralogy, and general geology. For other specific topics in geosciences see *categories 42 through 48*.

20040079392 NASA Goddard Space Flight Center, Greenbelt, MD, USA

GFO Altimeter Engineering Assessment Report. Update: The First 65 Cycles Since Acceptance, November 29, 2000 to December 9, 2003, Version 1

Hancock, D. W., III; Hayne, G. S.; Lockwood, D. W.; Brooks, R. L.; May 2004; 119 pp.; In English

Report No.(s): NASA/TM-2004-209984/VOL6/VER6; Rept-2004-02077-0/VOL6/VER1; No Copyright; Avail: CASI; A06, Hardcopy

The U.S. Navy's Geosat Follow-On (GFO) Mission, launched February 10, 1998, is one of a series of altimetric satellites which include Seasat, Geosat, ERS-1, and TOPEX/POSEIDON (T/P). The purpose of this report is to document the GFO altimeter performance determined from the analyses and results performed by NASA's GSFC and Wallops altimeter calibration team. It is the fourth of an anticipated series of NASA's GSFC and Wallops GFO performance documents, each of which will update assessment results. This report covers the performance from instrument acceptance by the Navy on November 29, 2000, to the end of Cycle 65 on December 9, 2003. Data derived from GFO will lead to improvements in the knowledge of ocean circulation, ice sheet topography, and climate change. In order to capture the maximum amount of information from the GFO data, accurate altimeter calibrations are required for the civilian data set which NOAA will produce.

Wallops Flight Facility has provided similar products for the Geosat and T/P missions and is doing the same for GFO.
Author
Altimeters; Geosat Satellites; Topography; Annual Variations; Geophysics

20040079824 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, Ellsworth J.; Ginoux, Paul; Colarco, Peter; Chin, Mian; Spinhirne, James D.; Palm, Steven P.; Hlavka, Dennis; Hart, William; [2003]; 1 pp.; In English; AGU Meeting, 8-12 Dec. 2003, San Francisco, 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 GUS 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; Vertical Distribution; Laser Altimeters; Atmospheric Models; Plumes; Dust

20040081228 NASA Ames Research Center, Moffett Field, CA, USA
Autotrophic Ecosystems on the Early Earth
Schulte, M.; August 06, 2003; 1 pp.; In English; Exobiology P.I. Symposium, 25-29 Aug. 2003, USA
Contract(s)/Grant(s): RTOP 344-34-21-10; No Copyright; Avail: Other Sources; Abstract Only

Ophiolite sequences, sections of lower oceanic crust and upper mantle that have been thrust onto continental craton, are located in northern and central California and provide easily accessible areas that serve as good analogs for similar, more extensive areas of the early Earth. We have begun investigating and characterizing these sites in order to understand better the processes that may be responsible for the water chemistry, mineralogy and biology of similar environments on the early Earth. The geophysical and geochemical processes in these terranes provide niches for unique communities of extremeophiles and likely provide a good analog to the location that first gave rise to life on Earth. The ophiolites found in northern and central California include the Trinity, Josephine, Coast Range and Point Sal, all of which are approximately 160 million years old. Fluids from serpentinizing springs are generally alkaline with high pH and H2 contents, indicating that the mafic rock compositions control the fluid composition through water-rock reactions during relatively low-grade hydrothermal processes. There are significant amounts of primary mineralogy remaining in the rocks, meaning that substantial alteration processes are still occurring in these terranes. The general reaction for serpentinization of olivine is given by one of the authors. olivine + H2O = serpentine + brucite + magnetite + H2. We have analyzed the mineralogical composition of several rock samples collected from the Coast Range Ophiolite near Clear Lake, CA by electron microprobe. The remnant primary mineralogy is fairly urnform in composition, with an olivine composition of Fo(sub 90), and with pyroxene compositions of En(sub 90) for orthopyroxene and En(sub 49)Wo(sub 48)Fs(sub 03) for the clinopyroxene. Other primary phases observed include chromites and other spinels. Examination of petrographic thin sections reveals that serpentinization reactions have occurred in these locations. The serpentine resulting from aqueous alteration of olivine resides in veins that are see to cross cut the primary mineral grains. There are several generations of alteration products, comprised mostly of serpentines that are magnesium rich, with magnetite, brucite and carbonates observed as accessory minerals. The formation of carbonates can be taken to indicate the presence of CO2 in the altering fluids. We collected samples from a spring in the Coast Range Ophiolite in order to determine whether the geochemical environment serves as a habitat for chemotrophic microorganisms. DNA was extracted from the sediment samples and the 16s rRNA gene was PCR amplified using universal Archaeal primers. Denaturing gradient gel electrophoresis (DGGE) was used to determine the community of Archaea thriving in these samples. Our results indicate that there were 8 different genera of Archaea from a single sample. A sequence was obtained from one of these eight. The sequence is of an organism similar to Halorubrum tibetense, and alkalophilic Archaeon. This result suggests that these

environments are likely hosts for communities of organisms that are adapted for the unique chemistry provided by the alkaline spring.
Author
Ecosystems; Microorganisms; Autotrophs; Earth Surface; Mineralogy; Biogeochemistry

20040081247 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Comparisons of Arctic In-Situ Snow and Ice Data with Airborne Passive Microwave Measurements
Markus, T.; Cavalien, D. J.; Gasiewski, A.; Sturm, M.; Klein, M.; Maslanik, J.; Stroeve, J.; Heinrichs, J.; Holmgren, J.; Irisov, V.; [2004]; 1 pp.; In English; IGARSS 2004, 20-24 Sep. 2004, Anchorage, AK, USA; No Copyright; Avail: Other Sources; Abstract Only

As part of the AMSR-E sea ice validation campaign in March 2003, aircraft flights over the Arctic sea ice were coordinated with ground measurements of snow and sea ice properties. The surface-based measurements were in the vicinity of Barrow, AK, and at a Navy ice camp located in the Beaufort Sea. The NASA P-3 aircraft was equipped with the NOAA ETL PSR microwave radiometer that has the same frequencies as the AMSR-E sensor. The goal was to validate the standard AMSR-E products ice temperature and snow depth on sea ice. Ground measurements are the only way to validate these parameters. The higher spatial resolution of the PSR instrument (between 30 and 500 m, depending on altitude) enables a better comparison between ground measurements and microwave data because of the expected smaller spatial variability. Maps of PSR data can then be used for further down-scaling to AMSR-E pixel areas. Initial results show a good qualitative agreement between the in-situ snow depths and the PSR data. Detailed studies are underway and latest results will be presented.
Author
Airborne Equipment; Arctic Regions; In Situ Measurement; Microwave Radiometers; Sea Ice; Snow; Data Acquisition

20040081265 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Earth Rotation Dynamics: Review and Prospects
Chao, Benjamin F.; 2004; 1 pp.; In English; Third IVS General Meeting, 9-11 Feb. 2004, Ottawa, Canada; No Copyright; Avail: Other Sources; Abstract Only

Modem space geodetic measurement of Earth rotation variations, particularly by means of the VLBI technique, has over the years allowed studies of Earth rotation dynamics to advance in ever-increasing precision, accuracy, and temporal resolution. A review will be presented on our understanding of the geophysical and climatic causes, or "excitations", for length-of-day change, polar motion, and nutations. These excitations sources come from mass transports that constantly take place in the Earth system comprised of the atmosphere, hydrosphere, cryosphere, lithosphere, mantle, and the cores. In this sense, together with other space geodetic measurements of time-variable gravity and geocenter motion, Earth rotation variations become a remote-sensing tool for the integral of all mass transports, providing valuable information about the latter on a wide range of spatial and temporal scales. Future prospects with respect to geophysical studies with even higher accuracy and resolution will be discussed.
Author
Earth Rotation; Time Measurement; Geodetic Surveys

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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*.

20040077269 California Univ., Santa Barbara, Goleta, CA, USA
Plumes and Blooms: Observations, Analysis and Modeling for SIMBIOS
Maritorena, S.; Siegel, D. A.; Nelson, N. B.; 2004; 8 pp.; In English
Contract(s)/Grant(s): NAS5-00201
Report No.(s): CR-2004-212756; No Copyright; Avail: CASI; A02, Hardcopy

The goal of the Plumes and Blooms (PnB) project is to develop, validate and apply to imagery state-of-the-art ocean color algorithms for quantifying sediment plumes and phytoplankton blooms for the Case II environment of the Santa Barbara Channel. We conduct monthly to twice-monthly transect observations across the Santa Barbara Channel to develop an

algorithm development and product validation data set. A primary goal is the use the PnB field data set to objectively tune semi-analytical models of ocean color for this site and apply them using available satellite imagery (SeaWiFS and MODIS). However, the comparison between PnB field observations and satellite estimates of primary products has been disappointing. We find that field estimates of water-leaving radiance correspond poorly to satellite estimates for both SeaWiFS and MODIS local area coverage imagery. We believe this is due to poor atmospheric correction due to complex mixtures of aerosol types found in these near-coastal regions.
Author
MODIS (Radiometry); Phytoplankton; Plumes; Mathematical Models; Satellite Observation; Marine Biology; Water Color

20040077279 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Linkages between the Urban Environment and Earth's Climate System
Shepherd, J. Marshall; Jin, Menglin; [2003]; 4 pp.; In English; No Copyright; Avail: CASI; A01, Hardcopy

Urbanization is one of the extreme cases of land use change. Although currently only 1.2% of the land is considered urban, the spatial coverage and density of cities are expected to rapidly increase in the near future. It is estimated that by the year 2025 60% of the world s population will live in cities (UNFP, 1999). Though urban areas are local in scale, human activity in urban environments has impacts at local, to global scale by changing atmospheric composition; impacting components of the water cycle; and modifying the carbon cycle 2nd ecosystems. For example, urban dwellers are undoubtedly familiar with "high" ozone pollution days, flash flooding in city streets, or heat stress on summer days. However, our understanding of urbanization on the total Earth-climate system is incomplete. Better understanding of how the Earth s weather, oceans, and land work together and the influence of the urban environment on this climate system is critical. This paper highlights some of the major and current issues involving interactions between urban environments and the Earth's climate system. It also captures some of the most current thinking and findings of the authors and key experts in the field.
Author
Atmospheric Composition; Carbon Cycle; Ecosystems; Ozone; Air Pollution

20040078945 Army Engineer Research and Development Center, Vicksburg, MS
Beach-Profile Evolution under Spilling and Plunging Breakers
Wang, Ping; Ebersole, Bruce A.; Smith, Ernest R.; Feb. 2003; 7 pp.; In English
Report No.(s): AD-A423537; No Copyright; Avail: CASI; A02, Hardcopy

Beach-profile evolution, along with measurements of waves, currents, and sediment concentration, under spilling and plunging breakers of similar height were studied in the three-dimensional Large-Scale Sediment Transport Facility at the U.S. Army Engineer Research and Development Center, Coastal and Hydraulics Laboratory. Unidirectional irregular waves were generated over a fine-sand beach. Beach-profile shape reached equilibrium after 1,330 and 280 minutes of spilling and plunging wave actions, respectively. Near the main breaker line, the profile evolved differently under plunging and spilling breakers. Across most of the midsurf zone dominated by surf bores, the equilibrium profile shapes were similar. Uniform energy dissipation per unit of volume at equilibrium, as assumed in the Dean 1977 model and often used in cross-shore sediment-transport modeling, was measured for both cases across most of the surf zone except at the main breaker line, where a much greater rate of dissipation occurred. The bar/ trough formation and maintenance were closely related to the local patterns of sediment suspension and bed scour at the plunging point. (7 figures, 12 refs.)
DTIC
Beaches; Circuit Breakers; Hydrodynamics; Sediment Transport; Spilling

20040078946 Army Engineer Research and Development Center, Vicksburg, MS
Evaluation of the CERC Formula Using Large-Scale Model Data
Smith, Ernest R.; Wang, Ping; Zhang, Jun; Jan. 2003; 14 pp.; In English; Original contains color illustrations
Report No.(s): AD-A423538; No Copyright; Avail: CASI; A03, Hardcopy

Longshore transport experiments were conducted in a large-scale physical model to evaluate predictions of the CERC formula with measured longshore sediment transport rates. It was found that the CERC formula produced reasonable estimates if the coefficient K was calibrated and applied to waves with similar breaker type. The calibrated K values are much smaller than values that are commonly used, and there appears to be a strong dependency of transport rate on breaker type. Additional comparisons were made with the formula proposed by Kamphuis (1991). The Kamphuis equation, which includes wave period, a factor that influences breaking, gave good estimates. Examination of the cross-shore distribution of longshore sediment transport indicates that there are three distinct zones of transport: the incipient breaker zone, the inner surf zone, and

the swash zone, with each zone contributing a different fraction to the total transport rate. Transport in the incipient breaker zone was influenced by breaker type, transport in the inner surf zone was controlled by depth, and transport in the swash zone showed dependencies on wave height and, in particular, wave period. Swash zone transport was found to have a significant contribution to the total transport rate. (7 figures, 24 refs.)
DTIC
Beaches; Hydrodynamics; Prediction Analysis Techniques; Sediment Transport

20040079736 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Integrating Indigenous Traditional, Local and Scientific Knowledge for Improved Management, Policy and Decision-Making in Reindeer Husbandry in the Russian Arctic
Maynard, Nancy G.; Yurchak, Boris; Turi, Johan Mathis; Mathiesen, Svein D.; Aissi-Wespi, Rita L.; 2004; 1 pp.; In English; 5th International Congress of Arctic social Sciences (ICASS V), 19*23 May 2004, Fairbanks, AK, USA; Copyright; Avail: Other Sources; Abstract Only

As scientists and policy-makers from both indigenous and non-indigenous communities begin to build closer partnerships to address common sustainability issues such as the health impacts of climate change and anthropogenic activities, it becomes increasingly important to create shared information management systems which integrate all relevant factors for optimal information sharing and decision-making. This paper describes a new GIs-based system being designed to bring local and indigenous traditional knowledge together with scientific data and information, remote sensing, and information technologies to address health-related environment, weather, climate, pollution and land use change issues for improved decision/policy-making for reindeer husbandry. The system is building an easily-accessible archive of relevant current and historical, traditional, local and remotely-sensed and other data and observations for shared analysis, measuring, and monitoring parameters of interest. Protection of indigenous culturally sensitive information will be respected through appropriate data protocols. A mechanism which enables easy information sharing among all participants, which is real time and geo-referenced and which allows interconnectivity with remote sites is also being designed into the system for maximum communication among partners. A preliminary version of our system will be described for a Russian reindeer test site, which will include a combination of indigenous knowledge about local conditions and issues, remote sensing and ground-based data on such parameters as the vegetation state and distribution, snow cover, temperature, ice condition, and infrastructure.
Author
Arctic Regions; Decision Making; Policies; Remote Sensing; Geographic Information Systems; Russian Federation

20040079779 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Small Orbital Planetary Lidar for Measurement of Water Vapor, Cloud and Aerosol Profiles
Allan, Graham R.; Krainak, Michael A.; Andrews, Arlyn E.; Gates, Amelia M.; Abshire, James B.; 2004; 3 pp.; In English; Laser Applications to Chemical and Environmental Analysis, 9-11 Feb. 2004, Annapolis, MD, USA; Copyright; Avail: CASI; A01, Hardcopy

Active remote sensing measurements of the total water vapor column content are presented using a frequency tuned DBR laser (940 nm band) and a hard target return for a 0.4 Km open path.
Author
Aerosols; Remote Sensing; Water Vapor; Optical Radar; Clouds (Meteorology); Mars Atmosphere

20040081051 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Example MODIS Global Cloud Optical and Microphysical Properties: Comparisons between Terra and Aqua
Hubanks, P. A.; Platnick, S.; King, M. D.; Ackerman, S. A.; Frey, R. A.; 2003; 1 pp.; In English; AGU Fall 2003 Meeting, 8-12 Dec. 2003, San Francisco, CA, USA; No Copyright; Avail: Other Sources; Abstract Only

MODIS observations from the NASA EOS Terra spacecraft (launched in December 1999, 1030 local time equatorial crossing) have provided a unique data set of Earth observations. With the launch of the NASA Aqua spacecraft in May 2002 (1330 local time), two MODIS daytime (sunlit) and nighttime observations are now available in a 24 hour period, allowing for some measure of diurnal variability. We report on an initial analysis of several operational global (Level-3) cloud products from the two platforms. The MODIS atmosphere Level-3 products, which include clear-sky and aerosol products in addition to cloud products, are available as three separate files providing daily, eight-day, and monthly aggregations; each temporal aggregation is spatially aggregated to a 1 degree grid. The files contain approximately 600 statisitical datasets (from simple means and standard deviations to 1 - and 2-dimensional histograms). Operational cloud products include detection (cloud fraction), cloud-top properties, and daytimeonly cloud optical thickness and particle effective radius for both water and ice

clouds. We will compare example global Terra and Aqua cloud fraction, optical thickness, and effective radius aggregations. Author

MODIS (Radiometry); Terra Spacecraft; Cloud Physics

20040081081 Lockheed Martin Space Operations, Bay Saint Louis, MS, USA

Synthetic Scene Generation of Stennis Target Range for the Calibration of Remote Sensing Systems

Cao, Chang-Yong; Blonski, Slawomir; Ryan, Robert; Gasser, Gerald; Zanoni, Vicki; Jenner, Jeff; April 1, 1999; 2 pp.; In English; 1999 International Symposium on Spectral Sensing Research, 31 Oct. - 4 Nov. 1999, Las Vegas, NV, USA

Contract(s)/Grant(s): NAS13-650

Report No.(s): SE-2003-05-00040-SSC; No Copyright; Avail: Other Sources; Abstract Only

The validation and verification (V&V) target range developed at Stennis Space Center is a useful tool for the calibration of remote sensing systems. In this paper, we present an algorithm for generating synthetic scenes or digital models of this target range. The atmospheric radiative transfer code Modtran 4 is used in simulating at-sensor radiance for a given sensor. Software is developed to generate the scene with different spatial and spectral resolutions using the at-sensor radiance values. Synthetic scenes provide a cost-effective way for in-flight validation for the spatial and radiometric accuracy of the data. Other applications include mission planning, sensor simulation, and trade-off analysis in sensor design. The radiometric and spatial accuracy of the simulation is evaluated by comparing simulated scenes with AVIRIS acquired values.

Author

Algorithms; Calibrating; Remote Sensing; Scene Generation; Targets

20040081105 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Mosquito Larval Habitats, Land Use, and Potential Malaria Risk in Northern Belize from Satellite Image Analyses

Pope, Kevin; Masuoka, Penny; Rejmankova, Eliska; Grieco, John; Johnson, Sarah; Roberts, Donald; [2004]; 24 pp.; In English

Contract(s)/Grant(s): NAG5-12593; NIAID-R01-AI49726; No Copyright; Avail: CASI; A03, Hardcopy

The distribution of Anopheles mosquito habitats and land use in northern Belize is examined with satellite data. -A land cover classification based on multispectral SPOT and multitemporal Radarsat images identified eleven land cover classes, including agricultural, forest, and marsh types. Two of the land cover types, Typha domingensis marsh and flooded forest, are Anopheles vestitipennis larval habitats. Eleocharis spp. marsh is the larval habitat for Anopheles albimanus. Geographic Information Systems (GIS) analyses of land cover demonstrate that the amount of T-ha domingensis in a marsh is positively correlated with the amount of agricultural land in the adjacent upland, and negatively correlated with the amount of adjacent forest. This finding is consistent with the hypothesis that nutrient (phosphorus) runoff from agricultural lands is causing an expansion of Typha domingensis in northern Belize. This expansion of Anopheles vestitipennis larval habitat may in turn cause an increase in malaria risk in the region.

Author

Land Use; Satellite Imagery

20040081159 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Moderate Image Spectrometer (MODIS) Fire Radiative Energy: Physics and Applications

Kaufman, Y.; [2004]; 1 pp.; In English; No Copyright; Avail: Other Sources; Abstract Only

MODIS fire channel does not saturate in the presence of fires. The fire channel therefore is used to estimate the fire radiative energy, a measure of the rate of biomass consumption in the fire. We found correlation between the fire radiative energy, the rate of formation of burn scars and the rate of emission of aerosol from the fires. Others found correlations between the fire radiative energy and the rate of biomass consumption. This relationships can be used to estimates the emissions from the fires and to estimate the fire hazards.

Author

Fires; MODIS (Radiometry); Reaction Kinetics; Radiative Heat Transfer

20040081161 NASA Goddard Space Flight Center, Greenbelt, MD, USA

NASA's Earth Science Research and Environmental Predictions

Hilsenrath, E.; [2004]; 1 pp.; In English; No Copyright; Avail: Other Sources; Abstract Only

NASA Earth Science program began in the 1960s with cloud imaging satellites used for weather observations. A fleet of satellites are now in orbit to investigate the Earth Science System to uncover the connections between land, Oceans and the

atmosphere. Satellite systems using an array of active and passive remote sensors are used to search for answers on how is the Earth changing and what are the consequences for life on Earth? The answer to these questions can be used for applications to serve societal needs and contribute to decision support systems for weather, hazard, and air quality predictions and mitigation of adverse effects. Partnerships with operational agencies using NASA's observational capabilities are now being explored. The system of the future will require new technology, data assimilation systems which includes data and models that will be used for forecasts that respond to user needs.
Author
Earth Sciences; NASA Programs; Earth Environment; Research and Development; Remote Sensors

20040081162 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Dust Transport and Deposition Observed from the Terra-Moderate Image Spectrometer (MODIS) Space Observations
Kaufman, Y.; [2004]; 1 pp.; In English; ISA-NASA Science Workshop, 4-8 May 2004, Dead Sea, Israel; 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 plus or minus 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 plus or minus 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
Deposition; Dust; Imaging Spectrometers; MODIS (Radiometry); Terra Spacecraft; Geophysics

20040081166 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Synergetic use of Aerosol Robotic Network (AERONET) and Moderate Image Spectrometer (MODIS)
Kaufman, Y.; [2004]; 1 pp.; In English; AERONET Workshop, 10-14 May 2004, El Arenosilo, Spain; No Copyright; Avail: Other Sources; Abstract Only

I shall describe several distinct modes in which AERONET data are used in conjunction with MODIS data to evaluate the global aerosol system and its impact on climate. These includes: 1) Evaluation of the aerosol diurnal cycle not available from MODIS, and the relationship between the aerosol properties derived from MODIS and the daily average of these properties; 2) Climatology of the aerosol size distribution and single scattering albedo. The climatology is used to formulate the assumptions used in the MODIS look up tables used in the inversion of MODIS data; 3) Measurement of the aerosol effect on irradiation of the surface, this is used in conjunction with the MODIS evaluation of the aerosol effect at the TOA; and 4) Assessment of the aerosol baseline on top off which the satellite data are used to find the amount of dust or anthropogenic aerosol.
Author
Aerosols; MODIS (Radiometry); Robotics; Climatology

20040081184 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Viewing Atmospheric Aerosols from the MODIS Satellite Sensor
Remer, L.; [2003]; 1 pp.; In English; No Copyright; Avail: Other Sources; Abstract Only

The MODerate resolution Imaging Spectroradiometer (MODIS) currently aboard both the Terra and Aqua satellites produces a suite of products designed to characterize global aerosol distribution, optical thickness and particle size. Never before has a space-borne instrument been able to provide such detailed information, complementing field and modeling efforts to produce a comprehensive picture of aerosol characteristics. The three years of Terra-MODIS data have been validated by comparing with co-located AERONET observations of aerosol optical thickness and derivations of aerosol size parameters. Some 8000 comparison points located at 133 AERONET sites around the globe show that the MODIS aerosol optical

thickness retrievals are accurate to within the pre-launch expectations, on a global basis. The global statistics, however, can hide local biases in the product. Some of these biases will be discussed. Nevertheless, the products can be used and are currently being used to answer some pressing questions concerning aerosol radiative forcing, aerosol-cloud interaction, estimating aerosol sources and height of transport, and Air Quality forecasting. A survey of current applications of MODIS aerosol products will be presented.
Author
Aerosols; MODIS (Radiometry); Satellite-Borne Instruments; Earth Atmosphere; Atmospheric Composition

20040081219 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Experimenting with Sensor Webs Using Earth Observing 1
Mandl, Dan; [2004]; 8 pp.; In English; IEEE Aerospace Conference, 6-13 Mar. 2004, Big Sky, MT, USA; No Copyright; Avail: CASI; A02, Hardcopy

The New Millennium Program (NMP) Earth Observing 1 (EO-1) satellite was launched November 21, 2000 as a one year technology validation mission. After an almost flawless first year of operations, EO-1 continued to operate in a test bed d e to validate additional technologies and concepts that will be applicable to future sensor webs. A sensor web is a group of sensors, whether space-based, ground-based or air plane-based which act in a collaborative autonomous manner to produce more value than would otherwise result from the individual observations.
Author
Experimentation; Sensors; Webs

20040081246 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Using Science Driven Technologies for the Defense and Security Applications
Habib, Shahid; Zukor, Dorthy; Ambrose, Stephen D.; [2004]; 1 pp.; In English; SPIE Defense and Security Symposium, 12-16 Apr. 2004, Orlando, FL, USA; No Copyright; Avail: Other Sources; Abstract Only

For the past three decades, Earth science remote sensing technologies have been providing enormous amounts of useful data and information in broadening our understanding of our home planet as a system. This research, as it has expanded our learning process, has also generated additional questions. This has further resulted in establishing new science requirements, which have culminated in defining and pushing the state-of-the-art technology needs. NASA s Earth science program has deployed 18 highly complex satellites, with a total of 80 sensors, so far and is in a process of defining and launching multiple observing systems in the next decade. Due to the heightened security alert of the nation, researchers and technologists are paying serious attention to the use of these science driven technologies for dual use. In other words, how such sophisticated observing and measuring systems can be used in detecting multiple types of security concerns with a substantial lead time so that the appropriate law enforcement agencies can take adequate steps to defuse any potential risky scenarios. This paper examines numerous NASA technologies such as laser/lidar systems, microwave and millimeter wave technologies, optical observing systems, high performance computational techniques for rapid analyses, and imaging products that can have a tremendous pay off for security applications.
Author
Earth Sciences; Remote Sensing; Defense Program; Security; Technology Utilization; NASA Programs

20040081253 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Modeling Studies of the MODIS Solar Diffuser Attenuation Screen and Comparison with On-Orbit Measurements
Waluschka, Eugene; Xiong, Xiao-Xiong; Guenther, Bruce; Barnes, William; VanSalomonson, Vincent V.; [2004]; 1 pp.; In English; SPIE Conference, 2-6 Oct. 2004, Denver, CO, USA; No Copyright; Avail: Other Sources; Abstract Only

The MODIS instrument relies on solar calibration to achieve the required radiometric accuracy. This solar calibration occurs as the TERRA spacecraft comes up over the North Pole. The earth underneath the spacecraft is still dark for approximately one minute and the sun is just rising over the earth's north polar regions. During this time the sun moves through about 4 degrees, the scan mirror rotates about 19 times and about 50 frames (exposures) are made of the white solar diffuser. For some of MODIS'S bands the brightness of the screen is reduced, to prevent detector saturation, by means of a pinhole screen, which produces approximately 600 pinhole images of the sun within the field of view of any one detector. Previous attempts at creating a detailed radiometric model of this calibration scenario produced intensity variations on the focal planes with insufficient detail to be useful. The current computational approach produces results, which take into account the motion of the sun and the scan mirror and produces variations, which strongly resemble the observed focal plane intensity

variations. The computational approach and results and a comparison with actual observational data are presented.
Author
MODIS (Radiometry); Atmospheric Models; Calibrating; Solar Activity; Atmospheric Attenuation

20040081254 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Application of Polarization to the MODIS Aerosol Retrieval Over Land
Levy, Robert C.; Remer, Lorraine R.; Kaufman, Yoram J.; [2004]; 11 pp.; In English; Original contains color illustrations; No Copyright; Avail: CASI; A03, Hardcopy

Reflectance measurements in the visible and infrared wavelengths, from the Moderate Resolution Imaging Spectroradiometer (MODIS), are used to derive aerosol optical thicknesses (AOT) and aerosol properties over land surfaces. The measured spectral reflectance is compared with lookup tables, containing theoretical reflectance calculated by radiative transfer (RT) code. Specifically, this RT code calculates top of the atmosphere (TOA) intensities based on a scalar treatment of radiation, neglecting the effects of polarization. In the red and near infrared (NIR) wavelengths the use of the scalar RT code is of sufficient accuracy to model TOA reflectance. However, in the blue, molecular and aerosol scattering dominate the TOA signal. Here, polarization effects can be large, and should be included in the lookup table derivation. Using a RT code that allows for both vector and scalar calculations, we examine the reflectance differences at the TOA, with and without polarization. We find that the differences in blue channel TOA reflectance (vector - scalar) may reach values of 0.01 or greater, depending on the sun/surface/sensor scattering geometry. Reflectance errors of this magnitude translate to AOT differences of 0.1, which is a very large error, especially when the actual AOT is low. As a result of this study, the next version of aerosol retrieval from MODIS over land will include polarization.
Author
MODIS (Radiometry); Polarization; Spectral Reflectance; Land; Aerosols

20040081308 NASA Stennis Space Center, Bay Saint Louis, MS, USA, Halcyon, Inc., USA
The Importance of Information Requirements in Designing Acquisition to Information Systems
Davis, Bruce A.; Hill, Chuck; Maughan, Paul M.; June 1998; 5 pp.; In English
Contract(s)/Grant(s): NAS13-658
Report No.(s): SE-1998-04-00005-SSC; No Copyright; Avail: CASI; A01, Hardcopy

The partnership model used by NASA's Commercial Remote Sensing Program has been successful in better defining remote sensing functional requirements and translation to technical specifications to address environmental needs of the 21st century.
Author
Remote Sensing; Environmental Monitoring; User Requirements; Information Management

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ENERGY PRODUCTION AND CONVERSION

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

20040077305 California Univ., La Jolla, CA, USA
CalnNAs Structures Grown by MBE for High-Efficency Solar Cells. Final Report June 25, 1999-August 24, 2002
Tu, C. W.; Aug. 2003; In English
Report No.(s): DE2003-15004566; NREL/SR-520-3458; No Copyright; Avail: National Technical Information Service (NTIS)

The focus of this work is to improve the quality of GaInNAs by advanced thin-film growth techniques, such as digital-alloy growth techniques and migration-enhanced epitaxy (MEE). The other focus is to further investigate the properties of such materials, which are potentially beneficial for high-efficiency, multijunction solar cells. 400-nm-thick strain-compensated Ga0.92In0.08As/GaN0.03As0.97 short-period superlattices (SPSLs) are grown lattice-matched to GaAs substrates. The photoluminescence (PL) intensity of digital alloys is 3 times higher than that of random alloys at room temperature, and the improvement is even greater at low temperature, by a factor of about 12.
NTIS
Solar Cells; Gallium Arsenides

20040079638 Iowa State Univ. of Science and Technology, Ames, IA
Organic Light-Emitting Devices (OLEDs) and their Optically Detected Magnetic Resonance (ODMR)
Li, G.; 2003; 144 pp.; In English
Report No.(s): DE2004-822052; No Copyright; Avail: Department of Energy Information Bridge

Organic Light-Emitting Devices (OLEDs), both small molecular and polymeric have been studied extensively since the first efficient small molecule OLED was reported by Tang and VanSlyke in 1987. Burroughes' report on conjugated polymer-based OLEDs led to another track in OLED development. These developments have resulted in full color, highly efficient (up to(approx) 20% external efficiency 60 lm/W power efficiency for green emitters), and highly bright (> 140,000 Cd/m(sup 2) DC,(approx)2,000,000 Cd/m(sup 2) AC), stable (> 40, 000 hr at 5 mA/cm(sup 2)) devices. OLEDs are Lambertian emitters, which intrinsically eliminates the view angle problem of liquid crystal displays (LCDs). Thus OLEDs are beginning to compete with the current dominant LCDs in information display. Numerous companies are now active in this field, including large companies such as Pioneer, Toyota, Estman Kodak, Philipps, DuPont, Samsung, Sony, Toshiba, and Osram, and small companies like Cambridge Display Technology (CDT), Universal Display Corporation (UDC), and eMagin. The first small molecular display for vehicular stereos was introduced in 1998, and polymer OLED displays have begun to appear in commercial products. Although displays are the major application for OLEDs at present, they are also candidates for nest generation solid-state lighting. In this case the light source needs to be white in most cases. Organic transistors, organic solar cells, etc. are also being developed vigorously.
NTIS
Light Sources; Liquid Crystals

20040079822 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Anti-Coincidence Detector for GLAST
Moiseev, Alexander A.; Hartman, R. C.; Johnson, Thomas E.; Ormes, Jonathan F.; Thompson, D. J.; [2004]; 1 pp.; In English; 12th Annual APS Meeting, 1-4 May 2004, Denver, CO, USA; No Copyright; Avail: Other Sources; Abstract Only

The Anti-Coincidence Detector (ACD) is the outermost detector layer in the GLAST Large Area Telescope (LAT), surrounding the top and sides of the tracker. The purpose of the ACD is to detect and veto incident cosmic ray charged particles, which outnumber cosmic gamma rays by 3-5 orders of magnitude. The challenge in ACD design is that it has to have high (0.9997) detection efficiency for relativistic charged particles, but must have low sensitivity to backsplash photons. These are products of high energy interactions in the LAT calorimeter, and can cause a veto signal in the ACD resulting in degradation of the LAT efficiency for high energy (>10 GeV) gamma-rays. The ACD requirement is that backsplash shall not reduce the LAT sensitivity by more than 20% for gamma rays of 300 GeV. To solve this problem, the ACD is divided into 89 scintillating tiles, with wave-length shifting fiber readout. The detector design and its characteristics are given in this paper.
Author
Detection; Telescopes; Cosmic Rays; Charged Particles; High Energy Interactions; Relativistic Particles

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ENVIRONMENT POLLUTION

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

20040074502 National Inst. for Occupational Safety and Health, Cincinnati, OH, USA
In-Depth Survey Report: Evaluation of Ventilation/Filtration System for 010 Culling System, at USA Postal Service, Cleveland Processing and Distribution Center, Cleveland, OH
Beamer, B. R.; Martin, S. B.; Topmiller, J. L.; Crouch, K. G.; Moyer, E. S.; Mar. 2004; 28 pp.; In English
Report No.(s): PB2004-105240; EPHB-279-20A; No Copyright; Avail: CASI; A03, Hardcopy

Researchers from the National Institute for Occupational Safety and Health (NIOSH) conducted an evaluation of the Ventilation/Filtration System (VFS) developed for the USA Postal Service (USPS) mail processing equipment-the 010 Culling System. The VFS was developed and installed by a private contractor hired by the USPS to reduce the potential for employee exposure to harmful substances that could be contained in mail pieces processed by the equipment. This effect is in response to the 2001 terrorist attacks that used the mail as a delivery system for anthrax. NIOSH was asked to assist the USPS in evaluating controls for this and other mail processing equipment. Evaluations were based on a variety of tests including: tracer gas (TG) experiments, air velocity measurements and smoke release observations to evaluate contaminant capture efficiency,

as well as simultaneous particle count experiments upstream and downstream of the VFS filtration to evaluate system filtration efficiency.
NTIS
Exposure; Filtration; System Effectiveness; Velocity Measurement; Ventilation

20040077310 Swedish Environmental Protection Agency, Stockholm, Sweden
National Land Cover Mapping for Air Pollution Studies
Mahlander, C.; Hellsten, S.; Akselsson, C.; Ekstrand, S.; 2004; In English
Report No.(s): PB2004-105945; IVL-B-1499; No Copyright; Avail: National Technical Information Service (NTIS)
A national land use map was produced in this project using IRS WiFS satellite data and supporting ancillary data. IRS WiFS satellite data only, without support from ancillary information, was found not be yield satisfactory accuracy given the classes required by the ASTA program. When used integrated with county statistics on forest and agricultural areas, as well as digital maps, the results, however, reached an acceptable quality level.
NTIS
Air Pollution; Land Use; Ecosystems

20040077312 Helsinki Univ. of Technology, Espoo, Finland
Remnoval of CO2 from Flue Gases using Magnesium Silicates in Finland
Kohlman, J.; 2001; In English
Report No.(s): PB2004-105815; TKK-ENY-3; No Copyright; Avail: National Technical Information Service (NTIS)
;Table of Contents: Introduction; Options for Co2 disposal; Mineral carbonization; Co2 disposal in Finland; Conclusions; How is continue; Literature and Appendix.
NTIS
Carbon Dioxide; Magnesium

20040077324 Texas A&M Univ., College Station, TX
Potential for Reduced Greenhouse Gas Emissions in Texas through the Use of High Volume Fly Ash Concrete
Estakhri, C.; Saylak, D.; Mohidekar, S. D.; Mar. 2004; In English
Report No.(s): PB2004-105726; SWUTC/04/167709-1; No Copyright; Avail: National Technical Information Service (NTIS)
The objective of this study was to determine the potential for reductions in carbon dioxide emissions in Texas by substituting high volumes of fly ash in concrete production and to identify the resulting benefits and challenges. Researchers reviewed the literature and determined that high volume fly ash (HVFA) can improve the properties of both the fresh and hardened concrete. It can improve workability, heat of hydration, strength, permeability, and resistance to chemical attack. A laboratory investigation was performed to investigate the potential of HVFA concrete in mitigating the effects of alkali-silica reactivity, which was recently a serious concern in Texas. The laboratory study showed high volumes of Class F ash are very effective in reducing the alkali-silica reaction from a potentially reactive state to an innocuous state. Researchers compiled data for 18 power plants located throughout Texas and determined that a total of 6.6 million tons of fly ash are produced annually in Texas and about 2.7 million tons (or 40%) are generally sold for use in concrete or other end products. Researchers estimated production of concrete in Texas and determined that if 60 percent of the portland cement used in Texas concrete production were replaced with fly ash, carbon dioxide emissions could potentially be reduced by 6.6 million tons annually by the year 2015.
NTIS
Alkalies; Silicon Dioxide; Reactivity

20040077325 Virginia Polytechnic Inst. and State Univ., Blacksburg, VA, USA, Virginia Transportation Research Council, Charlottesville, VA
Field Validation of Speed Estimation Techniques for Air Quality Conformity Analysis
Miller, J. S.; Fitch, G. M.; Dougald, L. E.; Kreissler, S. R.; Hill, D. H.; May 2004; In English
Report No.(s): PB2004-105722; VTRC 04-R19; No Copyright; Avail: National Technical Information Service (NTIS)
The air quality conformity analysis process requires the estimation of speeds for a horizon year on a link-by-link basis where only a few future roadway characteristics, such as forecast volume and capacity, are known. Accordingly, the Virginia Department of Transportation (VDOT) has at its disposal a variety of techniques, known as ‘speed post processors’ that estimate average travel speeds on each roadway link based on projected volumes from urban travel demand models. Using

field data collected at 15 sites in Richmond and Charlottesville, the accuracy of three post-processing techniques was determined by comparing predicted average travel speed and measured average travel speed. On average, the mean absolute errors for the post processors were relatively similar, ranging between 8 and 12 mph.
NTIS
Air Quality; Estimating

20040077339
Air Quality Analysis of MDT Transportation Improvements: Cost-Effectiveness Analysis of the MACI Program
Niemeier, D. A.; Shafizadeh, K.; Mar. 2004; In English
Report No.(s): PB2004-105651; FHWA/MT-04-002/8175; No Copyright; Avail: National Technical Information Service (NTIS)

The Montana Air Quality and Congestion Initiative (MACI) was established to take advantage of the flexibility in funding provided by TEA-21. Under TEA-21, part of Montana's CMAQ apportionment is dedicated to Missoula and the remainder of the CMAQ apportionment can be used to support any type of federal-aid project in nonattainment and maintenance areas. At the direction of the Montana Transportation Commission, the Montana Department of Transportation (MDT) uses the remainder of the CMAQ apportionment to provide funding to areas in non-attainment status that were previously ineligible for CMAQ funds and to proactively address air quality and automobile congestion problems through the Montana Air & Congestion Initiative (MACI) Program. The purpose of this project is to assess the costeffectiveness of projects funded to date through the MACI/CMAQ program.
NTIS
Air Quality; Cost Effectiveness

20040077341 Harvard School of Public Health, Boston, MA, USA
Technical Report on the Project 'Developing Exposure Controls by Material Balance Modeling'
Herrick, R. F.; Feb. 26, 2001; 54 pp.; In English
Report No.(s): PB2004-105572; No Copyright; Avail: CASI; A04, Hardcopy

Emission source characterization and detailed work task-exposure analysis were conducted at a gray iron foundry for the purpose of designing an exposure control system. The source characterization revealed that the emission of carbon monoxide from cooling molds is highly variable from mold to mold, and the quantity of CO emitted does not appear to be directly associated with the size of the casting. The unpredictable nature of the CO emissions made it infeasible to implement a model of ambient CO concentrations based upon the size and number of castings produced, however the detailed work task-exposure monitoring revealed the specific steps in the work process that made the greatest contribution to personal CO exposures. This information provided the basis for a set of recommendations on control options, and the foundry management has taken them under consideration.
NTIS
Carbon Monoxide; Exposure

20040077356 California Univ., Berkeley, CA
Air Pollutant Penetration through Airflow Leaks into Buildings
Liu, D. L.; 2002; In English
Report No.(s): DE2003-816065; No Copyright; Avail: National Technical Information Service (NTIS)

The penetration of ambient air pollutants into the indoor environment is of concern owing to several factors: (1) epidemiological studies have shown a strong association between ambient fine particulate pollution and elevated risk of human mortality; (2) people spend most of their time in indoor environments; and (3) most information about air pollutant concentration is only available from ambient routine monitoring networks. A good understanding of ambient air pollutant transport from source to receptor requires knowledge about pollutant penetration across building envelopes. Therefore, it is essential to gain insight into particle penetration in infiltrating air and the factors that affect it in order to assess human exposure more accurately, and to further prevent adverse human health effects from ambient particulate pollution. In this dissertation, the understanding of air pollutant infiltration across leaks in the building envelope was advanced by performing modeling predictions as well as experimental investigations. The modeling analyses quantified the extent of airborne particle and reactive gas (e.g., ozone) penetration through building cracks and wall cavities using engineering analysis that incorporates existing information on building leakage characteristics, knowledge of pollutant transport processes, as well as pollutant-surface interactions. Particle penetration is primarily governed by particle diameter and by the smallest dimension

of the building cracks. Particles of 0.1-1(micro)m are predicted to have the highest penetration efficiency, nearly unity for crack heights of 0.25 mm or higher, assuming a pressure differential of 4 Pa or greater and a flow path length of 3 cm or less. Supermicron and ultrafine particles (less than 0. 1(micro)m) are readily deposited on crack surfaces by means of gravitational settling and Brownian diffusion, respectively. The fraction of ozone penetration through building leaks could vary widely, depending significantly on its reactivity with the adjacent surfaces, in addition to the crack geometry and pressure difference. Infiltrating air can also travel through wall cavities, where the penetration of particles and ozone is predicted to vary substantially, depending mainly on whether air flow passes through fiberglass insulation. For ozone, its reactivity with the insulation materials is also an important factor. The overall pollutant penetration factor is governed by the flow-weighted average from all air leakage pathways. Large building leaks would strongly influence the overall penetration factor, because they permit much larger flow.
NTIS
Air Pollution; Air Flow; Health; Pollution Transport

20040077365, TDA Research, Inc., Wheat Ridge, CO, USA
Hybrid Sulfur Recovery Process for Natural Gas Upgrading. Quarterly Technical Report
Srinivas, G.; Gebhard, S. C.; DeBerry, D. W.; Aug. 2001; In English
Report No.(s): DE2003-816427; No Copyright; Avail: National Technical Information Service (NTIS)

This first quarter report of 2001 describes progress on a project funded by the U.S. Department of Energy (DOE) to test a hybrid sulfur recovery process for natural gas upgrading. The process concept represents a low cost option for direct treatment of natural gas streams to remove H(sub 2)S in quantities equivalent to 0.2-25 metric tons (LT) of sulfur per day. This process is projected to have lower capital and operating costs than the competing technologies, amine/aqueous iron liquid redox and amine/Claus/tail gas treating, and have a smaller plant footprint, making it well suited to both on-shore and offshore applications. CrystaSulf (service mark of Gas Research Institute) is a new nonaqueous sulfur recovery process that removes hydrogen sulfide (H(sub 2)S) from gas streams and converts it into elemental sulfur.
NTIS
Natural Gas; Hydrogen Sulfide; Oxidation-Reduction Reactions

20040077371 NASA Ames Research Center, Moffett Field, CA, USA
The Acid Catalyzed Nitration of Methanol: Formation of Methyl Nitrate via Aerosol Chemistry
Riffel, Brent G.; Michelsen, Rebecca R.; Iraci, Laura T.; 2004; 3 pp.; In English; American Geophysical Union Meeting 2004, 17-21 May 2004, Montreal, Canada
Contract(s)/Grant(s): RTOP 622-67-21-10; No Copyright; Avail: CASI; A01, Hardcopy

The liquid phase acid catalyzed reaction of methanol with nitric acid to yield methyl nitrate under atmospheric conditions has been investigated using gas phase infrared spectroscopy. This nitration reaction is expected to occur in acidic aerosol particles found in the upper troposphere/lower stratosphere as highly soluble methanol and nitric acid diffuse into these aerosols. Gaseous methyl nitrate is released upon formation, suggesting that some fraction of NO(x) may he liberated from nitric acid (methyl nitrate is later photolyzed to NO(x)) before it is removed from the atmosphere by wet deposition. Thus, this reaction may have important implications for the NO(x) budget. Reactions have been initiated in 45-62 wt% H2SO4 solutions at 10.0 C. Methyl nitrate production rates increased exponentially with acidity within the acidity regime studied. Preliminary calculations suggest that the nitronium ion (NO2(+) is the active nitrating agent under these conditions. The reaction order in methanol appears to depend on the water/methanol ratio and varies from first to zeroth order under conditions investigated. The nitration is first order in nitronium at all acidities investigated. A second order rate constant, kappa(sub 2), has been calculated to be 1 x 10(exp 8)/ M s when the reaction is first order in methanol. Calculations suggest the nitration is first order in methanol under tropospheric conditions. The infinitesimal percentage of nitric acid in the nitronium ion form in this acidity regime probably makes this reaction insignificant for the upper troposphere; however, this nitration may become significant in the mid stratosphere where colder temperatures increase nitric acid solubility and higher sulfuric acid content shifts nitric acid speciation toward the nitronium ion.
Author
Acidity; Catalysis; Nitration; Methyl Alcohol; Methyl Nitrate; Aerosols

20040079703 Oak Ridge National Lab., TN, USA
Tank Waste Transport Stability: Summaries of Hanford Slurry and Salt-Solution Studies for FY2000
Welch, T. D.; Jun. 2002; In English
Report No.(s): DE2003-814393; ORNL/TM-2000/302; No Copyright; Avail: National Technical Information Service (NTIS)

The RESRAD-BUILD computer code is a pathway analysis model designed to evaluate the potential radiological dose incurred by an individual who works or lives in a building contaminated with radioactive material. The transport of radioactive material within the building from one compartment to another is calculated with an indoor air quality model. The air quality model considers the transport of radioactive dust particulates and radon progeny due to air exchange, deposition and resuspension, and radioactive decay and in-growth. A single run of the RESRAD-BUILD code can model a building with up to three compartments, four source geometries (point, line, area, and volume), 10 distinct source locations, and 10 receptor locations. The volume source can be composed of up to five layers of different materials, with each layer being homogeneous and isotropic. A shielding material can be specified between each source-receptor pair for external gamma dose calculations. The user can select shielding material from eight different material types. Seven exposure pathways are considered in the RESRAD-BUILD code: (1) external exposure directly from the source, (2) external exposure to materials deposited on the floor, (3) external exposure due to air submersion, (4) inhalation of airborne radioactive particulates, (5) inhalation of aerosol indoor radon progeny and tritiated water vapor, (6) inadvertent ingestion of radioactive material directly from the source, and (7) ingestion of materials deposited on the surfaces of the building compartments. Various exposure scenarios may be modeled with the RESRAD-BUILD code. These include, but are not limited to, office worker, renovation worker, decontamination worker, building visitor, and residency scenarios. Both deterministic and probabilistic dose analyses can be performed with RESRAD-BUILD, and the results can be shown in both text and graphic reports.
NTIS
Aerosols; Air Quality; Decontamination; Dosage; Radioactive Decay; Waste Management

20040079737 Swedish Water and Air Pollution Research Lab., Stockholm, Sweden
Air Quality in Swedish Cities
Sjoberg, K.; Persson, K.; Brodin, Y.; 2004; In Swedish; In English
Report No.(s): PB2004-105954; IVL-B-1553; No Copyright; Avail: National Technical Information Service (NTIS)

Urban air pollution is considered to contribute to the death of more than a thousand people in Sweden each year. Measurements of air quality have been carried out in Sweden for many years. The measurements have shown that concentrations of all serious air pollutants but ozone have decreased strongly since the 1980s. The improvement is attributed to catalytic converters on automobiles, as well decreased emissions from industrial activity. The present report does however show no further downward trend for concentrations of air pollutants in Swedish cities since the late 1990s. Measurements were taken around forty municipalities in Sweden.
NTIS
Air Pollution; Air Quality

20040079743 Swedish Water and Air Pollution Research Lab., Stockholm, Sweden
Deposition and Run-off of Heavy Metal, Sulphur and Nitrogen at Holmsvattnet during the Period 1986-2002
Knulst, J. C.; Westling, O.; 2004; In Swedish; In English
Report No.(s): PB2004-105947; IVL-B-1528; No Copyright; Avail: National Technical Information Service (NTIS)

The study is based on monitoring of atmospheric deposition and run-off of sulphur, nitrogen and heavy metals 17 km SSW of a smelter at Ronnskar along the northeastern coast of Sweden. Measurements during the period 1986 to 2002 showed decreasing deposition of sulphur to open field and Norway spruce forest (throughfall). The deposition of heavy metals to open field and spruce forest decreased by 44-83% between 1986 and 2002. Overall annual precipitation increased during the 1990's and was greatest 2000/01. The following year, 2001/02 had a low annual precipitation. This even caused deposition of sulphur and nitrate to be somewhat lower the last year than between 1994 and 2001. Of the investigated metals, copper, zinc and lead concentrations were higher than general background levels for this area.
NTIS
Nitrogen; Metals; Deposition; Sulfur; Emission

20040079754 California Univ., Riverside, CA, USA, California Univ., San Diego, La Jolla, CA, USA
Refinement, Calibration, and Fields Studies Involving Transportable Aerosol Time-of-Flight Mass Spectrometers
Pastor, S. H.; Prather, K. A.; Aug. 2003; 394 pp.; In English
Report No.(s): PB2004-105585; No Copyright; Avail: CASI; A17, Hardcopy

Recently developed transportable aerosol time-of-flight mass spectrometry (ATOFMS) instruments and a lab-based ATOFMS instrument were used for the first long-term continuous monitoring study of the aerodynamic size and chemical composition of individual aerosol particles. This study was part of the 1997 Southern California Ozone Study-North American

Research Strategy for Tropospheric Ozone (SCOS97-NARSTO) Aerosol Program. The spatial and temporal variability of aerosol particles were studied, examining the effects of transport from regions with 'fresh' emissions (i.e. Los Angeles, CA) to areas of increasing pollution levels (i.e. Riverside, CA). A variety of strategies were developed to provide a picture of the particle sources and atmospheric processes occurring for particles in different regions. Procedures were developed to scale the ATOFMS data into atmospherically representative total, nitrate, and ammonium mass concentrations. Once calibrated, the ATOFMS data were plotted over time to study how particles vary over time in Southern California. The instruments developed as part of this project will continue to be used in studies throughout California to provide a more complete understanding of the sources of particles as well as their spatial and temporal variability due to atmospheric transformations.
NTIS
Mass Spectrometers; Aerosols; Troposphere

20040081062 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Stratospheric Ozone: Transport, Photochemical Production and Loss
Douglass, A. R.; Kawa, S. R.; Jackman, C. H.; 2003; 1 pp.; In English; Workshop on Process-Oriented Validation, 17-19 Nov. 2003, Garmish-Partenkirchen, Germany; No Copyright; Avail: Other Sources; Abstract Only

Observations from various satellite instruments (e.g., Total Ozone Mapping Spectrometer (TOMS), Halogen Occultation Experiment (HALOE), Microwave Limb Sounder (MLS)) specify the latitude and seasonal variations of total ozone and ozone as a function of altitude. These seasonal variations change with latitude and altitude partly due to seasonal variation in transport and temperature, partly due to differences in the balance between photochemical production and loss processes, and partly due to differences in the relative importance of the various ozone loss processes. Comparisons of modeled seasonal ozone behavior with observations test the following: the seasonal dependence of dynamical processes where these dominate the ozone tendency; the seasonal dependence of photochemical processes in the upper stratosphere; and the seasonal change in the balance between photochemical and dynamical processes.
Author
Ozone; Stratosphere; Total Ozone Mapping Spectrometer; Atmospheric Chemistry; Annual Variations

20040081169 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Possible NASA Contributions to HEAT
Shepherd, J. M.; [2004]; 1 pp.; In English; HEAT Workshop, 15-16 Mar. 2004, Boulder, CO, USA; No Copyright; Avail: Other Sources; Abstract Only

A four-year experiment (HEAT) has been proposed (one summer in the field, 2005) to determine the sources and causes for the enhanced cloud-to-ground lightning over Houston, Texas, in association with simultaneous experiments by the Environmental Protection Agency (EPA) and the Texas Natural Resource Conservation Commission (TNRCC). Houston is the third most populous city in the USA and the region contains 50% of the petroleum refining capacity of the USA. Recent studies covering the period 1989-2000 document a 50% increase of cloud-to-ground lightning in the Houston area as compared to background values, which is second in flash density only to the Tampa Bay, Florida area. It is suggested that the elevated flash densities could result from several factors, including, 1) the convergence due to the urban heat island effect and complex sea breeze, and 2) the increasing levels of air pollution from anthropogenic sources producing numerous small droplets and thereby suppressing mean droplet size. The latter effect would enable more cloud water to reach the mixed phase region where it is involved in the formation of precipitation and the separation of electric charge, leading to an enhancement of lightning. The primary goals of HEAT are to examine the effects of (1) pollution, (2) the urban heat island, and (3) the complex coastline, on storms and lightning characteristics in the Houston area. The project is a multi- agency effort and will employ numerous observing capabilities and expertise. Dr. Shepherd has been asked to serve as a possible co- investigator to contribute expertise in areas related to urban impacts on precipitation variability. Dr. Shepherd is also a key NASA representative in the interagency effort. This presentation will provide an overview of recent NASA research focused on urban rainfall in Houston and offer potential NASA capabilities that could contribute to HEAT.
Author
Air Pollution; Houston (Tx); Heat Islands; Lightning; NASA Programs

20040081286 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Dust, Climate, and Human Health
Maynard, Nancy G.; [2003]; 1 pp.; In English; AGU Fall Meeting, 8-12 Dec. 2003, San Francisco, CA, USA; No Copyright; Avail: Other Sources; Abstract Only

Air pollution from both natural and anthropogenic causes is considered to be one of the most serious world-wide environment-related health problems, and is expected to become worse with changes in the global climate. Dust storms from the atmospheric transport of desert soil dust that has been lifted and carried by the winds - often over significant distances - have become an increasingly important emerging air quality issue for many populations. Recent studies have shown that the dust storms can cause significant health impacts from the dust itself as well as the accompanying pollutants, pesticides, metals, salt, plant debris, and other inorganic and organic materials, including viable microorganisms (bacteria, viruses and fungi). For example, thousands of tons of Asian desert sediments, some containing pesticides and herbicides from farming regions, are commonly transported into the Arctic during dust storm events. These chemicals have been identified in animal and human tissues among Arctic indigenous populations. Millions of tons of airborne desert dust are being tracked by satellite imagery, which clearly shows the magnitude as well as the temporal and spatial variability of dust storms across the "dust belt" regions of North Africa, the Middle East, and China. This paper summarizes the most recent findings on the effects of airborne desert dust on human health as well as potential climate influences on dust and health.
Author
Dust Storms; Climate; Health; Air Pollution

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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*.

20040077201 NASA Goddard Space Flight Center, Greenbelt, MD, USA
The Forced Annual Wobble in Earth's Polar Motion
Chao, Benjamin F.; [2004]; 1 pp.; In English; Forcing of Polar Motion in the Chandler Frequency Band, 20-23 Apr. 2004, Luxembourg, Netherlands; No Copyright; Avail: Other Sources; Abstract Only

The annual wobble in Earth's polar motion is a forced motion, as opposed to an excited natural oscillation which is the Chandler wobble in the case of polar motion. It is forced by the combination of many angular momentum variations in the geophysical fluids that exchange these variations with the solid Earth, hence changing its rotation. Among all forcing sources of the annual wobble the geophysical fluid that has the dominant contribution is the atmosphere, while the oceans and the land hydrology make up the remaining budget together with tidal influences. The latter include that from the solid Earth deformation and that from the ocean tides at the annual period. The combined forcing produces both prograde and retrograde wobbles; the prograde wobble gets magnified substantially by the near-by presence of the natural Chandler wobble resonance. On the other hand, the closeness of the prograde annual forcing power to the Chandler period is an indication that some of the power leakage into the Chandler period band becomes the main excitation source for the Chandler wobble. In this paper we will review our knowledge about annual wobble and show the status in the effort of closing the budget with the annual angular momentum variations from the various geophysical fluids.
Author
Polar Wandering (Geology); Earth Surface; Annual Variations; Hydrology

20040078815 Texas Univ. at Dallas, Richardson, TX
Sensor Development Thermospheric Neutral Wind Measurements
Heelis, R. A.; Nov. 15, 2003; 11 pp.; In English
Contract(s)/Grant(s): F19628-00-C-0028; Proj-2310
Report No.(s): AD-A423268; UTD-STR-A002-01-630117; AFRL-VS-HA-TR-2004-1028; No Copyright; Avail: CASI; A03, Hardcopy

This report summarizes activities related to the development of a sensor to measure the in-situ neutral wind from a satellite in low-earth orbit. This development work sponsored by the Air Force allowed a credible proposal for flight instrumentation to be submitted to NASA. That proposal was subsequently funded and paved the way for a collaborative investigation of ion- neutral coupling of scientific and technical value to both NASA and the Air Force. The project started a conceptual design for neutral wind sensors, the development of computer models of the instrument performance, evaluation of the instrument optics, design and construction of laboratory prototypes and final construction of flight hardware. We briefly review the activities here making reference to previously released reports that provide more detail.
DTIC
Neutral Atmospheres; Thermosphere; Wind Measurement; Wind Velocity; Winds Aloft

20040078857 Air Force Research Lab., Hanscom AFB, MA
Simultaneous Balloon Launches to Investigate Wake Effects on Thermosonde Results
Jun. 26, 2003; 10 pp.; In English
Contract(s)/Grant(s): Proj-1010
Report No.(s): AD-A423354; AIAA-2003-3605; AFRL-VS-HA-TR-2004-1102; No Copyright; Avail: CASI; A02, Hardcopy

The thermosonde is a balloon borne instrument used by the Air Force and other organizations to measure optical turbulence in the atmosphere. A continuing uncertainty has been the effect of the balloon wake on the output of the instrument. Previous attempts to compare the results from a descending instrument to those of a nominal thermosonde have proven difficult and inconclusive. Over the years, the length of the line connecting the thermosonde to the balloon was lengthened until it did not seem to change the results. Since those results were never documented, a study was performed to determine the effect of different line lengths. Simultaneous launches were made with different length lines, and the impact on the thermosonde output was determined. while this experiment provided additional information about the effect of balloon wake, definitive quantification of the wake effects was not possible.
DTIC
Optical Properties; Turbulence; Wakes

20040078859 Air Force Research Lab., Hanscom AFB, MA
Reactions of O(+) With C(n)H(2n+2), n=2-4: A Guided-Ion Beam Study
Levandier, D. J.; Chiu, Y.; Dressler, R. A.; Apr. 15, 2004; 10 pp.; In English
Contract(s)/Grant(s): Proj-2303
Report No.(s): AD-A423356; AFRL-VS-HA-TR-2004-1097; No Copyright; Avail: CASI; A02, Hardcopy

We have measured absolute reaction cross sections for the interaction of 0+ with ethane, propane, and n-butane at collision energies in the range from near thermal to approximately 20 eV, using the guided-ion beam (GIB) technique. We have also measured product recoil velocity distributions using the GIB time-of-flight (TOF) technique for several product ions at a series of collision energies. The total cross sections for each alkane are in excess of 100 Angstrom(exp 2) at energies below ^2 eV, and in each case several ionic products arise. The large cross sections suggest reactions that are dominated by large impact parameter collisions, as is consistent with a scenario in which the many products derive from a near-resonant, dissociative charge- transfer process that leads to several fragmentation pathways. The recoil velocities, which indicate product ions with largely thermal velocity distributions, support this picture. Several product ions, most notably the C2H3+ fragment for each of the alkanes; exhibit enhanced reaction efficiency as collision energy increases, which can be largely attributed to endothermic channels within the dissociative charge-transfer mechanism.
DTIC
Atmospheric Models; Charge Transfer; Earth Ionosphere; Ion Beams

20040078860 Air Force Research Lab., Hanscom AFB, MA
The 27-Day Variations of Plasma Densities and Temperatures in the Topside Ionosphere
Rich, F. J.; Sultan, P. J.; Burke, W. J.; Jul. 23, 2003; 9 pp.; In English
Contract(s)/Grant(s): Proj-2311
Report No.(s): AD-A423357; AFRL-VS-HA-TR-2004-1046; No Copyright; Avail: CASI; A02, Hardcopy

Defense Meteorological Satellite Program (DMSP) spacecraft at 840 km observe a 27- day variation in plasma density and temperature at all subauroral latitudes. At the peak of the solar cycle, evening-sector variations are ^40-50% in plasma density and ^5-10% in electron temperature. The percent of variation decreases with decreasing solar activity to or below the threshold of detectability for the DMSP sensors. We compare in situ densities with simultaneous observations of total electron content but find that similar variations are not present in a consistent manner. Thus we conclude that the variations exist mostly as topside phenomena. However; comparisons with variations in the radio flux at 10. 7 cm (F(sub 10.7)), a standard proxy for solar EUV, indicate that the topside variations are driven by the solar EUV flux. When compared with the variations of several alterative proxies for the solar EUV flux, we find that only one of them correlates better than F(sub 10.7) . Because the topside ionosphere couples with the plasmasphere, we suggest that similar 27-day variations should appear in plasmaspheric parameters.
DTIC
Atmospheric Models; Earth Ionosphere; Meteorological Satellites; Plasma Density; Plasmasphere

20040078951 Idaho Univ., Moscow, ID
Rockburst Model Validation
Sprenke, Kenneth F.; Rohay, Allan C.; Stickney, Michael C.; Mar. 2004; 63 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DSWA01-97-C-0124
Report No.(s): AD-A423547; DTRA-TR-00-15; DTRA/FB-TR-00-15; No Copyright; Avail: CASI; A04, Hardcopy

Characterization of mining-related seismic events is critical to the implementation of the Comprehensive Nuclear Test-Ban Treaty monitoring system. Mine seismicity from uncontrolled sources are particularly troublesome, with magnitudes up to 4 or 5, producing signal strengths comparable to 1-10 kiloton contained nuclear explosions. The Coeur d'Alene district in northern Idaho is the most rockburst-prone mining district in the USA, producing a daily average of about 3 events with magnitudes ranging from 0 to 4. The hypocenter of many of these events are determined to an accuracy of within 30 meters by in-mine rockburst monitoring systems operated by the mining companies. Focal mechanism studies based on these systems, and a district-wide surface seismic network, indicate predominantly dilatational first motions events. We deployed a local seismograph system in the summer of 1998 to determine the source parameters and moment tensors for seismic events in the region in particular to confirm the shear implosional mechanisms suggested by the first motion studies. In this study, ground motions from four surface stations and one underground station were inverted to determine the complete moment tensor of a relatively large rockburst in the Coeur d'Alene Mining District in northern Idaho. Many rockbursts induced by the mining process show shear implosional source mechanisms a feature that should be useful to discriminate mining-related events from underground explosions.
DTIC
Underground Explosions

20040079717 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Magnectic Probing of Core Geodynamics
Voorhies, Coerte; [2004]; 1 pp.; In English; 2004 Joint AGU/CGU/SEG/EEGS Assembly, 17-21 May 2004, Montreal, Canada; No Copyright; Avail: Other Sources; Abstract Only

To better understand geomagnetic theory and observation, we can use spatial magnetic spectra for the main field and secular variation to test core dynamical hypotheses against seismology. The hypotheses lead to theoretical spectra which are fitted to observational spectra. Each fit yields an estimate of the radius of Earth s core and uncertainty. If this agrees with the seismologic value, then the hypotheses pass the test. A new way to obtain theoretical spectra extends the hydromagnetic scale analysis of Benton to scale-variant field and flow. For narrow scale flow and a dynamically weak field by the top of Earth s core, this yields a JGR-PI, and a secular variation spectrum modulated by a cubic polynomial in spherical harmonic degree n. The former passes the tests. The latter passes many tests, but does not describe rapid dipole decline and quadrupole rebound; some tests suggest it is a bit hard, or rich in narrow scale change.In a core geodynamo, motion of the fluid conductor does work against the Lorentz force. This converts kinetic into magnetic energy which, in turn, is lost to heat via Ohmic dissipation. In the analysis at length- scale l/k, if one presumes kinetic energy is converted in either eddy- overturning or magnetic free-decay time-scales, then Kolmogorov or other spectra in conflict with observational spectra can result. Instead, the rate work is done roughly balances the dissipation rate, which is consistent with small scale flow. The conversion time-scale depends on dynamical constraints. These are summarized by the magneto- geostrophic vertical vorticity balance by the top of the core, which includes anisotropic effects of rotation, the magnetic field, and the core-mantle boundary. The resulting theoretical spectra for the core- source field and its SV are far more compatible with observation. The conversion time-scale of order 120 years is pseudo-scale-invariant. Magnetic spectra of other planets may differ; however, if a transition to non-conducting fluid hydrogen in Jupiter acts as barrier to vertical flow, as well as current, then the shape of the jovi-magnetic spectrum could be remarkably Earth-like.
Author
Geomagnetism; Earth Core

20040081044 NASA Goddard Space Flight Center, Greenbelt, MD, USA
A Review of the Match Technique as Applied to AASE-2/EASOE and SOLVE/THESEO 2000
Morris, Gary A.; Bojkov, Bojan R.; Lait, Leslie R.; Schoeberl, Mark R.; Rex, Markus; [2004]; 60 pp.; In English; No Copyright; Avail: CASI; A04, Hardcopy

We apply the GSFC trajectory model with a series of ozonesondes to derive ozone loss rates in the lower stratosphere for the AASE-2/EASOE mission (January - March 1992) and for the SOLVE/THESEO 2000 mission (January - March 2000) in an approach similar to Match. Ozone loss rates are computed by comparing the ozone concentrations provided by ozonesondes

launched at the beginning and end of the trajectories connecting the launches. We investigate the sensitivity of the Match results on the various parameters used to reject potential matches in the original Match technique and conclude that only a filter based on potential vorticity changes along the calculated back trajectory seems necessary. Our study also demonstrates that calculated ozone loss rates can vary by up to a factor of two depending upon the precise trajectory paths calculated for each trajectory. As a result an additional systematic error might need to be added to the statistical uncertainties published with previous Match results. The sensitivity to the trajectory path is particularly pronounced in the month of January, the month during which the largest ozone loss rate discrepancies between photochemical models and Match are found. For most of the two study periods, our ozone loss rates agree with those previously published. Notable exceptions are found for January 1992 at 475 K and late February/early March 2000 at 450 K, both periods during which we find less loss than the previous studies. Integrated ozone loss rates in both years compare well with those found in numerous other studies and in a potential vorticity/potential temperature approach shown previously and in this paper. Finally, we suggest an alternate approach to Match using trajectory mapping that appears to more accurately reflect the true uncertainties associated with Match and reduces the dependence upon filters that may bias the results of Match through the rejection of greater than or equal to 80% of the matched sonde pairs and >99% of matched observations.
Author
Atmospheric Chemistry; Stratosphere; Ozone Depletion

20040081267 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Neutral Middle Atmospheric Influences by the Extremely Large October 2003 Solar Proton Event
Jackman, C. H.; Fleming, E. L.; 2004; 1 pp.; In English; 2004 Joint Assembly - CGU/AGU/SEG/EEGS, 17-21 May 2004, Montreal, Canada; No Copyright; Avail: Other Sources; Abstract Only

The huge coronal mass ejection (CME) on October 28,2003 caused an extremely large solar proton event (SPE) at the Earth, which impacted the middle atmospheric polar cap regions. The highly energetic protons produce ionizations, excitations, dissociations, and dissociative ionizations of the background constituents, which lead to the production of HOx (H, OH, HO2) and NOy (N, NO, NO2, NO3, N2O5, HNO3, HO2NO2, ClONO2, BrONO2). The total production of middle atmospheric NOy molecules by individual SPEs can be used to compare their sizes. Using this scale, the extremely large October 2003 SPE was the fourth largest in the past 40 years and the second largest of solar cycle 23. Only the October 1989, August 1972, and July 2000 SPEs were larger. The Goddard Space Flight Center (GSFC) Two-dimensional (2D) Model was used in computing the influence of this gigantic SPE. The NOy amount was increased by over two orders of magnitude in the mesosphere in both the GSFC 2D Model computations and Upper Atmosphere Research Satellite (UARS) Halogen Occultation Experiment (HALOE) measurements as a result of this noteworthy SPE. The model also calculated polar middle mesospheric ozone decreases of over 70% during the SPE. Other atmospheric impacts from both model predictions and measurements as a result of this major SPE will be discussed in this paper.
Author
Neutral Atmospheres; Mesosphere; Solar Protons; Coronal Mass Ejection

20040081281 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Bangui Anomaly
Taylor, Patrick T.; January 2004; 9 pp.; In English; No Copyright; Avail: CASI; A02, Hardcopy

Bangui anomaly is the name given to one of the Earth s largest crustal magnetic anomalies and the largest over the African continent. It covers two-thirds of the Central African Republic and therefore the name derives from the capitol city-Bangui that is also near the center of this feature. From surface magnetic survey data Godivier and Le Donche (1962) were the first to describe this anomaly. Subsequently high-altitude world magnetic surveying by the U.S. Naval Oceanographic Office (Project Magnet) recorded a greater than 1000 nT dipolar, peak-to-trough anomaly with the major portion being negative (figure 1). Satellite observations (Cosmos 49) were first reported in 1964, these revealed a 40nT anomaly at 350 km altitude. Subsequently the higher altitude (417-499km) POGO (Polar Orbiting Geomagnetic Observatory) satellite data recorded peak-to-trough anomalies of 20 nT these data were added to Cosmos 49 measurements by Regan et al. (1975) for a regional satellite altitude map. In October 1979, with the launch of Magsat, a satellite designed to measure crustal magnetic anomalies, a more uniform satellite altitude magnetic map was obtained. These data, computed at 375 km altitude recorded a -22 nT anomaly (figure 2). This elliptically shaped anomaly is approximately 760 by 1000 km and is centered at 6%, 18%. The Bangui anomaly is composed of three segments; there are two positive anomalies lobes north and south of a large central negative field. This displays the classic pattern of a magnetic anomalous body being magnetized by induction in a zero inclination field.

This is not surprising since the magnetic equator passes near the center of this body.
Author
Geomagnetism; Magnetic Anomalies; Magnetic Surveys

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METEOROLOGY AND CLIMATOLOGY

Includes weather observation forecasting and modification.

20040077260 Massachusetts Inst. of Tech., Cambridge, MA, USA
Research on the Natural Variability of Climate
[2004]; 2 pp.; In English
Contract(s)/Grant(s): NCC5-678; No Copyright; Avail: CASI; A01, Hardcopy

The scheme for ocean vertical mixing presented in Canuto, Howard, Cheng & Dubovikov and Canuto, Howard, Hogan, Cheng, Dubovikov & Montenegro [GISS mixing scheme] was extended to include the latitudinal dependence reported by Gregg, Sanford & Winkel of the input to the interior ocean turbulence field of energy from internal waves. The resulting latitude dependence was implemented in our module of code for the GISS vertical mixing scheme and tested in the global NCAR-CSM ocean model with 3 degree X 3 degree resolution and 25 levels in the vertical. With the latitude dependence, the background diffusivity decreases from approx. 0.1 sq cm/sec at midlatitudes to approx. less than 0.01 sq cm/sec at the equator. A significant improvement was seen in the tropical ocean, with tropical thermoclines being sharpened in agreement with the requirements of observational studies and the needs of ENS0 modeling. At the same time global measures nf performance such as the meridional overturning and northward heat transport were not adversely affected. Results were presented at the 2004 Layered Ocean Modeling meeting and a paper has been prepared and submitted to Geophysical Research Letters.
Derived from text
Climate; Heat Transfer; Ocean Models; Temperate Regions

20040077266 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Interannual Variations In the Low-Degree Components of the Geopotential derived from SLR and the Connections With Geophysical/Climatic Processes
Chao, Benjamin F.; Cox, Christopher M.; Au, Andrew Y.; 2004; 1 pp.; In English; EGU Meeting, 25-30 Apr. 2004, Nice, France; No Copyright; Avail: Other Sources; Abstract Only

Recent Satellite Laser Ranging derived long wavelength gravity time series analysis has focused to a large extent on the effects of the recent large changes in the Earth s 52, and the potential causes. However, it is difficult to determine whether there are corresponding signals in the shorter wavelength zonals from the existing SLR-derived time variable gravity results, although it appears that geophysical fluid transport is being observed. For example, the recovered J3 time series shows remarkable agreement with NCEP-derived estimates of atmospheric gravity variations. Likewise, some of the non-zonal spherical harmonic coefficient series have significant interannual signal that appears to be related to mass transport. The non-zonal degree 2 terms show reasonable correlation with atmospheric signals, as well as climatic effects such as El Nino Southern Oscillation. While the formal uncertainty of these terms is significantly higher than that for J2, it is also clear that there is useful signal to be extracted. Consequently, the SLR time series is being reprocessed to improve the time variable gravity field recovery. We will present recent updates on the J2 evolution, as well as a look at other components of the interannual variations of the gravity field, complete through degree 4, and possible geophysical and climatic causes.
Author
Time Series Analysis; Annual Variations; Satellite Laser Ranging; Climatology; Geopotential

20040077272 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Spatial Distribution of Large Cloud Drops
Marshak, A.; Knyazikhin, Y.; Larsen, M.; Wiscombe, W.; 2004; 17 pp.; In English
Contract(s)/Grant(s): DE-AI02-95ER-61061; No Copyright; Avail: CASI; A03, Hardcopy

By analyzing aircraft measurements of individual drop sizes in clouds, we have shown in a companion paper (Knyazikhin et al., 2004) that the probability of finding a drop of radius r at a linear scale l decreases as l(sup D(r)) where 0 less than or equal to D(r) less than or equal to 1. This paper shows striking examples of the spatial distribution of large cloud drops using models that simulate the observed power laws. In contrast to currently used models that assume homogeneity and therefore

a Poisson distribution of cloud drops, these models show strong drop clustering, the more so the larger the drops. The degree of clustering is determined by the observed exponents D(r). The strong clustering of large drops arises naturally from the observed power-law statistics. This clustering has vital consequences for rain physics explaining how rain can form so fast. It also helps explain why remotely sensed cloud drop size is generally biased and why clouds absorb more sunlight than conventional radiative transfer models predict.
Author
Drop Size; Remote Sensing; Spatial Distribution; Clouds (Meteorology); Mathematical Models

20040078798 Civil Aeromedical Inst., Oklahoma City, OK
The Effects of NEXRAD Graphical Data Resolution and Direct Weather Viewing on Pilots' Judgments of Weather Severity and Their Willingness to Continue a Flight
Beringer, Dennis B.; Ball, Jerry D.; Mar. 2004; 14 pp.; In English; Original contains color illustrations
Report No.(s): AD-A423239; DOT/FAA/AM-04/5; No Copyright; Avail: CASI; A03, Hardcopy

A study was conducted to determine how variations in displayed NEXRAD weather data resolution interact with the pilot's direct view of weather. Pilots (32) were assigned to on of four groups; 8km, 4km, or 2km resolution, and a baseline condition without NEXRAD imagery. Each flew the simulator from Santa Rosa, NM with the intent to land at Albuquerque. Heavy precipitation moved into the area during the flight, and pilots were required to decide, using both the NEXRAD data and their out-the-window view, whether to continue or to divert to an alternate airport. Pilots spent more time looking at higher- resolution images than at the lower-resolution ones. Baseline- and 2km-condition pilots deferred their decisions longer than did the other two groups.
DTIC
Graphs (Charts); Judgments; Meteorological Radar; Viewing; Weather

20040078829 Naval Research Lab., Bay Saint Louis, MS
Temporal and Spatial Variability of Satellite Sea Surface Temperature and Ocean Colour in the Japan/East Sea
Gould, Richard W., Jr.; Arnone, Robert A.; Apr. 20, 2004; 7 pp.; In English
Report No.(s): AD-A423291; NRL/JA/7330/01/0084; No Copyright; Avail: CASI; A02, Hardcopy

Temporal and spatial variability of Sea Surface Temperature (SST) and ocean color in the Japan/East Sea (JES) are examined during winter and spring using satellite data from Advanced Very High Resolution Radiometer (AVHRR) and Sea-viewing Wide Field of view Sensor (SeaWiFS).The timing of the spring phytoplankton bloom and the locations of the chlorophyll fronts are related to changes in the thermal fields and the locations of the temperature fronts. Daily images of SST and chlorophyll/ concentration show both differences and similarities of bio-optical and thermal front location, depending on region and season. our sub-regions in the JES were defined and SST and chlorophyll values were extracted from weekly and monthly composite images to derive summary statistics. SST at the Sub solar Front increased about 70 degrees C over a 1.5-month period from late April to early June in 1999. During this same period, elevated chlorophyll values near the Korean coast and in the southern basin decreased sharply as the phytoplankton bloom that first developed in the southern basin progressed to the front and northward. The SST/chlorophyll relationship is complex and seasonal. Near the Subpolar Front, SST and chlorophyll were positively related in April. In May, highest chlorophyll values corresponded to mixing regime by June. SST and chlorophyll near the front were inversely related.
DTIC
Artificial Satellites; Color; Japan; Satellite Temperature; Sea Surface Temperature; Seas; Surface Temperature; Variability

20040078881 Naval Research Lab., Bay Saint Louis, MS
Storm-Driven Mixing and Potential Impact on the Arctic Ocean
Yang, Jiayan; Comiso, Josefino; Walsh, David; Krishfield, Richard; Honjo, Susumu; Apr. 9, 2004; 19 pp.; In English
Report No.(s): AD-A423407; NRL/JA/7330/03/0032; No Copyright; Avail: CASI; A03, Hardcopy

Observations of the ocean, atmosphere, and ice made by Ice-Ocean Environmental Buoys indicate that mixing events reaching the depth of the halocline have occurred in various regions in the Arctic Ocean. This analysis suggests that these mixing events were mechanically forced by intense storms moving across the buoy sites. In this study, the authors analyzed these mixing events in the context of storm developments that occurred in the Beaufort Sea and in the general area just north of Fram Strait, two areas with quite different hydrographic structures. The Beaufort Sea is strongly influenced by inflow of Pacific water through the Bering Strait, while the area north of Fram Strait is directly affected by the inflow of warm and salty North Atlantic water. These analyses of the basin-wide evolution of the surface pressure and geostrophic wind fields indicate

that the characteristics of the storms could be very different. The buoy-observed mixing occurred only in the spring and winter seasons when the stratification was relatively weak. This indicates the importance of stratification, although the mixing itself was mechanically driven. The authors also analyze the distribution of storms, both the long-term climatology and the patterns for each year in the past 2 decades. The frequency of storms is also shown to be correlated (but not strongly) to Arctic Oscillation indices. This study indicates that the formation of new ice that leads to brine rejection is unlikely the mechanism that results in the type of mixing that could overturn the halocline. On the other hand, synoptic-scale storms can force mixing deep enough to the halocline and thermocline layers. Despite a very stable stratification associated with the Arctic halocline, the warm subsurface thermocline water is not always insulated from the mixed layer. (23 figures, 28 refs.)
DTIC
Arctic Ocean; Hydrography; Ice; Marine Meteorology; Storms; Thermodynamics

20040078927 Woods Hole Oceanographic Inst., MA
Stratus Ocean Reference Station (20 degree S, 85 degree W), Mooring Recovery and Deployment Cruise. R/V Revelle Cruise Dana 03, November 10 -November 26, 2003
Hutto, Lara; Weller, Robert; Lord, Jeff; Smith, Jason; Ryder, Jim; Mar. 2004; 139 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): NA17RJ1223
Report No.(s): AD-A423496; WHOI-2004-04; UOP-2004-01; No Copyright; Avail: CASI; A07, Hardcopy

The Ocean Reference Station at 20 degrees S, 85 degrees W under the stratus clouds west of northern Chile and Peru is being maintained to provide ongoing, climate-quality records of surface meteorology, of air-sea fluxes of heat, freshwater, and momentum, and of upper ocean temperature, salinity, and velocity variability. The Stratus Ocean Reference Station, hereafter ORS Stratus, is supported by the National Oceanic and Atmospheric Administrations (NOAA) Climate Observation Program. It is recovered and redeployed annually, with cruises that have come in October or November. During the November 2003 cruise of Scripps Institution of Oceanography's R/V Roger Revelle to the ORS Stratus site, the primary activities where the recovery of the WHOI surface mooring that had been deployed in October 2002, the deployment of a new WHOI surface mooring at that site, the in-situ calibration of the buoy meteorological sensors by comparison with instrumentation put on board by Chris Fairall of the NOAA Environmental Technology Laboratory (ETL), and observations of the stratus clouds and lower atmosphere by NOAA ETL and Jason Tomlinson from Texas A&M. The ORS Stratus buoys are equipped with two Improved Meteorological systems, which provide surface wind speed and direction, air temperature, relative humidity, barometric pressure, incoming shortwave radiation, incoming longwave radiation, precipitation rate, and sea surface temperature. The IMET data are made available in near real time using satellite telemetry. The mooring line carries instruments to measure ocean salinity, temperature, and currents. On some deployments, additional instrumentation is attached to the mooring to measure rainfall and bio-optical variability. The ETL instrumentation used during the 2003 cruise included a cloud radar, radiosonde balloons, and sensors for mean and turbulent surface meteorology.
DTIC
Deployment; Meteorological Instruments; Meteorological Parameters; Mooring; Oceans

20040078953 Army Engineer Research and Development Center, Vicksburg, MS
The Momentum Flux Balance at the Sea Surface
Resio, Donald; Long, Charles; Jan. 2002; 12 pp.; In English
Report No.(s): AD-A423553; No Copyright; Avail: CASI; A03, Hardcopy

Today, second- and third-generation wave models are used for many applications around the world. From the design of coastal structures to proper regional sediment management and from estimates of mixing in the upper ocean to the efficient routing of ships across oceans, the accuracy of these models has critical importance. However, following the development of the WAM model in the mid- to late 1980s, there has been little effort focused directly on wave model development. Instead, most research in this area has involved re-calibrating various source terms to obtain better fits to observations (satellite and in situ). Two likely reasons for the lack of focus in this area are (1) the general acceptance outside of the wave community that the WAM model physics provided a good "detailed balance" description of the wave generation process, and (2) wave researchers cannot agree on necessary modifications to the WAM physics. The purpose of this paper is to revisit the general framework of the physics of wave generation and attempt to formulate a concept for wave generation that seems to fit some important constraints implicit in observations over a wide range of generation scales (time and space). Toward this end, data from three very different sites will be used: (1) Lake George - a small, shallow site located in Southeast Australia; (2) FRF Gage #630 - a coastal site located in the Atlantic Ocean in a depth of about 18 meters of water approximately 5 km off the coast of Duck, North Carolina; and (3) NDBC Buoy 46035 - an open ocean site located in deep water in the Bering

Sea. These sites cover a wide range of practical wave generation scales, from shallow to deep and from very small fetch to extremely large fetch. (7 figures, 8 refs.)
DTIC
Deep Water; Hydrodynamics; Lakes; Momentum; Ocean Surface; Shallow Water; Water Waves; Wind Velocity

20040079381 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Improving Total Column Ozone Retrievals by Using Cloud Pressures Derived from Raman Scattering in the UV
Vasilkov, A.; Joiner, J.; Yang, K.; Bhartia, P. K.; 2004; 5 pp.; In English
Contract(s)/Grant(s): NAS5-00220; No Copyright; Avail: CASI; A01, Hardcopy

The higher spectral resolution, coverage, and sampling of the Aura satellite ozone monitoring instrument (OMI), as compared with the total ozone mapping spectrometer (TOMS) should allow for improved ozone retrievals, including estimates of tropospheric ozone. By default, the TOMS-like OMI total column ozone algorithm uses climatological cloud-top pressures based on infrared (IR) measurements to estimate the column ozone below the clouds. Alternatively, cloud pressure can be retrieved using atmospheric rotational Raman scattering with OMI. The retrieved cloud pressures should be more consistent with assumptions made in the total ozone algorithm. Here, we use data from the global ozone monitoring experiment (GOME) to estimate total ozone using both the IR-climatological and retrieved cloud pressures. The exceed approximately 15 DU. Use of the UV cloud pressure retrievals leads to a smoother distribution of ozone along a satellite track by reducing small spatial irregularities presumably caused by errors in the climatological cloud pressures.
Author
Climatology; Raman Spectra; Ultraviolet Spectra; Total Ozone Mapping Spectrometer; Clouds (Meteorology); Algorithms

20040079397 Meteorological Satellite Center, Kiyose, Japan
Intercalibration of the infrared Channels between GMS-5 and GOES-9
Tahara, Yoshihiko; Ohkawara, Nozomu; Okuyama, Arata; Meteorological Satellite Center Technical Note; March 2004; ISSN 0388-9653, No. 44, pp. 1-17; In English; See also 20040079396; Original contains black and white illustrations; Copyright; Avail: Other Sources

This study investigates intercalibration between the GOES-9 Imager and GMS-5 VISSR infrared channels. Observed and simulated brightness temperatures from GOES-9 and GMS-5 are used for this purpose. The observed brightness temperatures are obtained from images observed just before the switchover from GMS-5 to GOES-9; the simulated brightness temperatures are computed by MODTRAN 3.7. In the comparison of the horizontal images, a difference between GOES-9 and GMS-5 is recognized, as expected from their spectral response functions and each radiative path. Further, as the result of the statistical comparison of observed brightness temperatures with the same radiative path length from the satellites within the cloud-free ocean area, discrepancies inconsistent with simulations are detected. The averages of the discrepancies between GOES-9 and GMS-5 with respect to residuals of the observed from simulated brightness temperatures are 0.7 K for the infrared window channel 1 (IRl), 0.28 K for the infrared window channel 2 (IR2) and 2.4 K for the water vapor channel (WV). Potential sources of the differences are inaccurate calibration, the unveiled degradation of the sensors and the satellites, systematic error in the simulated brightness temperatures, etc. In order to identify the source, further research is necessary. Despite the fact that the sources are unconfirmed, the result of this study may be of help to revise the algorithms of GOES-9 applications. For instance, a linear relationship is found between GOES-9 and GMS-5 with respect to difference between the I R l and IR2 brightness temperatures.
Author
Visible Infrared Spin Scan Radiometer; Intercalibration; Goes 9

20040079704 Lawrence Livermore National Lab., Livermore, CA
Modeling and Prediction Overview
Emak, D. L.; Oct. 18, 2002; In English
Report No.(s): DE2004-15002132; UCRL-ID-150688; No Copyright; Avail: National Technical Information Service (NTIS)

Effective preparation for and response to the release of toxic materials into the atmosphere hinges on accurate predictions of the dispersion pathway, concentration, and ultimate fate of the chemical or biological agent. Of particular interest is the threat to civilian populations within major urban areas, which are likely targets for potential attacks. The goals of the CBNP Modeling and Prediction area are: (1) Development of a suite of validated, multi-scale, atmospheric transport and fate modeling capabilities for chemical and biological agent releases within the complex urban environment; (2) Integration of these models and related user tools into operational emergency response systems. Existing transport and fate models are being

adapted to treat the complex atmospheric flows within and around structures (e.g., buildings, subway systems, urban areas) and over terrain.
NTIS
Atmospheric Circulation; Toxicity; Models; Releasing

20040079710 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Analysis of Gauge-Measured and Passive Microwave Derived Snow Depth Variations of Snowfields
Chang, A. T. C.; Josberger, E. G.; Armstrong, R. L.; Kelly, R. E. J.; Foster, J. L.; Hall, D. K.; 2004; 32 pp.; In English; Copyright; Avail: CASI; A03, Hardcopy

Remote sensing of snow depth has been used to infer snow depth for many years. Passive microwave remote sensing of snow depth is compared with the snow gauge data.
Author
Measuring Instruments; Snow; Depth Measurement

20040079727 National Center for Atmospheric Research, Boulder, CO
Research and Development to Improve Quantitative Precipitation Forecasts in the Warm Season. A Synopsis of the March 2002 USWRP Workshop and Statement of Priority Recommendations
Fritsch, J. M.; Carbone, R. E.; Aug. 2003; In English
Report No.(s): PB2004-106028; No Copyright; Avail: National Technical Information Service (NTIS)

Warm season Quantitative Precipitation Forecast (QPF) is the poorest performance area of forecast systems worldwide. It stubbornly falls farther behind while other aspects of weather prediction steadily improve. Unless a major effort is mounted to overcome the impediments to improved prediction, it is certain to remain the Achilles heel of weather prediction, at a progressively greater cost to society. Improving warm-season QPF requires a substantial and sustained commitment of resources focusing on a complex suite of issues. It is an exceedingly challenging undertaking that must garner meaningful contributions from several disparate sub-disciplines. Nevertheless, the need is great, the potential benefits are many, and the technologies to meet the challenge are finally at hand.
NTIS
Weather Forecasting; Precipitation (Meteorology)

20040079735 NASA Langley Research Center, Hampton, VA, USA
Deep Convective Cloud Top Heights and Their Thermodynamic Control During CRYSTAL-FACE
Sherwood, Steven C.; Minnis, Patrick; McGill, Matthew; 2004; 16 pp.; In English; Original contains black and white illustrations
Contract(s)/Grant(s): NAG5-59632; NSF ATM-01-34893; No Copyright; Avail: CASI; A03, Hardcopy

Infrared (11 micron) radiances from GOES-8 and local radiosonde profiles, collected during the Cirrus Regional Study of Tropical Anvils and Cirrus Layers-Florida Area Cirrus Experiment (CRYSTAL-FACE) in July 2002, are used to assess the vertical distribution of Florida-area deep convective cloud top height and test predictions as to its variation based on parcel theory. The highest infrared tops (Z(sub 11)) reached approximately to the cold point, though there is at least a 1-km uncertainty due to unknown cloud-environment temperature differences. Since lidar shows that visible 'tops' are 1 km or more above Z(sub 11), visible cloud tops frequently penetrated the lapse-rate tropopause (approx. 15 km). Further, since lofted ice content may be present up to approx. 1 km above the visible tops, lofting of moisture through the mean cold point (15.4 km) was probably common. Morning clouds, and those near Key West, rarely penetrated the tropopause. Non-entraining parcel theory (i.e., CAPE) does not successfully explain either of these results, but can explain some of the day-to-day variations in cloud top height over the peninsula. Further, moisture variations above the boundary layer account for most of the day-today variability not explained by CAPE, especially over the oceans. In all locations, a 20% increase in mean mixing ratio between 750 and 500 hPa was associated with about 1 km deeper maximum cloud penetration relative to the neutral level. These results suggest that parcel theory may be useful for predicting changes in cumulus cloud height over time, but that parcel entrainment must be taken into account even for the tallest clouds. Accordingly, relative humidity above the boundary layer may exert some control on the height of the tropical troposphere.
Author
Cumulus Clouds; Vertical Distribution; Atmospheric Circulation

20040079753 National Oceanic and Atmospheric Administration, Washington, DC, USA
NOAA in the 21st Century: Natural and Technological Hazards. Meeting the Challenges
Nov. 2003; In English
Report No.(s): PB2004-105568; No Copyright; Avail: National Technical Information Service (NTIS)

The National Oceanic and Atmospheric Administration (NOAA)-in partnership with other organizations and emergency management responders-provides a coordinated suite of hazards-related services for the Nation. NOAA's increased environmental data-gathering efforts have led to breakthroughs in prediction and preparedness, enhancing the safety and security of our citizens.
NTIS
Hazards; Meteorological Charts; Emergencies

20040079784 NASA Goddard Space Flight Center, Greenbelt, MD, USA
A GEO Hyperspectral Mission For Continental-Scale 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.; Dabney, Philip W.; Huemmrich, K. Fred, et al.; 2004; 1 pp.; In English; 2004 ASPRS Annual Conference, 24-28 May 2004, Denver, CO, USA; No Copyright; Avail: Other Sources; Abstract Only

For both terrestrial and ocean carbon cycle science objectives, a hyperspectral geostationary sensor should enable the development of new remote sensing measurements for important but as yet unobservable variables, and 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 are needed to identify the geographical locations of carbon sources/sinks and to improve regional climate models and global climate change assessments. It is an enormous challenge to estimate CWE exchange from the infrequent temporal coverage provided by most polar-orbiting satellites, and without benefit of spectral indices that capture vegetation responses to stress conditions that down-regulate photosynthesis. Physiological status can be better assessed with spectral indices based on continuous, narrow (5 nm) bands, 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 scenarios. The GSFC Carbon Team has been pursuing a geostationary hyperspectral instrument, which would revolutionize our knowledge of biological processes on land, in the ocean, and along the coast by providing multiple, diurnal coverage. Preliminary studies in Goddard's Instrument Synthesis and Analysis Laboratory (ISAL) indicate that we can meet many of our science requirements: full spectral coverage (360-1000 nm); narrow bandwidths (5-10 nm); adequate ground resolution (100-200 m); and continental-scale coverage 4-6 times per day; all the while achieving a signal to noise ratio of between 500 and 1000 to 1. However, an innovative and bold focal plane design and a large mirror (1.8 meter diameter) would be required. The development of our science requirements and the results of the initial design study will be presented as well as our most recent technological developments.
Author
Carbon Cycle; Marine Biology; Remote Sensing; Synchronous Satellites; Oceanography

20040079803 Meteorological Satellite Center, Kiyose, Japan
Monthly Report of the Meteorological Satellite Center: March 2004
March 2004; In English; In Japanese; Document files and Satellite data are recorded in either ASCII or shift JIS code; Full Disk Earth's Cloud Images are recorded in Bit-Map (BMP) format; Copyright; Avail: Other Sources

The CD-ROM concerning the March 2004 Monthly Report of the Meteorological Satellite Center (MSC) contains the observation data derived from the Geostationary Meteorological Satellite (GMS) of Japan and the Polar Orbital Meteorological Satellites operated by NOAA. The CD-ROM contains the following observation data: Full Disk Earth's Cloud Image; Cloud Image of Japan and its vicinity; Cloud Amount; Sea Surface Temperature; Cloud Motion Wind; Water Vapor Motion Wind; Equivalent Blackbody Temperature; OLR (Out-going Longwave Radiation), Solar Radiation; Snow and Ice Index; Orbit Data; Attitude Data; VISSR Image Data Catalog (Cartridge Magnetic Tape (CMT), Micro Film); TOVS (TIROS Operational Vertical Sounder) Vertical Profile of Temperature and Precipitable Water; and TOVS Total Ozone Amount.
Derived from text
Satellite Observation; Satellite Sounding; Atmospheric Sounding; Meteorological Parameters; Satellite Imagery; Japan

20040079820 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Asymmetric Eyewall Vertical Motion in a High-Resolution Simulation of Hurricane Bonnie (1998)

Braun, Scott A.; Montgomery, Michael T.; Pu, Zhao-Xia; [2004]; 2 pp.; In English; 26th Conference on Hurricanes and Tropical Meteorology, 3-7 May 2004, Miami, FL, USA; Copyright; Avail: CASI; A01, Hardcopy

Reasor et al. (2004) examined the tilting of a vortex by shear and found that a damping mechanism intrinsic to the dry adiabatic dynamics suppresses departures from an upright state. This realignment occurs through projection of the tilt asymmetry onto two types of vortex Rossby waves: sheared vortex Rossby waves, in which the radial shear of the swirling flow axisymmetrizes tilt asymmetries, and a quasi-mode, or discrete, vortex Rossby wave that, in the absence of damping, causes precession of the upper vortex until it realigns with the lower one (thereafter undergoing repeated cycles of tilting and realignment). With damping, the vortex achieves a downshear-left equilibrium tilt. This paper examines the role of a damped quasi-mode in producing asymmetric vertical motions in a high-resolution simulation of Hurricane Bonnie (1998).

Derived from text

Asymmetry; High Resolution; Hurricanes; Simulation; Vertical Motion

20040079827 NASA Goddard Space Flight Center, Greenbelt, MD, USA

A Study of the Response of Deep Tropical Clouds to Mesoscale Processes, Part 2, Sensitivities to Microphysics, Radiation, and Surface Fluxes

Johnson, Daniel; Tao, Wei-Kuo; Simpson, Joanne; [2004]; 57 pp.; In English; No Copyright; Avail: CASI; A04, Hardcopy

The Goddard Cumulus Ensemble (GCE) model is used to examine the sensitivities of surface fluxes, explicit radiation, and ice microphysical processes on multi-day simulations of deep tropical convection over the Tropical Ocean Global Atmosphere Coupled Ocean-Atmosphere Response Experiment (TOGA COARE). The simulations incorporate large-scale advective temperature and moisture forcing, as well as large-scale momentum, that are updated every time step on a periodic lateral boundary grid. This study shows that when surface fluxes are eliminated, the mean atmosphere is much cooler and drier, convection and CAPE are much weaker, precipitation is less, and cloud coverage in stratiform regions much greater. Surface fluxes using the TOGA COARE flux algorithm are weaker than with the aerodynamic formulation, but closer to the observed fluxes. In addition, similar trends noted above for the case without surface fluxes are produced for the TOGA flux case, albeit to a much lesser extent. The elimination of explicit shortwave and longwave radiation is found to have only minimal effects on the mean thermodynamics, convection, and precipitation. However explicit radiation does have a significant impact on cloud temperatures and structure above 200 mb and on the overall mean vertical circulation. The removal of ice processes produces major changes in the structure of the cloud. Much of the liquid water is transported aloft and into anvils above the melting layer (600 mb), leaving narrow, but intense bands of rainfall in convective regions. The elimination of melting processes leads to greater hydrometeor mass below the melting layer, and produces a much warmer and moister boundary layer, leading to a greater mean CAPE. Finally, the elimination of the graupel species has only a small impact on mean total precipitation, thermodynamics, and dynamics of the simulation, but does produce much greater snow mass just above the melting layer. Some of these results differ from previous CRM studies of tropical systems, which is likely due to the type of simulated system, total time integration, and model setup.

Author

Cloud Physics; Cumulus Clouds; Mesoscale Phenomena; Tropical Regions; Convection; Atmospheric Models

20040079837 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Validation of EOS Aqua AMSR Sea Ice Products for East Antarctica

Massom, Rob; Lytle, Vicky; Allison, Ian; Worby, Tony; Markus, Thorsten; Scambos, Ted; Haran, Terry; Enomoto, Hiro; Tateyama, Kazu; Pfaffling, Andi; 2004; 1 pp.; In English; IGARSS 04, 20-24 Sep. 2004, Anchorage, AK, USA; Copyright; Avail: Other Sources; Abstract Only

This paper presents results from AMSR-E validation activities during a collaborative international cruise onboard the RV Aurora Australis to the East Antarctic sea ice zone (64-65 deg.S, 110-120 deg.E) in the early Austral spring of 2003. The validation strategy entailed an IS-day survey of the statistical characteristics of sea ice and snowcover over a Lagrangian grid 100 x 50 km in size (demarcated by 9 drifting ice beacons) i.e. at a scale representative of Ah4SR pixels. Ice conditions ranged h m consolidated first-year ice to a large polynya offshore from Casey Base. Data sets collected include: snow depth and snow-ice interface temperatures on 24 (?) randomly-selected floes in grid cells within a 10 x 50 km area (using helicopters); detailed snow and ice measurements at 13 dedicated ice stations, one of which lasted for 4 days; time-series measurements of snow temperature and thickness at selected sites; 8 aerial photography and thermal-IR radiometer flights; other satellite products (SAR, AVHRR, MODIS, MISR, ASTER and Envisat MERIS); ice drift data; and ancillary meteorological (ship-based, meteorological buoys, twice-daily radiosondes). These data are applied to a validation of standard AMSR-E ice

concentration, snowcover thickness and ice-temperature products. In addition, a validation is carried out of ice-surface skin temperature products h m the NOAA AVHRR and EOS MODIS datasets.
Author
Ice Floes; Sea Ice; Snow Cover; Surface Temperature; Temperature Measurement

20040081055 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Multi-Spectral Cloud Retrievals from Moderate Image Spectrometer (MODIS)
Platnick, Steven; 2004; 1 pp.; In English; No Copyright; Avail: Other Sources; Abstract Only

MODIS observations from the NASA EOS Terra spacecraft (1030 local time equatorial sun-synchronous crossing) launched in December 1999 have provided a unique set of Earth observation data. With the launch of the NASA EOS Aqua spacecraft (1330 local time crossing! in May 2002: two MODIS daytime (sunlit) and nighttime observations are now available in a 24-hour period allowing some measure of diurnal variability. A comprehensive set of remote sensing algorithms for cloud masking and the retrieval of cloud physical and optical properties has been developed by members of the MODIS atmosphere science team. The archived products from these algorithms have applications in climate modeling, climate change studies, numerical weather prediction, as well as fundamental atmospheric research. In addition to an extensive cloud mask, products include cloud-top properties (temperature, pressure, effective emissivity), cloud thermodynamic phase, cloud optical and microphysical parameters (optical thickness, effective particle radius, water path), as well as derived statistics. An overview of the instrument and cloud algorithms will be presented along with various examples, including an initial analysis of several operational global gridded (Level-3) cloud products from the two platforms. Statistics of cloud optical and microphysical properties as a function of latitude for land and Ocean regions will be shown. Current algorithm research efforts will also be discussed.
Author
Cloud Physics; Climate Change; MODIS (Radiometry); Imaging Spectrometers; Numerical Weather Forecasting

20040081056 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Parameter Estimation in Atmospheric Data Sets
Wenig, Mark; Colarco, Peter; [2004]; 1 pp.; In English; International Quadrennial Ozone Symposium, 1-8 Jun. 2004, Kos, Greece; No Copyright; Avail: Other Sources; Abstract Only

In this study the structure tensor technique is used to estimate dynamical parameters in atmospheric data sets. The structure tensor is a common tool for estimating motion in image sequences. This technique can be extended to estimate other dynamical parameters such as diffusion constants or exponential decay rates. A general mathematical framework was developed for the direct estimation of the physical parameters that govern the underlying processes from image sequences. This estimation technique can be adapted to the specific physical problem under investigation, so it can be used in a variety of applications in trace gas, aerosol, and cloud remote sensing. As a test scenario this technique will be applied to modeled dust data. In this case vertically integrated dust concentrations were used to derive wind information. Those results can be compared to the wind vector fields which served as input to the model. Based on this analysis, a method to compute atmospheric data parameter fields will be presented. .
Author
Atmospheric Composition; Estimating; Remote Sensing; Tensors; Aerosols

20040081059 NASA Ames Research Center, Moffett Field, CA, USA
Entrainment, Drizzle, and Stratocumulus Cloud Albedo
Ackerman, A. S.; Kirkpatrick, M. P.; Stevens, D. E.; Toon, O. B.; 2004; 1 pp.; In English; 14th International Conference on Clouds and Precipitation, 18-23 Jul. 2004, Bologna, Italy; No Copyright; Avail: Other Sources; Abstract Only

Globally averaged cloud changes from GCMs on average show a doubling of the Twomey effect, which is the change in cloud albedo with respect to changes in droplet concentrations for fixed cloud water and droplet dispersion. In contrast, ship-track measurements show a much more modest amplification of the Twomey effect, suggesting that the GCMs are exaggerating the indirect aerosol effect. We have run large-eddy simulations with bin microphysics of marine stratocumulus from multiple field campaigns, and find that the large-eddy simulations are in much better agreement with the ship-track measurements. The inversion strength over N. Pacific stratocumulus (as measured during DYCOMS-II) is generally much stronger than over N. Atlantic stratocumulus (as measured during ASTEX), and we have found that the response of cloud water to increasing droplet concentration changes sign as the inversion strengthens. For the different environmental conditions, we will show the overall response of cloud albedo to droplet concentrations, and decompose the response into its contributing

factors of changes in cloud water, droplet dispersion, and horizontal inhomogeneity.
Author
Stratocumulus Clouds; Entrainment; Albedo; Inversions; Aerosols

20040081060 NASA Ames Research Center, Moffett Field, CA, USA
Characteristics of Type I PSCs Derived from POAM Observations
Strawa, Anthony W.; Drdla, Katja; Bokarius, Konstantin; Fromm, Michael D.; Alfred, Jerome M.; [2004]; 2 pp.; In English; Quadrennial Ozone Symposium, 3-9 Jun. 2004, Kos, Greece; Copyright; Avail: CASI; A01, Hardcopy

The characteristics of Polar Ozone and Aerosol Measurement III (POAM 3) observations of Type I Arctic Polar Stratospheric Clouds (PSCs) from 1998 to 2003 are studied using a scheme that discriminates Type la from Ib PSCs. The PSCs observed in these years are studied simultaneously by aligning the day in each year when the temperature associated with a POAM observation first reaches T(sub NAT). It is observed that PSC formation occurs within days of the minimum observation temperature reaching T(sub NAT) and that the majority of these first PSCs are Type Ia. Our observations support the hypothesis that heterogeneous freezing contributes at least in part to the freezing of solid phase PSCs.
Author
Ozone; Polar Meteorology; Stratosphere; Clouds (Meteorology); Arctic Regions; Aerosols

20040081061 NASA Ames Research Center, Moffett Field, CA, USA
Entrainment, Drizzle, and Cloud Albedo
Ackerman, A. S.; Kirkpatrick, J. P.; Stevens, D. E.; Toon, O. B.; 2004; 1 pp.; In English; No Copyright; Avail: Other Sources; Abstract Only

Increased aerosol and hence droplet concentrations in polluted clouds are expected to inhibit precipitation and thereby increase cloud water, leading to more reflective clouds that partially offset global warming. Yet polluted clouds are not generally observed to hold more water. Much of the uncertainty regarding the indirect aerosol effect stems from inadequate understanding of such changes in cloud water. Detailed simulations show that the relative humidity of air overlying stratocumulus is a leading factor determining whether cloud water increases or decreases when precipitation is suppressed. When the overlying air is dry, cloud water can decrease as droplet concentrations increase.
Author
Stratocumulus Clouds; Entrainment; Global Warming; Aerosols; Albedo; Drops (Liquids)

20040081063 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Overview on Role of the Troposphere
Newman, Paul A.; [2003]; 1 pp.; In English; Workshop on Process-Oriented Validation of Coupled Chemistry-Climate Models, 17-19 Nov. 2003, Garmisch-Partenkirchen, Germany; No Copyright; Avail: Other Sources; Abstract Only

The troposphere is the lower boundary for the stratosphere. As such, it provides a radiative boundary that is a large source of IR flux into for the stratosphere and scattered UV-Vis energy. Planetary-scale waves that are forced in the troposphere can propagate into the stratosphere, providing a large additional source of energy for the stratosphere. This wave energy is the principal energy source for the Brewer-Dobson circulation. Medium-scale wave can also propagate into the lower stratosphere, but have a smaller effect. The final source of energy for the stratosphere comes from smaller scale disturbances such as gravity waves, mixed Rossby-gravity modes, and Kelvin waves. These smaller scale waves provide an important source of energy for the stratosphere. In this presentation we will cover these tropospheric sources of energy that effect the stratosphere. In particular, we will focus attention on planetary scale waves and their forcings.
Author
Troposphere; Planetary Waves; Gravity Waves; Kelvin Waves

20040081083 NASA Ames Research Center, Moffett Field, CA, USA
Virtual Sensors: Using Data Mining to Efficiently Estimate Spectra
Srivastava, Ashok; Oza, Nikunj; Stroeve, Julienne; March 08, 2004; 1 pp.; In English; IEEE International Geoscience and Remote Sensing Symposium; No Copyright; Avail: Other Sources; Abstract Only

Detecting clouds within a satellite image is essential for retrieving surface geophysical parameters, such as albedo and temperature, from optical and thermal imagery because the retrieval methods tend to be valid for clear skies only. Thus, routine satellite data processing requires reliable automated cloud detection algorithms that are applicable to many surface types. Unfortunately, cloud detection over snow and ice is difficult due to the lack of spectral contrast between clouds and snow.

Snow and clouds are both highly reflective in the visible wavelen,ats and often show little contrast in the thermal Infrared. However, at 1.6 microns, the spectral signatures of snow and clouds differ enough to allow improved snow/ice/cloud discrimination. The recent Terra and Aqua Moderate Resolution Imaging Spectro-Radiometer (MODIS) sensors have a channel (channel 6) at 1.6 microns. Presently the most comprehensive, long-term information on surface albedo and temperature over snow- and ice-covered surfaces comes from the Advanced Very High Resolution Radiometer (AVHRR) sensor that has been providing imagery since July 1981. The earlier AVHRR sensors (e.g. AVHRR/2) did not however have a channel designed for discriminating clouds from snow, such as the 1.6 micron channel available on the more recent AVHRR/3 or the MODIS sensors. In the absence of the 1.6 micron channel, the AVHRR Polar Pathfinder (APP) product performs cloud detection using a combination of time-series analysis and multispectral threshold tests based on the satellite's measuring channels to produce a cloud mask. The method has been found to work reasonably well over sea ice, but not so well over the ice sheets. Thus, improving the cloud mask in the APP dataset would be extremely helpful toward increasing the accuracy of the albedo and temperature retrievals, as well as extending the time-series of albedo and temperature retrievals from the more recent sensors to the historical ones. In this work, we use data mining methods to construct a model of MODIS channel 6 as a function of other channels that are common to both MODIS and AVHRR. The idea is to use the model to generate the equivalent of MODIS channel 6 for AVHRR as a function of the AVHRR equivalents to MODIS channels. We call this a Virtual Sensor because it predicts unmeasured spectra. The goal is to use this virtual channel 6. to yield a cloud mask superior to what is currently used in APP . Our results show that several data mining methods such as multilayer perceptrons (MLPs), ensemble methods (e.g., bagging), and kernel methods (e.g., support vector machines) generate channel 6 for unseen MODIS images with high accuracy. Because the true channel 6 is not available for AVHRR images, we qualitatively assess the virtual channel 6 for several AVHRR images.
Derived from text
Data Mining; Detection; Ice; Snow; Spectral Signatures; Clouds (Meteorology); Imaging Techniques

20040081106 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Intraseasonal Oscillations over South America: A Study with a Regional Climate Model
Chen, Baode; Chao, Winston; 2003; 51 pp.; In English; No Copyright; Avail: CASI; A04, Hardcopy

The National Center for Atmospheric Research (NCAR) regional climate model version 2 (RegCM2) is used to investigate the observed characteristics of intraseasonal oscillations over South America. Our study is mainly concentrated on an intraseaonal mode, which is observed to account for a large portion of the intraseasonal variation, to have a standing feature and to be independent of the MJO. The NCEPDOE AMIP-II reanalysis is utilized to provide initial and lateral boundary conditions for the RegCM2 based upon the OOZ, 062, 122 and 182 data.Our results indicate that the intraseasonal oscillation still exists with time- averaged lateral boundary condition, which prevents the MJO and other outside disturbances from entering the model's domain, suggesting a locally forced oscillation responsible for ths intraseasonal mode independent of the MJO. Further experiments show that the annual and daily variabilities and a radiative-convective interaction are not essential to the locally forced intraseasonal oscillation. The intraseasonal oscillations over Amazon in our model essentially result from interactions among atmospheric continental- scale circulation, surface radiation, surface sensible and latent heat fluxes, and cumulus convection. The wavelet analyses of various surface energy fluxes and surface energy budget also verify that the primary cause of intraseasonal oscillation is the interaction of land surface processes with the atmosphere.
Author
Climate Models; Intraseasonal Variations

20040081108 NASA Goddard Space Flight Center, Greenbelt, MD, USA
A Reply to Diem et al.'s Commentary on a Recent Literature Contribution Focused on Urban-Induced Rainfall in Atlanta
Shepherd, J. Marshall; [2004]; 19 pp.; In English; Original contains color illustrations; No Copyright; Avail: CASI; A03, Hardcopy

A response is provided to Diem and colleagues discussion on the whether urbanization-enhanced precipitation should be maximized in the South-Southeast of Atlanta, Georgia as documented in Shepherd et al. (2003). Diem and colleagues have offered a critical response to Shepherd et al. (2002). The response herein offers both general and specific responses to issues raised by Diem and colleagues.
Author
Rain; Georgia

20040081115 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Studying the Diurnal Cycle of Convection Using a TRMM-Calibrated Infrared Rain Algorithm

Negri, Andrew J.; Adler, Robert F.; Huffman, George J.; Manyin, Michael; 2004; 1 pp.; In English; AMS 18th Conference on Hydrology, 11-15 Jan. 2004, Seattle, WA, USA; No Copyright; Avail: Other Sources; Abstract Only

The development of a satellite infrared (IR) technique for estimating convective and stratiform rainfall and its application in studying the diurnal variability of rainfall on a global scale is presented. The Convective-Stratiform Technique (CST), calibrated by coincident, physically retrieved rain rates from the Tropical Rainfall Measuring Mission (TRMM) Precipitation Radar (PR), is applied over the global tropics. The technique makes use of the IR data from the TRMM Visible/Infrared Scanner (VIRS) before application to global geosynchronous satellite data. The calibrated CST technique has the advantages of high spatial resolution (4 km), filtering of non-raining cirrus clouds, and the stratification of the rainfall into its convective and stratiform components, the last being important for the calculation of vertical profiles of latent heating. The diurnal cycle of rainfall, as well as the division between convective and stratiform rainfall will be presented. The technique is validated using available data sets and compared to other global rainfall products such as Global Precipitation Climatology Project (GPCP) IR product, calibrated with TRMM Microwave Imager (TMI) data. Results from five years of PR data will show the global-tropical partitioning of convective and stratiform rainfall.

Author

Trmm Satellite; Diurnal Variations; Infrared Radiation; Algorithms; Convection; Calibrating; Precipitation (Meteorology)

20040081119 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Evidence of Urban Precipitation Anomalies from Satellite and Ground-Based Measurements

Shepherd, J. M.; Manyin, M.; Negri, A.; 2004; 1 pp.; In English; 2004 AMS Satellite Meteorology and Oceanography Conference, Sep. 2004, USA; No Copyright; Avail: Other Sources; Abstract Only

Urbanization is one of the extreme cases of land use change. Most of world s population has moved to urban areas. Although currently only 1.2% of the land is considered urban, the spatial coverage and density of cities are expected to rapidly increase in the near future. It is estimated that by the year 2025,60% of the world s population will live in cities. Human activity in urban environments also alters weather and climate processes. However, our understanding of urbanization on the total Earth-weather-climate system is incomplete. Recent literature continues to provide evidence that anomalies in precipitation exist over and downwind of major cities. Current and future research efforts are actively seeking to verify these literature findings and understand potential cause- effect relationships. The novelty of this study is that it utilizes rainfall data from multiple satellite data sources (e.g. TRMM precipitation radar, TRMM-geosynchronous-rain gauge merged product, and SSM/I) and ground-based measurements to identify spatial anomalies and temporal trends in precipitation for cities around the world. Early results will be presented and placed within the context of weather prediction, climate assessment, and societal applications.

Author

Precipitation (Meteorology); Precipitation Measurement; Trmm Satellite; Meteorological Radar

20040081120 NASA Goddard Space Flight Center, Greenbelt, MD, USA

GMS-based"Future Time" Rainfall Data Assimilation for Mesoscale Weather Prediction over Korean Peninsula and Future Prospects with GPM Satellite Measurements

Smith, Eric A.; Ou, Mi-Lim; [2004]; 3 pp.; In English; ICHWC 2004 Conference, 22-26 Mar. 2004, Seoul, Korea, Republic of; No Copyright; Avail: CASI; A01, Hardcopy

This study examines the use of satellite-derived nowcasted (short-term forecasted) rainfall over 3-hour time periods to gain an equivalent time increment in initializing a nonhydrostatic mesoscale model used for predicting convective rainfall events over the Korean peninsula. Infrared (IR) window measurements from the Japanese Geostationary Meteorological Satellite (GMS) are used to specify latent heating for a spinup period of the model - but in future time -- thus initializing in advance of actual time in the framework of a prediction scenario. The main scientific objective of the study is to investigate the strengths and weaknesses of this approach insofar as data assimilation, in which the nowcasted assimilation data are derived independently of the prognostic model itself. Although there have been various recent improvements in formulating the dynamics, thermodynamics, and microphysics of mesoscale models, as well as computer advances which allow the use of high resolution cloud-resolving grids and explicit latent heating over regional domains, spinup remains at the forefront of unresolved mesoscale modeling problems. In general, non-realistic spinup limits the skill in predicting the spatial-temporal distribution of convection and precipitation, primarily in the early hours of a. forecast, stemming from standard prognostic variables not representing the initial diabatic heating field produced by the ambient convection and cloud fields. The long-term goal of this research is to improve short-range (12-hour) quantitative precipitation forecasting (QPF) over the Korean

peninsula through the use of innovative data assimilation methods based on geosynchronous satellite measurements. As a step in th~s direction, a non-standard data assimilation experiment in conjunction with GMS-retrieved nowcasted rainfall information introduced to the mesoscale model is conducted. The 3-hourly precipitation forecast information is assimilated through nudging the associated diabatic heating during the early stages of a forecast period. This procedure is expected to enhance details in the moisture field during model integration, and thus improve spinup performance, assuming the errors in the future time latent heating data ate less than intrinsic model background errors.
Author
Forecasting; Rain; Predictions; Meteorological Satellites; Satellite Observation; Mesometeorology; Weather Forecasting

20040081127 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Why Is Rainfall Error Analysis Requisite for Data Assimilation and Climate Modeling?
Hou, Arthur Y.; Zhang, Sara Q.; 2004; 1 pp.; In English; Eighth International Conference on Precipitation, 8-11 Aug. 2004, Vancouver, Canada; No Copyright; Avail: Other Sources; Abstract Only

Given the large temporal and spatial variability of precipitation processes, errors in rainfall observations are difficult to quantify yet crucial to making effective use of rainfall data for improving atmospheric analysis, weather forecasting, and climate modeling. We highlight the need for developing a quantitative understanding of systematic and random errors in precipitation observations by examining explicit examples of how each type of errors can affect forecasts and analyses in global data assimilation. We characterize the error information needed from the precipitation measurement community and how it may be used to improve data usage within the general framework of analysis techniques, as well as accuracy requirements from the perspective of climate modeling and global data assimilation.
Derived from text
Assimilation; Atmospheric Models; Forecasting

20040081135 NASA Goddard Space Flight Center, Greenbelt, MD, USA
On the Causes of the 1930s Dust Bowl
Schubert, Siegfried; Suarez, Max; Pegion, Philip; Koster, Randal; Bacmeister, Julie; [2004]; 1 pp.; In English; No Copyright; Avail: Other Sources; Abstract Only

During the 1930s the USA experienced one of the most devastating droughts of the last century. The drought affected almost 2/3 of the country and parts of Mexico and Canada and was infamous for the numerous dust storms that lead to the characterization of much of the Great Plains as the 'Dust Bowl'. Results from an ensemble of 100-year simulations with the NASA Seasonal-to-Interannual Prediction Project (NSIPP-1) atmospheric general circulation model (AGCM) forced with observed SSTs show that the model reproduces the basic features of the 1930s drought. In this study we exploit this realism in the model simulation to examine in more detail the role of the SST and soil moisture in the development and maintenance the 1930s drought. Results will be presented from simulations in which the SST anomalies are confined to the separate ocean basins, as well as from runs in which soil moisture feedback is turn off.
Author
Great Plains Corridor (North America); Drought; Atmospheric General Circulation Models

20040081148 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Mesoscale Assimilation of TMI Rainfall Data with 4DVAR: Sensitivity Studies
Tao, Wei-Kuo; Pu, Zhaoxia; January 2004; 26 pp.; In English; No Copyright; Avail: CASI; A03, Hardcopy

Sensitivity studies are performed on the assimilation of TRMM (Tropical Rainfall Measurement Mission) Microwave Imager (TMI) derived rainfall data into a mesoscale model using a four-dimensional variational data assimilation (4DVAR) technique. A series of numerical experiments is conducted to evaluate the impact of TMI rainfall data on the numerical simulation of Hurricane Bonnie (1998). The results indicate that rainfall data assimilation is sensitive to the error characteristics of the data and the inclusion of physics in the adjoint and forward models. In addition, assimilating the rainfall data alone is helpful for producing a more realistic eye and rain bands in the hurricane but does not ensure improvements in hurricane intensity forecasts. Further study indicated that it is necessary to incorporate TMI rainfall data together with other types of data such as wind data into the model, in which case the inclusion of the rainfall data further improves the intensity forecast of the hurricane. This implies that proper constraints may be needed for rainfall assimilation.
Author
Mesoscale Phenomena; Microwave Imagery; Trmm Satellite; Rain; Sensitivity Analysis; Data Acquisition

20040081152 NASA Goddard Space Flight Center, Greenbelt, MD, USA

The Eastern Pacific ITCZ during the Boreal Spring

Gu, Guojun; Adler, Robert F.; Sobel, Adam H.; March 2004; 45 pp.; In English; Original contains color and black and white illustrations; No Copyright; Avail: CASI; A03, Hardcopy

The 6-year (1998-2003) rainfall products from the Tropical Rainfall Measuring Mission (TRMM) are used to quantify the Intertropical Convergence Zone (ITCZ) in the eastern Pacific (defined by longitudinal averages over 90 degrees W-130 degrees W) during boreal spring (March-April). The double ITCZ phenomenon, represented by the occurrence of two maxima with respect to latitude in monthly mean rainfall, is observed in most but not all of the years studied. The relative spatial locations of maxima in sea surface temperature (SST), rainfall, and surface pressure are examined. Interannual and weekly variability are characterized in SST, rainfall, surface convergence, total column water vapor, and cloud water. There appears to be a competition for rainfall between the two hemispheres during this season. When one of the two rainfall maxima is particularly strong, the other tends to be weak, with the total rainfall integrated over the two varying less than does the difference between the rainfall integrated over each separately. There is some evidence for a similar competition between the SST maxima in the two hemispheres, but this is more ambiguous, and there is evidence that some variations in the relative strengths of the two rainfall maxima may be independent of SST. Using a 25-year (1979-2003) monthly rainfall dataset from the Global Precipitation Climatology Project (GPCP), four distinct ITCZ types during March-April are defined, based on the relative strengths of rainfall peaks north and south of, and right over the equator. Composite meridional profiles and spatial distributions of rainfall and SST are documented for each type. Consistent with previous studies, an equatorial cold tongue is essential to the existence of the double ITCZs. However, too strong a cold tongue may dampen either the southern or northern rainfall maximum, depending on the magnitude of SST north of the equator.

Author

Convergence; Trmm Satellite; Tropical Regions; Pacific Ocean; Climatology; Spring (Season)

20040081178 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Observed Changes in the Sea Ice Cover

Comiso, Josefino C.; [2003]; 1 pp.; In English; WCRP Meetings, 14-17 Oct. 2003, Victoria, British Columbia, Canada; No Copyright; Avail: Other Sources; Abstract Only

Satellite passive microwave data from November 1998 through October 2002 are used to evaluate the changing characteristics and the variability of the sea ice cover in the Northern and Southern Hemisphere. Large seasonal changes in the extent and area are apparent with those of the Southern Hemisphere being more seasonal but less symmetric than those of the Northern Hemisphere. In the Northern Hemisphere, the ice cover is observed to be on a decline at the rate of -2% and -3% per decade for ice extent and ice area, respectively, but there are areas like the Bering Sea with strong positive trends. It is remarkable. however, that the rate of decline of the perennial ice cover. or ice area at the end of the summer, is considerably larger at -9% per decade. If such a rate of decline is sustained for a few more decades, the perennial ice cover may disappear within this century. In the Antarctic, large year to year anomalies in the ice cover are observed but they follow a pattern of alternating positive and negative anomalies around the continent and showing consistency with a propagating Antarctic Circumpolar wave that circles around the region. Large negative trends of about - 11% per decade are, however, observed in the Bellingshausen/Amundsen Seas but this is offset by a similar magnitude but positive trend in the Ross Sea region. Overall, the trend for the entire Antarctic ice cover is positive but basically insignificant.

Author

Microwaves; Sea Ice; Annual Variations; Antarctic Regions; Climate Change

20040081179 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Variability in Tropical Tropospheric Ozone as Observed by SHADOZ

Thompson, Anne M.; Witte, Jacquelyn C.; Coetzee, Geert J. R.; Chatfield, Robert B.; Hudson, Robert D.; [2004]; 1 pp.; In English; No Copyright; Avail: Other Sources; Abstract Only

The SHADOZ (Southern Hemisphere Additional Ozonesondes) ozone sounding network was initiated in 1998 to improve the coverage of tropical in-situ ozone measurements for satellite validation, algorithm development and related process studies. Over 2000 soundings have been archived at the central website, <http://croc.gsfc.nasa.gov/shadoz>, for 12 stations: Ascension Island; Nairobi and Malindi, Kenya; Irene, South Africa; Reunion Island; Watukosek, Java; Fiji; Tahiti; American Samoa; San Cristobal, Galapagos; Natal, Brazil; Paramaribo, Surinam. Some results to date indicate reliability of the measurement and highly variable interactions between ozone and tropical meteorology. For example: 1. By using ECC sondes with similar procedures, 5-10% accuracy and precision (1-sigma) of the sonde total ozone measurement was achieved [Thompson et al., 2003al; 2. Week-to-week variability in tropospheric ozone is so great that statistics are frequently not

Gaussian and most stations vary up to a factor of 3 in column amount over the course of a year [Thompson et al., 2002b]. 3. Longitudinal variability in tropospheric ozone profiles is a consistent feature, with a 10- 15 DU column-integrated difference between Atlantic and Pacific sites; this is the cause of the zonal wave-one feature in total ozone [Shiotani, 1992]. The ozone record from Paramaribo, Surinam (6N, 55W) is a marked contrast to southern tropical ozone because Surinam is often north of the Intertropical Convergence Zone. Interpretations of SHADOZ time-series and approaches to classification suggested by SHADOZ data over Africa and the Indian Ocean will be described.
Author
Ozone; Sondes; Southern Hemisphere; Troposphere; Variability; Tropical Regions; Tropical Meteorology

20040081197 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Progress and Challenges in Subseasonal Prediction
Schubert, Siegfried; [2003]; 1 pp.; In English; 84th Annual AMS Meeting; No Copyright; Avail: Other Sources; Abstract Only

While substantial advances have occurred over the last few decades in both weather and seasonal prediction, progress in improving predictions on subseasonal time scales (approximately 2 weeks to 2 months) has been slow. In this talk I will highlight some of the recent progress that has been made to improve forecasts on subseasonal time scales and outline the challenges that we face both from an observational and modeling perspective. The talk will be based primarily on the results and conclusions of a recent NASA-sponsored workshop that focused on the subseasonal prediction problem. One of the key conclusions of that workshop was that there is compelling evidence for predictability at forecast lead times substantially longer than two weeks, and that much of that predictability is currently untapped. Tropical diabatic heating and soil wetness were singled out as particularly important processes affecting predictability on these time scales. Predictability was also linked to various low-frequency atmospheric phenomena such as the annular modes in high latitudes (including their connections to the stratosphere), the Pacific/North American pattern, and the Madden-Julian Oscillation. I will end the talk by summarizing the recommendations and plans that have been put forward for accelerating progress on the subseasonal prediction problem.
Author
Weather Forecasting; Seasons; Atmospheric Models

20040081202 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Discoveries about Tropospheric Ozone Pollution from Satellite and Sounding
Thompson, Anne M.; [2004]; 1 pp.; In English; Dubai International Conference on Atmospheric Pollution, 21-24 Feb. 2004, Dubai, United Arab Emirates; No Copyright; Avail: Other Sources; Abstract Only

We have been producing near-real time tropospheric ozone satellite maps from the TOMS (Total Ozone Mapping Spectrometer) sensor since 1997. This is most readily done for the tropics, where the stratospheric and tropospheric ozone column amounts can be discriminated readily. Maps for 1996-2000 for the operational Earth-Probe instrument reside at: chttp://www.atmos.umd.edu/-trope>. Pollution in the tropics is influenced by biomass burning and by transport patterns that favor recirculation and in other cases reflect climate variability like the El-Nino-Southern Oscillation [Thompson et al., 2001]. Time permitting, examples of mid-latitude, intercontinental transport of ozone pollution sensed by TOMS will be shown. The satellite view of chemical-dynamical interactions in tropospheric ozone is not adequate to capture vertical variability. Thus, in 1998, NASA's Goddard Space Flight Center and a team of international sponsors established the SHADOZ (Southern Hemisphere ADditional OZonesondes) project to address the gap in tropical ozone soundings. SHADOZ augments launches and provides a public archive of ozonesonde data from twelve tropical stations at http://croc.gsfc.nasa.gov/shadoz. Further insights into the role of chemical and dynamical influences have emerged from the first 4-5 years of SHADOZ data (less than 2000 ozone profiles): (a) highly variable tropospheric ozone; (b) a zonal wave-one pattern in tropospheric column ozone; (c) convective variability affects tropospheric ozone over the Indian and Pacific Ocean; (d) a "tropical Atlantic Paradox" appears in December-January-February.
Author
Ozone; Troposphere; Atmospheric Composition

20040081207 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Use of Radon for Evaluation of Atmospheric Transport Models: Sensitivity to Emissions
Gupta, Mohan L.; Douglass, Anne R.; Kawa, S. Randolph; Pawson, Steven; February 03, 2004; 37 pp.; In English
Contract(s)/Grant(s): NAG5-12162; No Copyright; Avail: CASI; A03, Hardcopy

This paper presents comparative analyses of atmospheric radon (Rn) distributions simulated using different emission scenarios and the observations. Results indicate that the model generally reproduces observed distributions of Rn but there are

some biases in the model related to differences in large-scale and convective transport. Simulations presented here use an off-line three-dimensional chemical transport model driven by assimilated winds and two scenarios of Rn fluxes (atom/cm s) from ice-free land surfaces: (A) globally uniform flux of 1.0, and (B) uniform flux of 1.0 between 60 deg. S and 30 deg. N followed by a sharp linear decrease to 0.2 at 70 deg. N. We considered an additional scenario (C) where Rn emissions for case A were uniformly reduced by 28%. Results show that case A overpredicts observed Rn distributions in both hemispheres. Simulated northern hemispheric (NH) Rn distributions from cases B and C compare better with the observations, but are not discernible from each other. In the southern hemisphere, surface Rn distributions from case C compare better with the observations. We performed a synoptic scale source-receptor analysis for surface Rn to locate regions with ratios B/A and B/C less than 0.5. Considering an uncertainty in regional Rn emissions of a factor of two, our analysis indicates that additional measurements of surface Rn particularly during April-October and north of 50 deg. N over the Pacific as well as Atlantic regions would make it possible to determine if the proposed latitude gradient in Rn emissions is superior to a uniform flux scenario.
Author
Evaluation; Atmospheric Circulation; Atmospheric Models; Three Dimensional Models

20040081210 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Convective Generation of Cirrus Near the Tropopause
Garrett, T. J.; Haymsfield, A. J.; McGill, Matthew J.; Baumgardner, D. G.; Bui, P. T.; Ridley, B. A.; Webster, C. R.; Weinstock, E. M.; [2004]; 24 pp.; In English; Original contains black and white illustrations; No Copyright; Avail: CASI; A03, Hardcopy

The July 2004 CRYSTAL-FACE field program, based from Key West, Florida, showed that long-lived thin tropopause cirrus (TTC) layers were common above thunderstorm anvils. This paper investigates the origins of these cloud using airborne measurements. The horizontal dimensions of the TTC were nearly identical to the convectively formed anvil beneath. However, the TTC did not appear to have originated from convective detrainment. Rather it appears to have formed in stably stratified air derived from high altitudes near the tropopause. The TTC was separated from the anvil by approx. 1 km, it lacked precipitation particles, and it was strongly depleted in HDO. Nonetheless, compared to surrounding clear air near the tropopause, the TTC was enriched in moisture and trace gases in a manner consistent with it having mixed with the same convective airmass that produced the anvil. Unlike surrounding air, the TTC had embedded a monochromatic gravity wave with a wavelength of 2 km and an amplitude of several hundred meters. Combined, this evidence, supported by a photograph from CRYSTAL-FACE, leads to the conjecture that the TTC originated as a pileus cloud layer, which formed near the tropopause ahead of vigorous convective uplift. We hypothesize that the pileus was penetrated by the convection, moistened through mixing, and once the convection subsided, it was sustained by radiative cooling due to the presence of the anvil layer beneath.
Author
Cirrus Clouds; Atmospheric Circulation; Tropopause

20040081226 NASA Goddard Space Flight Center, Greenbelt, MD, USA
The Impact of Model Configuration and Large-Scale, Upper-Level Forcing on CRM- Simulated Convective Systems
Tao, W.-K.; Zeng, X.; Shie, C.-L.; Starr, D.; Simpson, J.; 2004; 1 pp.; In English; ARM Science Meeting, 22-26 Mar. 2004, Albuquerque, NM, USA; No Copyright; Avail: Other Sources; Abstract Only

Real clouds and cloud systems are inherently three-dimensional (3D). Because of the limitations in computer resources, however, most cloud-resolving models (CRMs) today are still two-dimensional (2D, see a brief review by Tao 2003). Only recently have 3D experiments been performed for multi-day periods for tropical cloud systems with large horizontal domains at the National Center for Atmospheric Research, at NOAA GFDL, at the U. K. Met. Office, at Colorado State University and at NASA Goddard Space Flight Center (Tao 2003). At Goddard, a 3D Goddard Cumulus Ensemble (GCE) model was used to simulate periods during TOGA COARE (December 19-27, 1992), GATE (September 1-7, 1974), SCSMEX (June 2-11, 1998), ARM (June 26-30, 1997) and KWAJEX (August 7-13, August 18-21, and August 29-September 12, 1999) using a 512 by 512 km domain (with 2-km resolution). The results indicate that surface precipitation and latent heating profiles are similar between the 2D and 3D GCE model simulations. However, there are difference in radiation, surface fluxes and precipitation characteristics. The 2D GCE model was used to perform a long-term integration on ARM/GCSS case 4 (22 days at the ARM Southern Great Plains site in March 2000). Preliminary results showed a large temperature bias in the upper troposphere that had not been seen in previous tropical cases. The major objectives of this paper are: (1) to determine the sensitivities to model configuration (i.e., 2D in west-east, south-north or 3D), (2) to identify the differences and similarities in the organization and

entrainment rates of convection between 2D- and 3D-simulated ARM cloud systems, and (3) assess the impact of upper tropospheric forcing on tropical and ARM case 4 cases.
Author
Cumulus Clouds; Three Dimensional Models; Atmospheric Models

20040081244 NASA Goddard Space Flight Center, Greenbelt, MD, USA
How Can AERONET Help with Monitoring Clouds?
Marshak, A.; [2004]; 1 pp.; In English; AERONET/Photon Workshop, 10-14 May 2004, Huelva, Spain; No Copyright; Avail: Other Sources; Abstract Only

When conditions are inappropriate to make AErosol RObotic NETwork (AERONET) measurements for aerosol studies, new measurements related to cloud physics can be made instead. As such, several AERONET CIMEL sunphotometers have been equipped with a new "cloud mode." This mode allows the CIMELs to make measurements of zenith radiance when the Sun in blocked by clouds. When in cloud mode, a CIMEL points straight up every 10-15 minutes and takes 10 measurements over a 9 second time interval at four wavelengths: 440,670,870, and 1020 nm. For cloudy conditions above green vegetation, the spectral contrast in surface albedo dominates over Rayleigh and aerosol effects. We have developed a new method for retrieving cloud optical depth, even for broken clouds, that uses data from the 670 (and/or 440) and 870 nm channels. In addition to cloud optical depth, the method also infers a "radiatively effective" cloud fraction. The results of the retrievals at the ARM Central Facility in Oklahoma are compared with the ones from Microwave Radiometer (MWR) and Multi-Filter Rotating Shadowband Radiometers (MFRSR).
Author
Cloud Physics; Aerosols; Robotics; Computer Networks; Photometers

20040081245 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Meridional Propagation of the MJO/ISO and Asian Monsoon Variability
Wu, Man Li C.; Schubert, Siegfried; Suarez, Max; Pegion, Phil; Waliser, D.; 2003; 1 pp.; In English; APEC Climate Network Symposium, 7-10 Oct. 2003, Jeju Island, Korea, Democratic People's Republic of; No Copyright; Avail: Other Sources; Abstract Only

In this study we examine the links between tropical heating, the Madden Julian Oscillation (MJO)/Intraseasonal Oscillation (ISO), and the Asian monsoon. We are particularly interested in isolating the nature of the poleward propagation of the ISO/MJO in the monsoon region. We examine both observations and idealized "MJO heating" experiments employing the NASA Seasonal-Interannual Prediction Project (NSIPP) atmospheric general circulation model (AGCM). In the idealized 10-member ensemble simulations, the model is forced by climatological SST and an idealized eastward propagating heating profile that is meant to mimic the canonical heating associated with the MJO in the Indian Ocean and western Pacific. In order to understand the impact of SST on the off equatorial convection (or Rossby-wave response), a second set of 10-member ensemble simulations is carried out with the climatological SSTs shifted in time by 6-months. The observational analysis highlights the strong link between the Indian summer monsoon and the tropical ISO/MJO activity and heating. This includes the well-known meridional propagation that affects the summer monsoons of both hemispheres. The AGCM experiments with the idealized eastward propagating MJO-like heating reproduce the observed meridional propagation including the observed seasonal differences. The impact of the SSTs are to enhance the magnitude of the propagation into the summer hemispheres. The results suggest that the winter/summer differences associated with the MJO/ISO are auxiliary features that depend on the MJO's environment (basic state and boundary conditions) and are not the result of fundamental differences in the MJO itself.
Author
Madden-Julian Oscillation; Asia; Monsoons; Atmospheric General Circulation Models; Climatology

20040081262 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Wavefront Sensing using a Multi-Object Spectrograph (NIRSpec)
Dean, Bruce; [2004]; 1 pp.; In English; SPIE Astronomical Telescope Conference, Jun. 2004, Scotland, UK; No Copyright; Avail: Other Sources; Abstract Only

An analysis is presented that illustrates how the JWST fine-phasing process can be carried out using NIRSpec data collected at the science focal plane. The analysis is based on a multi-plane diffraction model which properly accounts for the microshutter diffractive element placed at the first relay position of the spectrograph. Wavefront sensing results are presented

based on both simulated as well as real data collected from the NASA Goddard Microshutter Testbed.
Author
Wave Fronts; Detection; Diffraction

20040081268 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Status of NASA Satellite, Field Observations, and Numerical Modeling Addressing the Impact of Urbanization on Short and Long Term Precipitation Variability
Shepherd, J. Marshall; Manyin, Michael; Burian, Steve; Garza, Carlos; [2004]; 4 pp.; In English; Original contains black and white illustrations; Copyright; Avail: CASI; A01, Hardcopy

Howard (1833a) made the first documented observation of a temperature difference between an urban area and its rural environment. Manley (1958) termed this contrast the "urban heat island (UHI)". The UHI has now become a widely acknowledged, observed, and researched phenomenon because of its broad implications. It is estimated that by the year 2025, 60% of the world's population will live in cities (UNFP, 1999). In the USA, the current urban growth rate is approximately 12.5%, with 80% currently living in urban areas. As cities continue to grow, urban sprawl creates unique problems related to land use, transportation, agriculture, housing, pollution, and development for policymakers. Urban expansion and its associated urban heat islands also have measurable impacts on weather and climate processes.
Author
Mathematical Models; Urban Development; Precipitation (Meteorology)

20040081273 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Factors Affecting the Evolution of Hurricane Erin and the Distributions of Hydrometeors: Role of Microphysical Processes
McFarquhar, Greg M.; Zhang, Henian; Dudhia, Jimy; Halverson, Jeffrey B.; Heymsfield, Gerald; Hood, Robbie; Marks, Frank, Jr.; [30 Jun. 2003]; 68 pp.; In English
Contract(s)/Grant(s): CAMEX-0000-0024; Copyright; Avail: CASI; A04, Hardcopy

Fine-resolution simulations of Hurricane Erin 2001 are conducted using the Penn State University/National Center for Atmospheric Research mesoscale model version 3.5 to investigate the role of thermodynamic, boundary layer and microphysical processes in Erin's growth and maintenance, and their effects on the horizontal and vertical distributions of hydrometeors. Through comparison against radar, radiometer, and dropsonde data collected during the Convection and Moisture Experiment 4, it is seen that realistic simulations of Erin are obtained provided that fine resolution simulations with detailed representations of physical processes are conducted. The principle findings of the study are as follows: 1) a new iterative condensation scheme, which limits the unphysical increase of equivalent potential temperature associated with most condensation schemes, increases the horizontal size of the hurricane, decreases its maximum rainfall rate, reduces its intensity, and makes its eye more moist; 2) in general, microphysical parameterization schemes with more categories of hydrometeors produce more intense hurricanes, larger hydrometeor mixing ratios, and more intense updrafts and downdrafts; 3) the choice of coefficients describing hydrometeor fall velocities has as big of an impact on the hurricane simulations as does choice of microphysical parameterization scheme with no clear relationship between fall velocity and hurricane intensity; and 4) in order for a tropical cyclone to adequately intensify, an advanced boundary layer scheme (e.g., Burk-Thompson scheme) must be used to represent boundary layer processes. The impacts of varying simulations on the horizontal and vertical distributions of different categories of hydrometeor species, on equivalent potential temperature, and on storm updrafts and downdrafts are examined to determine how the release of latent heat feedbacks upon the structure of Erin. In general, all simulations tend to overpredict precipitation rate and hydrometeor mixing ratios. The ramifications of these findings for quantitative precipitation forecasts (QPFs) of tropical cyclones are discussed.
Author
Atmospheric Models; Boundary Layers; Hurricanes; Hydrometeors

20040081274 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Accuracy Assessments and Validation of an Expanded UV Irradiance Database from Satellite Total Ozone Mapping Spectrometer (TOMS)
Krotkov, N. A.; Herman, J.; Fioletov, V.; Seftor, C.; Larko, D.; Vasilkov, A.; 2004; 1 pp.; In English; International Quadrennial Ozone Symposium (QOS 2004), 1-8 Jun. 2004, Kos, Greece; No Copyright; Avail: Other Sources; Abstract Only

The TOMS UV irradiance database (1978 to 2000) has been expanded to include 5 new products (noon irradiance at 305, 310, 324, and 380 nm, and noon erythemal-weighted irradiance), in addition to the existing erythemal daily exposure, which

permit direct Comparisons with ground-based measurements from UV spectrometers. Sensitivity studies are conducted to estimate uncertainties of the new TOMS UV irradiance data due to algorithm apriori assumptions. Comparisons with Brewer spectrometers as well as filter radiometers are used to review of the sources of known errors. Inability to distinguish between snow and cloud cover using only TOMS data results in large errors in estimating surface UV using snow climatology. A correction is suggested for the case when the regional snow albedo is known from an independent source. The summer-time positive bias between TOMS UV estimations and Brewer measurements can be seen at all wavelengths. This suggests the difference is not related to ozone absorption effects. We emphasize that uncertainty of boundary layer UV aerosol absorption properties remains a major source of error in modeling UV irradiance in clear sky conditions. Neglecting aerosol absorption by the present TOMS algorithm results in a positive summertime bias in clear-sky UV estimations over many locations. Due to high aerosol variability the bias is strongly site dependent. Data from UV-shadow-band radiometer and well-calibrated CIMEL sun-sky radiometer are used to quantify the bias at NASA/GSFC site in Greenbelt, MD. Recommendations are given to enable potential users to better account for local conditions by combining standard TOMS UV data with ancillary ground measurements.
Author
Accuracy; Data Bases; Irradiance; Total Ozone Mapping Spectrometer; Climatology; Ultraviolet Radiation

20040081277 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Correlations between Inter-Annual Variations in Arctic Sea Ice Extent, Greenland Surface Melt, and Boreal Snow Cover
Markus, Thorstena; Stroeve, Julienne C.; Armstrong, Richard L.; [2004]; 1 pp.; In English; IGARSS 2004, 20-24 Sep. 2004, Anchorage, AK, USA; No Copyright; Avail: Other Sources; Abstract Only

Intensification of global warming in recent decades has caused a rise of interest in year-to-year and decadal-scale climate variability in the Arctic. This is because the Arctic is believed to be one of the most sensitive and vulnerable regions to climatic changes. For over two decades satellite passive microwave observations have been utilized to continuously monitor the Arctic environment. Derived parameters include sea ice cover, snow cover and snow water equivalent over land, and Greenland melt extent and length of melt season. Most studies have primarily concentrated on trends and variations of individual variables. In this study we investigated how variations in sea ice cover, Greenland surface melt, and boreal snow cover are correlated. This was done on hemispheric as well as on regional scales. Latest results will be presented including data from the summer of 2004.
Author
Global Warming; Periodic Variations; Arctic Regions

20040081279 NASA Goddard Space Flight Center, Greenbelt, MD, USA
The Misnomer of East Asia Summer Monsoon
Chao, Winston C.; Chen, Baode; [2004]; 8 pp.; In English; Original contains color illustrations; No Copyright; Avail: CASI; A02, Hardcopy

The terminology East Asian summer monsoon is used to refer to the heavy rainfall in southeast China including the Yangtze River Valley starting in May and ending in August (e.g., Chen and Chang 1980, Tao and Chen 1987, Ding 1992, Chang et al. 2000a.) This rainfall region is associated with the Mei-Yu front, which extends to Japan and its neighborhood and is called Baiu there. The Mei-Yu front becomes prominent in May and has a slow northward movement. From May to July the elongated rain belt moves from the southeast coast of China to the Yangtze River Valley. The rain belt extends north-east-ward to south of Japan in May and later covers Korea also. The purpose of this note is to point out that the terminology of East Asian summer monsoon is a misnomer to refer to the portion of this rainbelt residing over East Asia, in the sense that it is not a monsoon.
Author
Rain; Monsoons; Asia

20040081280 NASA Goddard Space Flight Center, Greenbelt, MD, USA
The EOS Aura Mission
Schoebert, Mark R.; Douglass, A. R.; Hilsenrath, E.; Bhartia, P. K.; Barnett, J.; Gille, J.; Beer, R.; Gunson, M.; Waters, J.; Levelt, P. F., et al.; [2004]; 7 pp.; In English; Original contains color illustrations; No Copyright; Avail: CASI; A02, Hardcopy

The Earth Observing System (EOS) Aura satellite is scheduled to launch in the second quarter of 2004. The Aura mission is designed to attack three science questions: (1) Is the ozone layer recovering as expected? (2) What are the sources and

processes that control tropospheric pollutants? (3) What is the quantitative impact of constituents on climate change? Aura will answer these questions by globally measuring a comprehensive set of trace gases and aerosols at high vertical and horizontal resolution. Fig. 1 shows the Aura spacecraft and its four instruments.
Author
Ozonosphere; Troposphere; Pollution; Climate Change

20040081283 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Rain, Snow, Hurricanes, and Blizzards: Remote Sensing of Cloud Particles
Jackson, Gail Skofronick; [2004]; 1 pp.; In English; Florida State Univ. Physics Dept. Colloquium, 8 Apr. 2004, FL, USA; No Copyright; Avail: Other Sources; Abstract Only

Hurricanes, blizzards and other weather events are important to understand not only for disaster preparation, but also to track the global energy balance and to improve weather and climate forecasts. For several decades, passive radiometers and active radars on aircraft and satellites have been employed to remotely sense rain rates and the properties of liquid particles. In the past few years the relationships between frozen particles and millimeter-wave observations have become understood well enough to estimate the properties of ice in clouds. This colloquium will start with a broad background of the use of remote sensing of precipitation and then focus on recent research in the estimation of frozen cloud properties, both for ice that will eventually melt into rain and for solid precipitation falling in northern climates. The electromagnetic absorption and scattering properties of liquid rain and frozen particles will be explained. Retrieved cloud particle contents and size distributions for Hurricane Erin (2001) and the March 5-6, 2001 New England regional blizzard will be discussed. Future directions and challenges of this work will also be presented.
Author
Rain; Snow; Hurricanes; Remote Sensing; Cloud Physics

20040081284 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Towards a High Temporal Frequency Grass Canopy Thermal IR Model for Background Signatures
Ballard, Jerrell R., Jr.; Smith, James A.; Koenig, George G.; [2004]; 1 pp.; In English; International Society for Optical Engineering Conference, 12-16 Apr. 2004, Orlando, FL, USA; No Copyright; Avail: Other Sources; Abstract Only

In this paper, we present our first results towards understanding high temporal frequency thermal infrared response from a dense plant canopy and compare the application of our model, driven both by slowly varying, time-averaged meteorological conditions and by high frequency measurements of local and within canopy profiles of relative humidity and wind speed, to high frequency thermal infrared observations. Previously, we have employed three-dimensional ray tracing to compute the intercepted and scattered radiation fluxes and for final scene rendering. For the turbulent fluxes, we employed simple resistance models for latent and sensible heat with one-dimensional profiles of relative humidity and wind speed. Our modeling approach has proven successful in capturing the directional and diurnal variation in background thermal infrared signatures. We hypothesize that at these scales, where the model is typically driven by time-averaged, local meteorological conditions, the primary source of thermal variance arises from the spatial distribution of sunlit and shaded foliage elements within the canopy and the associated radiative interactions. In recent experiments, we have begun to focus on the high temporal frequency response of plant canopies in the thermal infrared at 1 second to 5 minute intervals. At these scales, we hypothesize turbulent mixing plays a more dominant role. Our results indicate that in the high frequency domain, the vertical profile of temperature change is tightly coupled to the within canopy wind speed In the results reported here, the canopy cools from the top down with increased wind velocities and heats from the bottom up at low wind velocities. .
Author
Infrared Signatures; Infrared Radiation; Spatial Distribution; Thermal Radiation; Meteorological Parameters; Grasses

48
OCEANOGRAPHY

Includes the physical, chemical and biological aspects of oceans and seas; ocean dynamics; and marine resources. For related information see also *43 Earth Resources and Remote Sensing.*

20040081064 NASA Goddard Space Flight Center, Greenbelt, MD, USA
EOS Aqua AMSR-E Arctic Sea Ice Validation Program
Cavalieri, D. J.; Markus, T.; Gasiewski, A.; Klein, M.; Maslanik, J.; Sturm, M.; Stroeve, J.; Heinrichs, J.; [2004]; 1 pp.; In English; IGARSS 2004, 20-24 Sep. 2004, Anchorage, AK, USA; No Copyright; Avail: Other Sources; Abstract Only

A coordinated Arctic sea ice validation field campaign using the NASA Wallops P-3B aircraft was successfully completed in March 2003. This campaign was part of the program for validating the Earth Observing System (EOS) Aqua Advanced Microwave Scanning Radiometer (AMSR-E) sea ice products. The AMSR-E, designed and built by the Japanese National Space Development Agency for NASA, was launched May 4,2002 on the EOS Aqua spacecraft. The AMSR-E sea ice products include sea ice concentration, sea ice temperature, and snow depth on sea ice. The primary instrument on the P-3B aircraft was the NOAA ETL Polarimetric Scanning Radiometer (PSR) covering the same frequencies and polarizations as the AMSR-E. This paper describes the objectives of each of the seven flights, the Arctic regions overflown, and the coordination among satellite, aircraft, and surface-based measurements. Two of the seven aircraft flights were coordinated with scientists making surface measurements of snow and ice properties including sea ice temperature and snow depth on sea ice at a study area near Barrow, AK and at a Navy ice camp located in the Beaufort Sea. The remaining flights covered portions of the Bering Sea ice edge, the Chukchi Sea, and Norton Sound. Comparisons among the satellite and aircraft PSR data sets are presented.
Author
Sea Ice; Arctic Regions; Earth Observing System (Eos); Satellite Observation; Microwave Radiometers

20040081066 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Recent Trends in Global Ocean Chlorophyll
Gregg, Watson; Casey, Nancy; 2004; 1 pp.; In English; ASLO/TOS Meeting, 15-19 Feb. 2004, Honolulu, HI, USA; No Copyright; Avail: Other Sources; Abstract Only

Recent analyses of SeaWiFS data have shown that global ocean chlorophyll has increased more than 5% since 1998. The North Pacific ocean basin has increased nearly 19%. To understand the causes of these trends we have applied the newly developed NASA Ocean Biogeochemical Assimilation Model (OBAM), which is driven in mechanistic fashion by surface winds, sea surface temperature, atmospheric iron deposition, sea ice, and surface irradiance. The mode1 utilizes chlorophyll from SeaWiFS in a daily assimilation. The model has in place many of the climatic variables that can be expected to produce the changes observed in SeaWiFS data. Th~s enables us to diagnose the model performance, the assimilation performance, and possible causes for the increase in chlorophyll.
Author
Biogeochemistry; Chlorophylls; Ocean Models; Sea-Viewing Wide Field-of-View Sensor; Sea Ice

20040081242 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Optimization of Ocean Color Algorithms: Application to Satellite Data Merging
Ritorena, Stephane; Siegel, David A.; Morel, Andre; [2004]; 12 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): NAS5-00196
Report No.(s): NASA/CR-2004-212758; No Copyright; Avail: CASI; A03, Hardcopy

The objective of the program is to develop and validate a procedure for ocean color data merging, which is one of the major goals of the SIMBIOS project. As part of the SIMBIOS Program, we have developed a merging method for ocean color data. Conversely to other methods our approach does not combine end-products like the subsurface chlorophyll concentration (chl) from different sensors to generate a unified product. Instead, our procedure uses the normalized water-leaving radiances L((sub wN)(lambda)) from single or multiple sensors and uses them in the inversion of a semi-analytical ocean color model that allows the retrieval of several ocean color variables simultaneously. Beside ensuring simultaneity and consistency of the retrievals (all products are derived from a single algorithm), this model-based approach has various benefits over techniques that blend end-products (e.g. chlorophyll): 1) It works with single or multiple data sources regardless of their specific bands; 2) It exploits band redundancies and band differences; 3) It accounts for uncertainties in the L((sub wN)(lambda)) data; 4) It provides uncertainty estimates for the retrieved variables.
Author
Sea-Viewing Wide Field-of-View Sensor; MODIS (Radiometry); Multisensor Fusion

20040081263 California Univ., San Diego, La Jolla, CA, USA
Bio-Optical Measurement and Modeling of the California Current and Southern Oceans
Mitchell, B. Gregg; Mitchell, B. Greg; November 2003; 28 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): NAS5-01002
Report No.(s): CR-2004-212759; No Copyright; Avail: CASI; A03, Hardcopy

The SIMBIOS project's principal goals are to validate standard or experimental ocean color products through detailed

bio-optical and biogeochemical measurements, and to combine Ocean optical observations with modeling to contribute to satellite vicarious radiometric calibration and algorithm development.
Author
Water Color; Ocean Currents; In Situ Measurement; Colorimetry

20040081316 NASA Stennis Space Center, Bay Saint Louis, MS, USA
The Transport and Fate of Particulate Material in a Shallow, Turbid Estuary: Seasonal and Decadal Characteristics from 7-Be and 210-Pb Techniques
Booth, J. G.; McKee, Brent A.; Meriwether, John R.; June 1999; 42 pp.; In English
Report No.(s): SE-1999-06-00019-SSC; Copyright; Avail: CASI; A03, Hardcopy

Seasonal and long-term sediment transport characteristics were examined using surficial sediment 7-Be inventories and the down core distribution of excess 210-Pb. Data were collected in the Barataria Basin, LA over the fifteen month period from September 1995 to January 1997. Seasonal sediment transport rates based on 7-Be inventories ranged from -1.6E3 to 1.42E4 g/m2/yr, whereas decadal sediment burial rates based on excess 210-Pb ranged from 3.83E2 to 2.00E3 g/m2/yr, respectively. Seasonal transport characteristics vary with location in the basin and appear to be largely controlled by seasonal weather patterns and the associated winds. It appears that, at less sheltered locations, long term rates of sediment burial are controlled by frontal passages and the associated strong northerly and southerly component winds; whereas at fetch limited locations burial rates are likely controlled by stronger weather events such as tropical storms and hurricanes.
Author
Sediment Transport; Beryllium; Lead (Metal); Sediments; Annual Variations; Secular Variations; Estuaries

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*.

20040077270 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Did the Pre-RNA World Rest Upon DNA Molecules?
Lazcano, Antonio; Dworkin, Jason P.; Miller, Stanley L.; 2004; 2 pp.; In English; No Copyright; Avail: CASI; A01, Hardcopy

The isolation of a DNA sequence that catalyzes the ligation of oligodeoxynucleotides via the formation of 3' - 5' phosphodiester linkage significance in selection experiments has been reported. Ball recently used this to discuss the possibility that natural DNA molecules may have formed in the primitive Earth leading to the origin of life. As noted by Ferris and Usher, if metabolic pathways evolved backwards, it could be argued that the biosynthesis of 2-deoxyribose from ribose suggests that RNA came from DNA. As summarized elsewhere, there are several properties of deoxyribose which could be interpreted to support the possibility that DNA-like molecules arose prior to the RNA world. For example, 2-deoxyribose is slightly more soluble than ribose (which may have been an advantage in a drying pool scenario), may have been more reactive under possible prebiotic conditions (it forms a nucleoside approx. 150 times faster than ribose with the alternative base urazole at 25 C), while it decomposes in solution (approximately 2.6 times more slowly than ribose at 100 C). Other advantages of DNA over RNA are that it has one fewer chiral center, has a greater stability at the 8.2 pH value of the current oceans, and does not has the 2'5' and 3'5' ambiguity in polymerizations. Yet, there is strong molecular biological and biochemical evidence that RNA was featured in the biology well before the last common ancestor. The presence of sugar acids, including both ribo- and deoxysugar acids, in the 4.6 Ga old Murchison meteorite suggest that both may have been available in the primitive Earth, derived from the accretion of extraterrestrial sources and/or from endogenous processes involving formaldehyde and its derivatives. However, the abiotic synthesis of deoxyribose, ribose, and other sugars from glyceraldehyde and acetaldehyde under alkaline conditions is inefficient and unespecific. Although sugars are labile compounds, the role of cyanamide or borate minerals in the stabilization of the cyclic forms of ribose and other pentoses has recently been demonstrated. Nonetheless, the assumption either RNA or DNA was the first genetic material needs to be supplemented by laboratory models demonstrating that the prebiotic synthesis of activated beta-D-(deoxy)ribonucleotides and their polymers was feasible. As of today such evidence is lacking, and there is no convincing synthesis of any nucleotide, since all model experiments produce complex mixtures of products in which there is no preferential synthesis of chiral D-nucleotides. This strongly suggests that both DNA and RNA may have been preceded by pairing structures much simpler than extant nucleic

acids. It is doubtful that DNA molecules, or indeed other (de0xy)ribofuranoid oligonucleotides formed the basis of these as yet undescribed pre-RNA worlds.
Author
Deoxyribonucleic Acid; Biochemistry; Biological Evolution; Ribonucleic Acids

20040078785 Boston Univ., Boston, MA
Health Status of Current National Guard Members
Proctor, Susan P.; Feb. 2004; 33 pp.; In English
Contract(s)/Grant(s): DAMD17-00-1-0064
Report No.(s): AD-A422960; No Copyright; Avail: CASI; A03, Hardcopy

Two projects are being conducted under this funding award. The cross-sectional survey study (project #1) lays the groundwork to better understand the impacts of Army National Guard (ARNG) jobs on health by examining current and former Massachusetts (MA) ARNG soldiers as they remain State- side; are deployed for combat, peacekeeping, or civilian emergency duties; and after they leave the military. The objectives are as follows: (1) describe the current health status of this ARNG cohort; (2) examine to what extent the job strain of ARNG service affects the relationship between civilian job strain and health and job performance outcomes; and (3) examine whether retention in the ARNG is related to current health status. The study cohort includes current MA ARNG members and prior members who have left ARNG service within the past 3-4 years. A prospective deployment health field study (project #2) involving a MA ARNG group that deployed to Bosnia in 2001 and a comparison group (non- deployed) is being carried out to examine cognitive readiness and potential changes in health related to deployment. Data collection phases for the two research projects are complete; data analyses are in progress. These research projects represent some of the first to focus on the role that one's ARNG job plays on health status and quality of life. (6 tables, 15 figures, 29 refs.)
DTIC
Armed Forces (United States); Deployment; Health; Mental Health; Military Personnel; Physical Fitness; Stress (Psychology)

20040078790 Cleveland Clinic Foundation, Cleveland, OH
Investigation of SNARE-Mediated Membrane Trafficking in Prostate Cancer Cells
Li, Xin; Nov. 2003; 58 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-02-1-0039
Report No.(s): AD-A423230; No Copyright; Avail: CASI; A04, Hardcopy

In order to better understand how polarized membrane trafficking pathways change during the loss of epithelial cell polarity during cancer progression we have studied syntaxins 3 and 4 in prostate cancer. Tumors of different stages from a TRAMP mice, human prostate cancers, and human prostate cancer cell lines were investigated for the expression and subcellular localization of syntaxins 3 and 4 by confocal microscopy and Western blot analysis. Like in renal epithelial cells, syntaxins 3 and 4 are strictly localized to the apical and basolateral plasma membrane, respectively, in normal human and mouse prostate epithelial cells. The expression of syntaxin 3 and syntaxin 4 in the plasma membrane were down-regulated in the tumor cells of Tramp mice and human prostate cancers, although they were still localized apically, basolaterally, respectively in tumor cells, in which the cell polarity was preserved. In contrast, syntaxins 3 and 4 were mislocalized to intracellular vesicles in metastatic prostate cancer cells. The mislocalization was also observed in human prostate cancer cell line DU145 when the cell polarity lost when the cells were cultured in low calcium medium. These results suggest that loss of epithelial cell polarity during cancer progression involves major changes in polarized exocytic pathways.
DTIC
Cancer; Membranes; Prostate Gland; Proteins

20040078792 Cleveland Clinic Foundation, Cleveland, OH
Development of a Biologic Basis for PSMA Targeting in Prostate Cancer
Heston, Warren; Feb. 2004; 45 pp.; In English
Contract(s)/Grant(s): DAMD17-00-1-0043
Report No.(s): AD-A423232; No Copyright; Avail: CASI; A03, Hardcopy

PSMA is a membrane protein that is highly expressed in the prostate and prostate cancers. It is also strongly expressed in the neovasculature of most solid tumors. PSMA is therefore an excellent target for therapy. We have examined the biology of PSMA relative to ;he possibility of it serving as a target for prodrug or targeted small molecule therapeutics. We observe

that although PSMA can hydrolyze glutamate from polygammglutamated methotrexate, that not all antifolate serve as substrates that can have their antitumor activity enhanced by PSMA. We have also observed that other forms of PSMA such as PSM' and PSMA-like proteins, lack folate hydrolase activity and thus will not interfere with the prodrug activities of PSMA. Ligands that bind with high affinity to PSMA may have activity as imaging agents, but we have not observed that ligands increase the rate of internalization of PSMA and thus targeted toxins need to be designed that do not need to be internalized for their antitumor activity to be expressed.
DTIC
Cancer; Folic Acid; Glutamic Acid; Membranes; Prostate Gland

20040078801 Georgetown Univ. Hospital, Washington, DC
Molecular Characterization of Resistance
Clarke, Robert; Jul. 2003; 93 pp.; In English
Contract(s)/Grant(s): DAMD17-00-1-0256
Report No.(s): AD-A423243; No Copyright; Avail: CASI; A05, Hardcopy

This is an annual report of an IDEA Award to study the molecular mechanisms driving acquired antiestrogen resistance. We have identified several genes associated with resistance to ICI 182,780 (Fulvestrant. Faslodex). Our initial studies with NFkB have now been published (Mol Cell Biol, 23: 6887-6900, 2003). Further functional studies on the role of other genes are in progress, and we have made good progress with IRF-1 using a dominant negative construct. We also have built and tested neural network predictors to separate several antiestrogen resistance phenotypes. We have completed and published a method that allows us to visualize very high dimensional data while maximizing the discriminant information in the molecular profiles (J Signal Process Systems, in press, 2003) . Thus, we have made substantial progress in defining initial components of a broader antiestrogen signaling network that is directly associated with acquired antiestrogen resistance.
DTIC
Cancer; Genes; Mammary Glands

20040078803 Minnesota Univ., Minneapolis, MN
Mechanisms of Alcohol Induced Effects on Cellular Cholesterol Dynamics
Sep. 2003; 47 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-00-1-0583
Report No.(s): AD-A423245; No Copyright; Avail: CASI; A03, Hardcopy

Cholesterol is important in regulation of cell structure and function. Equally important is the role that cholesterol plays in vascular disease. The focus of this grant is on mechanisms of alcohol induced disruption of cellular cholesterol transport and distribution. An overriding conclusion of the work of the past 3 years is that ethanol at concentrations observed in problem drinkers and alcoholics (e. g., an individual consuming either 6 beers, or 6 one shots of whiskey, or 6 glasses of wine) has a profound and multifaceted effect on cellular regulation of cholesterol. Our work to date shows that many of the systems involved in regulating cholesterol transport are perturbed by ethanol (HDL, apoA-I, LDL, PC-PLC, PC-PLD). The Golgi complex plays an important role in protein and lipid trafficking and our new data confirm that the Golgi complex is perturbed by ethanol. Moreover, we are now able to measure the distribution of cholesterol in the Golgi complex and we now show that ethanol has a very specific effect on regions of the Golgi complex and acts to reduce cholesterol in the trans-Golgi region.
DTIC
Alcohols; Cholesterol; Endothelium; Heart

20040078804 National Rehabilitation Hospital, Washington, DC
Assistive Technology Research Center
Toerge, John; Feb. 2004; 51 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-00-1-0056
Report No.(s): AD-A423246; No Copyright; Avail: CASI; A04, Hardcopy

The Assistive Technology Research Center, ATRC, is comprised of a set of interrelated research and development projects which apply modern technologies, in particular those which have been exploited in the military, to the practice of medical rehabilitation and technological support for independent living for individuals with disabilities. The Center seeks to work collaboratively to meet the particular mandates of the U.S. Army Medical Research and Materiel Command. Projects are physically conducted and administratively located in the departments of rehabilitation engineering and neuroscience at the National Rehabilitation Hospital. Individual researchers from several other hospital services and clinical professions are also

involved. The ATRC takes advantage of a unusual combination of skills, facilities, and interest; specifically a strong community of r&d specialists in biomedical engineering and neuropsychology is positioned to undertake collaborative projects unlike those under way at more conventional staffed laboratories. The projects whose progress is detailed in this report target the needs of individuals with head injury, stroke, spinal cord injury and developmental disabilities. These activities address the clinical techniques of psychologists, occupational, and physical therapist, physicians and speech pathologists. The make use of technologies based particularly in software development but also in man-machine systems, human factors, biomechanics, telehealth, virtual reality methods, and instrumentation. Assessment and enhancement of motor and cognitive function; and support and measurement of functional performance are the prevailing research themes.
DTIC
Medical Science; Neurology; Psychology; Research Facilities; Telemedicine

20040078805 Indiana Univ., Indianapolis, IN
Roles of Steroid Receptor Coactivators in Breast Cancer
Jeng, Meei-Huey; Aug. 2003; 14 pp.; In English
Contract(s)/Grant(s): DAMD17-99-1-9430
Report No.(s): AD-A423247; No Copyright; Avail: CASI; A03, Hardcopy

The purpose of this study is to determine the roles of steroid receptor coactivators in breast cancer. The scope of the research is assessing the expression of SRC-1 family members (SRC-1, TIF2, and AIB1) during breast cancer progression using breast cancer tissue and adjacent normal tissue obtained from Indiana University Tissue Procurement Facility. In addition, functions of these coactivators have been studies during this report period. We have constructed adenovirus expressing these three coactivators. We found that AIB1 protein was overexpressed in human breast cancer specimens, as compared to adjacent normal breast tissue. In addition, increased expression of AIB1 in human breast cancer cells stimulated the S phase entry during cell cycle progression, indicating the involvement of AIB1 in cell cycle control and cell growth of human breast cancer cells. Furthermore, overexpression of AIB1 dramatically increased the phosphorylation of Akt and Akt kinase activity in human breast cancer cells. These studies provide important insights how AIB1 works in human breast cancer cells to promote breast cancer progression.
DTIC
Cancer; Mammary Glands; Steroids; Tissues (Biology)

20040078807 Sunnybrook and Women's Coll. Health Sciences Centre, Toronto, Ontario
Constrained MRI Impedance Imaging
Plewes, Donald B.; Sep. 2003; 15 pp.; In English
Contract(s)/Grant(s): DAMD17-01-1-0637
Report No.(s): AD-A423254; No Copyright; Avail: CASI; A03, Hardcopy

An approach for measuring local electric tissue properties in-vivo is proposed. The technique relies upon the integration of MRI data with electrical potential measurements. Through a technique referred to as constrained electric impedance tomography (CEIT), the conductivity of specific regions identified in MRI data can be calculated. A two- dimensional simulation of a phantom containing three-regions of varying electrical conductivity was generated and a finite- element model of electrical current propagation created. The geometry encompassed a total of 24 electrodes arranged around the object with voltages applied between all possible electrode pairs. The resulting potentials for the remaining electrodes were calculated. In order to constrain the reconstruction, co-registered MRI data was used to define the boundaries of the internal structures. Conductivity values were assigned to these regions and the resulting field patterns calculated form a finite element model of the problem. The assumed conductivity was adjusted with an iterative nonlinear optimization technique that minimized the difference between the calculated and measured electrode potentials. When used in the absence of noise, the calculations converged quickly toward the correct conductivity values. However, with the addition of noise (SNR=10), we noted conductivity errors of -20% for high conductivity structures. These encouraging results demonstrate the electric impedance tomography reconstruction is possible by integrating MRI derived spatial constraints. Further improvement would be expected in a full 3D geometry to provide a greater number of independent measures for the iteration process. Further research in this topic is warranted.
DTIC
Cancer; Imaging Techniques; Impedance; Magnetic Resonance; Mammary Glands; Tomography

20040078809 Jackson (Henry M.) Foundation, Rockville, MD

Development of Internet-Accessible Prediction Models for Prostate Cancer Diagnosis, Treatment, and Follow-Up

Sun, Leon L.; Moul, Judd W.; Wu, Hongyu; Bensouda, Fatiha; Wu, Hongyan; Jan. 2004; 152 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAMD17-02-1-0066

Report No.(s): AD-A423256; No Copyright; Avail: CASI; A08, Hardcopy

The objective of the development of Internet- accessible prediction models is to enhance the diagnosis accuracy, treatment efficacy and prognosis for patients with carcinoma of prostate cancer (CaP). On the basis of the established tools (Oracle database, Internet-accessible data collection applications, and program packages for data retrieval and standardization) in the first year of the support, the roles of a set of variables (race/ethnicity, diagnostic age, labs, delayed treatment interval, treatment types, early and late hormonal therapy, etc.) on the outcome of CaP patients were analyzed. The results show that delayed surgery over 3 months post diagnosis would impact the outcome of patients with high risk disease (submitted to J Urol). Early hormonal therapy can delay clinical metastasis only in men with high risk disease (J urol, in press). Race, percentage of cancer positive cores over total biopsy cores, surgical margin status and seminal vesicle invasion are independent prognostic variables for men with intermediate risk disease (submitted to J urol). Race plays an important role in tumor volume and spatial distribution based on 3 dimensional reconstructed models with radical prostatectomy specimens (submitted to J Urol). Post-treatment PSA doubling time < 3 months is a surrogate for prostate cancer specific mortality following surgery or radiation therapy (J Clin Onc 2003). PSA Doubling time calculator and CPDR nomograms were implemented on CPDR website.
DTIC

Cancer; Diagnosis; Internets; Mathematical Models; Medical Science; Prostate Gland

20040078810 Prins Maurits Lab. TNO, Rijswijk

New Approaches Towards the Elucidation of Epidermal-Dermal Separation in Sulfur Mustard-Exposed Human Skin and Directions for Therapy

Mol, Marijke A.; Jan. 2004; 23 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAMD17-02-1-0206

Report No.(s): AD-A423257; No Copyright; Avail: CASI; A03, Hardcopy

Microvesication in human skin, due to ex viva exposure to HD, can be blocked by 1) hydroxamate-based inhibitors of MMPs and related enzymes, 2) furin inhibitor and 3) pancaspase inhibitor. The observation that one of the hydroxamate-based inhibitors, BB94, can be applied until 18h after exposure to HD suggests that non-urgent cure of HD casualties is possible. During pathogenesis of HD-induced microvesication the expression of laminin-5, one of the key proteins in epidermal dermal attachment, is reduced. However, although laminin-5 is target protein for MMps and related enzymes, these enzymes are not responsible for the decrease in laminin-5 expression. Moreover, epidermal-dermal attachment is still possible, in spite of reduced amounts of laminin-5. Cleavage of other attachment proteins than laminin-5 by MMps and related enzymes probably causes the break between epidermis and dermis. Impediment of the apoptotic cell death process appears to be also very effective in maintaining epidermal-dermal adhesion. The observation that caspase inhibitors prevent fragmentation of keratins 14, 16, and 17 in HD-exposed HEK may suggest that an intact cytoskeleton of keratin filaments is essential for epidermal-dermal adhesion. The observation that caspase inhibitors prevent fragmentation of keratins 14, 16, and 17 in HD-exposed HEK may suggest that an intact cytoskeleton of keratin filaments is essential for epidermal-dermal attachment.
DTIC

Skin (Anatomy); Sulfur; Sulfur Compounds; Therapy

20040078813 Utah Univ., Salt Lake City, UT

Synthesis of Lipoprotein Immunostimulants for Treating Prostate Cancer

Hinshaw, Jerald C.; Jan. 2004; 14 pp.; In English

Contract(s)/Grant(s): DAMD17-02-1-0150

Report No.(s): AD-A423265; No Copyright; Avail: CASI; A03, Hardcopy

The prospects of stimulating a patient's own immune system as a therapeutic approach to the treatment of cancer in general, and prostate cancer in particular, is intriguing. However, thus far immunotherapeutic approaches to the treatment of cancer (including prostate cancer) in the clinical setting have not been uniformly successful. We are chemically synthesizing molecular conjugates that comprise a Toll-Like Receptor (TLR) ligand covalently linked to a prostate cancer tumor-associated antigen protein or peptide. Using this tactic, we anticipate that the TLR-ligand portion of the conjugates will stimulate dendritic cells (DCs) (as well as other TLR-expressing antigen presenting cells) to secrete immune-activating cytokines. Concomitantly the tumor antigen component of the complex will be processed and presented to activated T cells. In this way,

a new and potent immune system stimulation and antigen presentation mechanism aimed at the stimulation of combined CD8+ and CD4+ T-cell responses, along with B-cell activation via the innate/adaptive immune response connection, is being developed. We have prepared TLR-4 and TLR-7 ligands and are preparing mouse immunization experiments to test the efficacy of this new approach to cancer immunotherapy.
DTIC
Cancer; Lipoproteins; Prostate Gland

20040078814 Ohio State Univ., Columbus, OH
Sodium Iodide Symporter Gene Transfer for Imaging and Ablation of Prostate Cancer
Jhiang, Sissy M.; Jan. 2004; 31 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-02-1-0119
Report No.(s): AD-A423266; No Copyright; Avail: CASI; A03, Hardcopy

The sodium iodide symporter (NIS) mediates iodide uptake in thyroid follicular cells and provides a mechanism for effective radioiodide treatment of residual, recurrent, and metastatic thyroid cancers. The objective of the proposed research is to test the hypothesis that expression of exogenous hNIS in prostatic tissue will enable radioiodide to localize and ablate residual prostate cancer following prostatectomy, such that recurrence and metastasis of the disease can be prevented. The specific aims of this project are to: (1) confirm metastatic progression to distant lymph nodes and lungs following subcutaneous inoculation of rats with MATLyLu prostatic adenocarcinoma cells expressing hNIS; (2) investigate whether radioiodide therapy will prevent metastases and/or prolong survival in rats bearing subcutaneous MATLyLu tumors that express hNIS; (3) determine the expression level of hNIS required to elicit selective radioiodide-mediated killing of MATLyLu-hNIS prostatic adeoncarcinoma cells in vivo; and, (4) restrict hNIS expression in prostatic tissue under transcriptional regulation of prostate-specific promoter.
DTIC
Ablation; Cancer; Imaging Techniques; Prostate Gland; Sodium Iodides

20040078822 California Univ., San Francisco, CA
Identification of MMP Substrates in the Mammary Gland
Dijkgraaf, Gerrit J.; Jul. 2003; 12 pp.; In English
Contract(s)/Grant(s): DAMD17-02-1-0333
Report No.(s): AD-A423278; No Copyright; Avail: CASI; A03, Hardcopy

Matrix metalloproteinases (MMPs) are a family of zinc-dependent extracellular endopeptidases that have traditionally been viewed as effectors of late stages of cancer evolution. Recently, MMP-3 and MMP-14 were shown to act as natural tumor promoters when overproduced in mouse mammary glands (Sternlicht et al., 1999; Ha et al., 2001). To understand how these MMPs can alter cell behavior and influence breast cancer susceptibility, the yeast two-hybrid system was used to identify interacting proteins as potential novel MMP substrates. Three different bait' constructs were generated for each mouse and human MMP, but only the hemopexin domain hybrids appear suitable for screening. The catalytic domain hybrids are sticky' and auto-activate one or both reporters. The full-length hybrids also contain this sticky' catalytic domain and are probably poorly folded, as mature MMPs expressed in the yeast cytoplasm are inactive. Screening of a mouse and human mammary gland cDNA library form ATCC identified to date only intracellular interacting proteins. As the mRNA sources for these libraries were less than optimal, we may look for other libraries or make our own. In the latter case rough-ER bound mRNA will be isolated, to enrich for clones encoding membrane and secreted proteins.
DTIC
Cancer; Mammary Glands; Membranes; Substrates

20040078823 Michigan Univ., Ann Arbor, MI
Humanizing the Mouse Androgen Receptor to Study Polymorphisms and Mutations in Prostate Cancer
Robins, Diane M.; Jan. 2004; 7 pp.; In English
Contract(s)/Grant(s): DAMD17-02-1-0099
Report No.(s): AD-A423279; No Copyright; Avail: CASI; A02, Hardcopy

Androgen receptor (AR) plays a critical role in prostate oncogenesis. Allelic variants of AR, particularly in length of an N-terminal glutamine (Q) tract, are associated with distinct risks of disease. Mutation of AR in tumors may enter into resistance to treatment and androgen independence. Initiation and progression have been difficult to study due to lack of early disease samples and lack of animal models. This has been partly overcome with transgenic mouse tumor models. However,

mouse AR differs significantly from human in the N- terminus. In order to critically evaluate the role of the polymorphic glutamine tract in disease, and to identify relevant sites in the N-terminus whose mutation can lead to androgen-independent AR function, we have "humanized" the mouse by converting its androgen receptor gene to the human sequence. We have done this by homologous recombination in embryonic stem cells, introducing AR alleles with 12, 21, or 41 glutamines. Mice bearing the "wild type" allele with 21 glutamines are normal by all indications, including microarray analysis. However, expression of specific androgen target genes suggests subtle disfunctions exist. This will be explored in detail by examining tumor progression and by sequencing AR cDNAs from tumors of castrated vs. intact mice. DTIC

Cancer; Genes; Hormones; Males; Mice; Mutations; Polymorphism; Prostate Gland; Receptors (Physiology)

20040078824 Georgetown Univ., Washington, DC

FGF Activation and Signaling in Breast Cancer

Swift, Matthew R.; Jul. 2003; 16 pp.; In English

Contract(s)/Grant(s): DAMD17-02-1-0397

Report No.(s): AD-A423280; No Copyright; Avail: CASI; A03, Hardcopy

Fibroblast growth factor binding protein (FGF-BP1) is a crucial molecule that acts to chaperone active FGFs to receptors, thus propagating angiogenic signals for the development of new vasculature. We have shown that FGF-BP1 is expressed in head and neck, skin, cervical, and lung squamous cell carcinomas. A second family member, FGF-BP2 has been identified in our lab and is present in mammary tissue. In this grant, we hypothesized that FGF-BP2 acts in a similar pro- angiogenic capacity as FGF-BP1. The aims were 1) to produce recombinant FGF-BP2 and test its effect on signal transduction, and 2) to study the expression of FGF-BP2 during mouse mammary gland development and carcinogenesis. To date, we have isolated human FGF-BP2 cDNA and protein and confirmed its ability to modulate FGF2. However, we have yet to discover the murine homologue to FGF-BP2. We have identified a third family member, FGF-BP3 in human and mouse. Accordingly, we have adjusted our focus to the characterization of FGF-BP3 activity and expression while continuing our search for murine FGF-BP2. FGF-BP3 has been shown to complex with FGF2, promote increased proliferation, MAPK activation, and anchorage-independent growth in SW-13 adrenal carcinoma cells, and is present in high levels in mouse embryonic tissue. DTIC

Cancer; Mammary Glands

20040078826 University of North Texas Health Science Center, Forth Worth, TX

Neuroprotection from Brain Injury by Novel Estrogens

Simpkins, James W.; Aug. 2001; 176 pp.; In English

Contract(s)/Grant(s): DAMD17-99-1-9473

Report No.(s): AD-A423288; No Copyright; Avail: CASI; A09, Hardcopy

The present program of research aims at determining the neuroprotective activity of novel estrogens in both male and female animal models for brain ischemic damage. We have proposed to achieve 4 technical aims over the course of 3 years. These aims relate to a description of the activity of several estrogens against cerebral damage related to middle cerebral artery occlusion in a rodent model, when the estrogens are administered prior to or following the ischemic event. We also are pursuing our observation that androgen reduction is neuroprotective in male subjects. We will assess (during years 2 and 3 of the grant) the potential mechanism(s) of the neuroprotective activity of estrogens (and of androgen reduction) in these models by determining the extent to which estrogens (or androgen reduction) reduce oxidative damage associated with stroke and then assess the involvement of signal transduction processes and anti-apoptotic proteins in the neuroprotective activity of estrogens. Collectively, these studies will provide the knowledge needed to determine if estrogen therapy and androgen reduction therapy are usefi%l in protection of the brain tissue from damage related to the activities of U.S. Army male and female personnel.

DTIC

Brain; Brain Damage; Estrogens; Injuries

20040078832 Health Research, Inc., Buffalo, NY

Biomarkers of Selenium Chemoprevention of Prostate Cancer

Dong, Yan; Jan. 2004; 44 pp.; In English

Contract(s)/Grant(s): DAMD17-02-1-0134

Report No.(s): AD-A423294; No Copyright; Avail: CASI; A03, Hardcopy

The present study examined the cellular and molecular effects of selenium in the androgen-responsive LNCaP cells. Physiological concentrations of selenium produced a dose- and time-dependent inhibition of growth with this cell line. An arrest at 00/G1 phase was observed at 24 h. A marked decrease in the transcript and protein level of androgen receptor (AR) and prostate-specific antigen was detected as early as 6 b, suggesting that the interference of androgen signaling by selenium is not a consequence of growth arrest. Additional experiments showed that selenium was capable of suppressing the DNA-binding and the trans-activating activity of AR. Gene expression profiling was carried out in order to identify other AR-targets responsive to selenium modulation. The analysis showed that selenium was able to countermand the expression of a subset of 12 additional AR-regulated genes. These genes all contain ARE motifs in their promoters. As a follow-up to the above investigation, we also found that selenium favorably altered the expression of 12 putative oncogenes, tumor-suppressor genes, or genes implicated in the transformation to androgen-independency. By extracting relevant information from the microarray data, we have thus uncovered a number of potentially exciting clues regarding the action of selenium in prostate cancer prevention.
DTIC
Biomarkers; Cancer; Prostate Gland; Selenium

20040078834 Battelle Memorial Inst., Columbus, OH
A Medical Research and Evaluation Facility (MREF) and Studies Supporting the Medical Chemical Defense Program (Task Order 0020): Evaluation of Decontamination Solutions for Use on Remains
Estep, James E.; Olson, Carl T.; Oct. 2004; 69 pp.; In English
Contract(s)/Grant(s): DAMD17-99-D-0010
Report No.(s): AD-A423297; No Copyright; Avail: CASI; A04, Hardcopy

Priority 1 - Embalming Fluid Effects on Chemical Warfare Agent- The objective was to determine if embalming fluids alone would significantly destroy chemical warfare agents (HD and VX) such that is would serve as a decontaminant. This would simplify the decontamination procedure and provide a cost savings to the Army. The study evaluated embalming fluids Rex 36, Hexaphene MA 64, and Polar Cavity FirmindexR 53, as potential decontamination material by assaying the extracts with time. Priority 2 - Compare DF2OO with Soapy Water/2 Percent Bleach - The objective was to determine if DF2OO was any better than plain soapy water/2 percent bleach as a decontamination treatment. This study tested chemical warfare agents (HD and VX) on pigskin obtained form a slaughterhouse using DF2OO and soapy water/2 percent bleach as decontamination treatments. Priority 3 - Effect of DF2OO on Skin Integrity under Expected Human Remains Storage Conditions - The objective was to determine if DF2OO, in the presence of various embalming fluids, caused cosmetic or structural damage to the skin under the conditions that we would expect human remains to be handled. The concern was that the DF2OO might affect the integrity of the skin resulting in severe damage from normal handling procedures or possible damaging cosmetic effects. The testing procedures were carried out using porcine skin tissue. The skin was exposed to DF2OO and various embalming fluids and stored at room temperature for approximately 1 week. Two concentration of bleach were also evaluated in the presence of the embalming fluids. No chemical warfare agents were used
DTIC
Chemical Defense; Chemical Warfare; Decontamination; Defense Program; Medical Science

20040078835 Civil Aeromedical Inst., Oklahoma City, OK
The Formation of Ethanol in Postmortem Tissues
Johnson, Robert D.; Lewis, Russell J.; Angier, Mike K.; Vu, Nicole T.; Feb. 2004; 14 pp.; In English
Report No.(s): AD-A423300; DOT/FAA/AM-04/4; No Copyright; Avail: CASI; A03, Hardcopy

During the investigation of aviation accidents, postmortem samples obtained from fatal accident victims are submitted to the FAA's Civil Aerospace Medical Institute for toxicological analysis. During toxicological evaluations, ethanol analysis is performed on all cases. Many species of bacteria, yeast and fungi have the ability to produce ethanol and other volatile organic compounds in postmortem specimens. The potential for postmortem ethanol formation complicates the interpretation of ethanol-positive results from accident victims. Therefore, the prevention of ethanol formation at all steps following specimen collection is a priority. Sodium fluoride is the most commonly used preservative for postmortem specimens. Several studies have been published detailing the effectiveness of sodium fluoride for the prevention of ethanol formation in blood and urine specimens; however, our laboratory receives blood or urine in approximately 70% of cases. Thus, we frequently rely on tissue specimens for ethanol analysis. The postmortem tissue specimens received by our laboratory have generally been subjected to severe trauma and may have been exposed to numerous microbial species capable of ethanol production. With this in mind, we designed an experiment utilizing unadulterated tissue specimens obtained from a aviation accident victims to determine the effectiveness of sodium fluoride at various storage temperatures for the prevention of microbial ethanol formation. We

found that without preservative, specimens stored at 4 deg C for 96 h showed an average increase in ethanol concentration of 1470%. At 25 deg C, these same specimens showed an average ethanol increase of 1432% after 48 h. With the addition of 1. 00% sodium fluoride, there was no significant increase in ethanol concentration at either temperature.
DTIC
Aircraft Accidents; Ethyl Alcohol; Microorganisms; Tissues (Biology)

20040078836 Hebrew Univ., Jerusalem
Development of Protective Agent Against Sulfur Mustard-Induced Skin Lesions
Wormser, Uri; Mar. 2004; 40 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-03-2-0013
Report No.(s): AD-A423301; No Copyright; Avail: CASI; A03, Hardcopy

Previous studies demonstrated the protective effect of our novel iodine formulation against SM-induced skin lesions. In order to improve the preparation we investigated the inflammatory processes occurring upon SM exposure and particularly those involve cyclooxygenase activity. To evaluate the role of cyclooxygenas-l and -2 (COX-l, COX-2) in sulfur mustard-induced skin toxicity, we applied the agent to the ears of wildtype (WI) and COX-l- and COX-2-deficient mice. In the latter, ear swelling 24 and 48 h after exposure was significantly reduced by 55% and 30%, respectively, compared to WT These findings were confirmed by histopathological evaluation. The COX-2 inhibitor celecoxib resulted in significant reductions of 27% and 28% in ear swelling at intervals of 40 and 60 min between exposure and treatment, respectively. These findings encouraged us to introduce celecoxib, together with the steroidal anti-inflammatory agent clobetasol, into our iodine preparation. After optimization procedures, the ointment was efficacious 60 min (or less) following exposure. The ability of low iodine concentrations to scavenge reactive oxygen species and to inhibit oxidative burst of activated mouse neutropils might explain the protective mechanism of action of iodine. Previous results have shown that prophylactic injection of H2A histone fragment protected against SM-induced skin lesions. In the present report we found that the T1/2 of the peptide in mouse and humans serum was 7 and 14 min. We also identified the cleavage sites of the peptide by mouse and human serum proteinases; and accordingly synthesized N-methylated analogs for stabilizing the peptide against this proteolytic activity. Injection of the peptide 30 min after exposure significantly reduced ear swelling in the mouse edema model.
DTIC
Enzymes; Health; Lesions; Peptides; Skin (Anatomy); Sulfur; Sulfur Compounds; Toxicity

20040078837 Texas Univ. Health Science Center, Houston, TX
Noninvasive Continuous Physiologic Data Acquisition and Analysis as a Predictor of Outcome Following Major Trauma: A Pilot Study
Duke, James H.; Holcomb, John B.; Sep. 2003; 20 pp.; In English
Contract(s)/Grant(s): DAMD17-02-1-0689
Report No.(s): AD-A423303; No Copyright; Avail: CASI; A03, Hardcopy

The ability to accurately triage trauma patients can be problematic in the prehospital environment. Many prehospital triage scores have been developed to facilitate this process, perhaps demonstrating that a good deal of uncertainty remains in these methods. 1-18 The primary reason to perform prehospital scoring is to determine if the patient should be transported immediately to a trauma center (TC) and thus benefit from the TC's ability to rapidly provide lifesaving interventions (LSI), resulting in the survival of patients that would have otherwise died. 19-27 The potential benefit of the TC is related to the concentration of experienced personnel and technology at one location that specializes in the care of seriously injured patients. Organized TC's have been shown to decrease preventable mortality in the intermediate group of patients that arrive seriously ill. Mortality in current mature TC's is approximately 3% of admissions and usually occurs in patients that have devastating injuries and a very low probability of survival, despite very aggressive diagnostic and intervention maneuvers.27 Thus using mortality as the primary endpoint of a prehospital triage tool only identifies those small numbers of patients who received a LSI and died at the TC rather than those who received LSI and benefited from the intervention. Others have recommended utilizing an Injury Severity score (ISS) > 15 as an indicator of appropriate triage, however these data are not available until hospital discharge. This highlights the fact that while ISS is often appropriately used to retrospectively compare outcome between groups of patients, the data that are used to compile the ISS are not available until discharge from the hospital. Thus the ISS is not a tool that can be utilized for prehospital or even ED triage. More importantly, up to 25% of patients with low (1 - 9)ISS scores required the resources available at TC's.28.
DTIC
Data Acquisition; Medical Services; Physiology

20040078838 Rochester Univ., NY
Suppression of Androgen Receptor Transactivation by Akt Kinase
Chang, Chanshang; Jan. 2004; 15 pp.; In English
Contract(s)/Grant(s): DAMD17-02-1-0133
Report No.(s): AD-A423309; No Copyright; Avail: CASI; A03, Hardcopy

Data suggest androgen/androgen receptor (AR) may be involved in proliferation of prostate cancer, but opposite roles of in inhibition of cell growth and apoptosis are documented. The detailed mechanism of how androgen/AR functions in apoptosis, remains unclear. Serine/threonine kinase (Akt) plays a role in promoting cell survival through anti-apoptotic effects. Akt was found active in prostate cancer LNCaP cells and plays an essential role for survival. Our preliminary data demonstrated that Akt phosphorylates AR at Ser2l0 and Ser790. Mutation at Ser2l0 results in reversion of Akt-mediated suppression of AR transactivation. Activation of phosphatidylinositol-3-OH kinase/Akt pathway results in the suppression of AR target genes. Our hypothesis is that Akt may control androgen/AR-induced apoptosis by phosphorylating and inhibiting AR. In this past year our Akt studies have led into study of the PTEN pathway. We have shown 1) via P13K/Akt- dependent pathway, PTEN regulates AR activity in high passage LNCaP cells and suppresses AR activity in the early passage LNCP cells, 2) P13K/Akt pathway promoted AR ubiquitylation, leading to AR degradation, and 3) restoration of AR function or P13KIAkt pathway rescues cells from PTEN-induced apoptosis. Our project's success may enhance our understanding of cross- talk between Akt and androgen/AR pathway on prostate cancer progression.
DTIC
Cancer; Hormones; Males; Prostate Gland

20040078839 Illinois Univ. at Urbana-Champaign, Urbana, IL
Control of Transformation and Invasiveness of Breast Cancer Cells by Estrogen Regulation of Proteinase Inhibitor 9
Antonaci, Francesca C.; Apr. 2003; 23 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-02-1-0410
Report No.(s): AD-A423310; No Copyright; Avail: CASI; A03, Hardcopy

Coagulation factor VIIa, a circulating serine protease, binds to its cofactor, tissue factor (TF), to trigger the blood clotting cascade. TF is a glycoprotein present on the surface of a variety of cell types found outside of the vasculature, and on various types of cancer cells. TF:VIIa complex formation ultimately leads to fibrin polymerization and platelet activation, in both normal states and thrombotic disease. Complex formation has also been shown to activate certain signaling cascades, altering cellular properties such as adhesion, migration, and potential for apoptosis. Many types of cancer cells have been shown to express high levels of TF. Blockage with anti-TF antibodies has demonstrated that metastasis depends on the presence of catalytically competent TF:VIIa complexes. Such cellular alterations, the high morbidity associated with thrombosis, and the privileged position of VIIa in the coagulation cascade, make inhibition of TF:VIIa an important issue in cancer therapy. We have demonstrated that antithrombin (AT) can inhibit TF:VIIa, when in the presence of heparin, and AT:VIIa complexes have been detected in plasma, suggesting that Vila is inhibited by AT in vivo. We have also shown that vitronectin enhances AT activity, and hence, VIIa inhibition, and that AT can reversibly inhibit VIIa in vitro.
DTIC
Blood Coagulation; Cancer; Cells (Biology); Estrogens; Inhibitors; Mammary Glands; Proteins

20040078840 National Academy of Sciences - National Research Council, Washington, DC
Patterns of Illness and Care Before Deployment to the Persian Gulf War
Miller, Richard N.; Jun. 2003; 35 pp.; In English
Contract(s)/Grant(s): DAMD17-00-C-0027
Report No.(s): AD-A423311; No Copyright; Avail: CASI; A03, Hardcopy

Between 1990 and 1991, some 700,000 American military personnel were deployed to the Persian Gulf. Following the return of these troops home, many complained of ailments that could not be medically explained. Subsequently, the Department of Veterans Affairs and the Department of Defense created several registries to document and track illness associated with the PGW. The current study compares the pattern of health care seeking between registrants with multi-symptom illness and those considered well in the year prior to deployment. Cases were defined as those registrants assigned code diagnoses such as somatization disorder, myalgia and myositis unspecified, chronic fatigue syndrome, fibromyalgia, unexplained musculoskeletal and connective tissues problems, etc. Controls were defined as individuals with a code indicating "well" or "no complaint." Rates of those registrants with multi-symptom illness were compared to those defined as "well." Results were broken down by the type of registry (Persian Gulf Registry Old, Persian Gulf Registry New, and Comprehensive Clinical Evaluation Program) and the type of medical care visit (whether it was an elective

visit or administrative visit). Odds rations and regression coefficients were calculated using logistic regression analyses, and adjusted for age, race, sex, marital status, and enlisted status. It is anticipated that the results of this study will be published in a peer-reviewed scientific journal.
DTIC
Deployment; Military Personnel; Persian Gulf; Sicknesses; Warfare

20040078842 Vanderbilt Univ., Nashville, TN
Paracrine Regulation of Prostatic Carcinogenesis
Hayward, Simon W.; Jan. 2004; 12 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-02-1-0151
Report No.(s): AD-A423319; No Copyright; Avail: CASI; A03, Hardcopy

This report summarizes the second year of activity on this study. The long term goal of this project is to better understand why some prostate tumors grow aggressively while others are extremely slow growing lesions. The objective of the proposed research is to establish immortalized stromal cell lines derived from normal human prostate and from human prostate cancer and to use these cells to investigate the role of IGFs in prostate cancer growth. In this year we have focussed on using the molecular tools made in year one to generate new immortalized stromal cell lines and to examine the effects of IGF signaling on malignant and pre-malignant epithelial cells. Data have been generated, which at this time must be considered preliminary, which suggest a role for IGF signaling in malignant progression as hypothesized in the original application. No major technical obstacles have cropped up. The project is close to its timeline predicted in the accepted statement of work.
DTIC
Cancer; Carcinogens; Epithelium; Prostate Gland; Tumors

20040078844 Cancer Therapy and Research Foundation, San Antonio, TX
Predictive Biomarkers of Response to Bcl-2 Biomodulation by G3139 and Docetaxel in Hormone-Refractory Prostate Cancer
Tolcher, Anthony W.; Jan. 2004; 20 pp.; In English
Contract(s)/Grant(s): DAMD17-02-1-0047
Report No.(s): AD-A423327; No Copyright; Avail: CASI; A03, Hardcopy

The specific aims of this grant are to demonstrate (1) that bcl-2 overexpression in prostate cancer specimens is a predictive biomarker for enhanced responsiveness to G3139, and antisense oligonucleotide targeting Bcl-2, and docetaxel; (2) that the degree of bcl-2 downregulation in normal tissue surrogate (peripheral blood mononuclear cells MNC) will predict prostate cancer responsiveness to G3139 and docetaxel; and (3) whether the pharinacokinetic parameters of 63139 and docetaxel are predictive of bcl-2 biomodulation and antitumor activity, respectively. The mean G3139 steady-state concentrations (Css) was significantly higher in responding patients than in those patients who did not respond (6.2 +/- 0. 4 versus 4.3 +/- 0.3 microg/mL, p = 0.015), with a longer, although not statistically significant, increase in median survival for patients with Css > 5 microg/mL (689 versus 595 days, P > 0.05). Bcl-2 levels in MNC, although decreased in the majority of patients after 5 days of G3139, were not predictive of clinical response. G3139 Cs5 is a predictive marker for response and optimal concentrations for G3139 may need to be targeted above 5 microg/mL. Immunohistochemistry for Bcl-2, BAX and Bcl-X(L) and the relationship to response and survival is continuing.
DTIC
Biomarkers; Cancer; Hormones; Predictions; Prostate Gland; Refractories

20040078846 JAYCOR, San Diego, CA
Overuse Injury Assessment Model
Stuhmiller, James H.; Feb. 2004; 96 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-02-C-0073
Report No.(s): AD-A423332; No Copyright; Avail: CASI; A05, Hardcopy

The aim of the present research is to equip our military leaders with knowledge and software tools which better assist them in the design of boot camp training regimens. More specifically, our research enhances of the state-of-the-art in bone overuse injury prediction. A significant part of our effort is geared towards the prediction and analysis of skeletal strain fields which result during a specific pattern of locomotion and for a given skeletal morphology. Once the intrinsic loads on the skeleton are known for various activities, it is possible to make educated inferences on how different training programs affect skeletal fatigue life, or in other words, the injury rate. First we researched and evaluated different approaches taken by others who have

attempted to predict bone overuse injury rates before us. We then embarked on a multifaceted approach which utilizes biomechanics, inverse dynamics, static optimization, structural analysis, and statistical regression to determine skeletal fatigue, loads during locomotion. The present deliverable is a model which accepts experimental video and force plate data gathered from normal gait as inputs and then determines the strain fields which arise due to the observed locomotion in a realistic simulated femur.
DTIC
Bones; Injuries

20040078848 Johns Hopkins Univ., Baltimore, MD
Antigen-Specific Immunotherapy Using Lentivirus- Transduced Hematopoietic Progenitor Cell: A Novel Approach for the Treatment of Metastatis Prostate Cancer
Cheng, Linzhao; Jan. 2004; 14 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-02-1-0075
Report No.(s): AD-A423340; No Copyright; Avail: CASI; A03, Hardcopy

This group has completed the goal set for Task 1 ("To examine the immune responses to a model tumor antigen selectively expressed in DCs differentiated in vivo from transduced hematopoietic progenitor cells"). They have: 1) made lentiviral vectors expressing a model tumor antigen influenza hemagglutinin (HA) ; 2) developed a method to efficiently transduce mouse bone marrow progenitor cells that reconstitute immune and blood systems in irradiated and transplanted mice; 3) demonstrated that the transplanted and transduced cells can persistently present the HA model tumor antigen and stimulate T cell responses; 4) devised a tripartite strategies to mount powerful and specific attack on HA-expressing experimental tumors; and 5) demonstrated the efficacy to eradicate an aggressive pre-established tumor expressing the HA antigen. This study provides a proof-of- principle in immune competent animals models that transplantation of antigen gene transduced hematopoietic progenitor cells adds a new component to achieve potent and sustained antigen-specific immunotherapy of aggressive tumors. Key discoveries by this group and their Hopkins colleagues were published in a leading biomedical research journal Nature Medicine (10: 882).
DTIC
Antigens; Cancer; Genes; Hematopoietic System; Metastasis; Prostate Gland

20040078850 Wisconsin Univ., Madison, WI
Molecular Markers and Prostate Cancer Radiation Response
Ritter, Mark A.; Jan. 2004; 16 pp.; In English
Contract(s)/Grant(s): DAMD17-02-1-0164
Report No.(s): AD-A423342; No Copyright; Avail: CASI; A03, Hardcopy

Two cohorts of relatively early stage prostate cancer patients, one treated with radiation therapy and the other with surgery, have been identified and have been shown to have similar 5-year disease free survivals after treatment. Abnormal p53 protein levels, indicating mutation, are present in a substantial percentage of relatively early stage prostate cancer patients. High levels of p53 protein strongly correlates, both under univariate and multivariate analysis with higher rates of subsequent PSA failure in patients treated with radiation therapy but not in patients treated with radical prostatectomy, indicating a predictive power that has significant specificity for radiation. This suggest that p53 may be a very strong predictor of outcome after radiotherapy but not after surgery in early stage prostate cancer. If pretreatment markers specific for radiation response could be identified and confirmed in additional clinical trials, their availability could ultimately supplement the medical decision-making process and allow a better prospective tailoring of treatment to the biological characteristics of each patients tumor. For example, a patient predicted to be at high risk for failure specifically after conventional radiotherapy might be better served by surgery or by aggressive dose escalation or perhaps by therapies that target the identified molecular defect.
DTIC
Cancer; Markers; Prostate Gland; Radiation Effects

20040078854 Brooke Army Medical Center, Fort Sam Houston, TX
A Statistical Analysis of the Relationship of Distance and Mode of Transportation on Length of Stay at Brooke Army Medical Center
Hagen, John P.; Jul. 1997; 69 pp.; In English
Report No.(s): AD-A423351; BAMC-3-97; No Copyright; Avail: CASI; A04, Hardcopy

This retrospective quantitative study examined the relationship of distance, measured based on catchment are status, and

mode of transportation, measured based on the use of the U.S. Transportation Command's (TRANSCOM) aeromedical evacuation system, to determine their influence on length of hospital stay at Brooke Army Medical Center in FY 1996 in order to better understand the irnpact these patients have on utilization management. Based on criteria driven selection of four discharge Diagnosis Related Groups (DRGs), patient records (n = 657) were selected for review. Based on statistical analysis, this study determined that increases in LOS for patients using the aeromedical evacuation system were statistically significant when compared to patients arriving at BAMC by other means. These results were expected. This study also determined that LOS for patients coming from outside the local catchinent area did not have statistically significant increases in LOS when compared to those from within the local catchrnent area. Based on the literature review and subjective observations, these results were not anticipated. This study recommends establishing a preadmission assessment process for all inpatient transfers coming to BAMC via the aeromedical evacuation system to determine the need for admission based on physician assessment. In addition, continued use of the Remain Overnight (RON) service as a means to reduce LOS in aeromedical evacuation patients is highly recommended. No recommendations for change were made regarding out-of-catchment area patient management. Based on the results of this study, out-of-catchinent area patients appear to have similar utilization patterns based on the LOS as patients from within the catchment area.
DTIC
Air Transportation; Evacuating (Transportation); Medical Services; Statistical Analysis; Transportation

20040078864 Army Research Inst. of Environmental Medicine, Natick, MA
Conversion of a Large Animal Inhalational Anesthesia Machine to One for Small Animal Use
Leon, Lisa R.; Blaha, Michael D.; DuBose, David A.; Walker, Larry D.; May 2004; 19 pp.; In English
Report No.(s): AD-A423377; USARIEM-TR-T04-04; No Copyright; Avail: CASI; A03, Hardcopy

The use of injectable anesthesia in animal research practices has the disadvantage of uncontrollable anesthesia depth, which leads to toxicity and at times death. This adversely influences research and, animal care and welfare. Injectable anesthesia is generally employed in small research animals, since body mass issues prevent the use of conventional inhalation anesthesia machines, while specialized small animal devices are too costly. To support small animal research in mice and rats, a conventional inhalation anesthesia machine, suitable only for large animals, was converted such that it could also support small animal anesthesia. This conversion was rapidly and easily achieved employing inexpensive materials generally found in most laboratories. Multiple animals could be simultaneously anesthetized, such that surgical procedures in large groups of animals could be completed in less time. Animals rapidly- recovernd from anesthesia to become ambulatory. No anesthesia-related deaths were recorded. This modification employed effective strategies to limit anesthetic gas contamination of the outside environment, such that exposures to personnel were within acceptable limits. Such a conversion of inhalation anesthesia equipment provided an effective, efficient and safe alternative to the use of injectable anesthetics in small research animals. Its application supported conservation of research resources, reduced anesthesia-related confounding factors on research quality, and improved animal care and welfare.
DTIC
Anesthesia; Animals; Respiration

20040078866 Pittsburgh Univ., Pittsburgh, PA
Dendritic Cell-Based Immunotherapy of Breast Cancer: Modulation by CpG DNA
Baar, Joseph; Sep. 2003; 15 pp.; In English
Contract(s)/Grant(s): DAMD17-01-1-0372
Report No.(s): AD-A423383; No Copyright; Avail: CASI; A03, Hardcopy

Breast cancer is the most common non-skin cancer in women, and the American Cancer Society estimates that there will be 203,500 new cases of invasive breast cancer and 40,000 deaths form metastatic breast cancer (MBC) in the U.S. in 2002. Thus, patients with MBC who fail conventional therapies are candidates for clinical trials using novel therapies, including immunotherapy. Dendritic cells (DC) are potent antigen-presenting cells that prime antitumor cytotoxic T lymphosytes against tumor-associated antigens and bacterial DNA oligodeoxynucleotides containing unmethylated CpC seouences (CpG DNA) further augment the immune priming functions of DCs. We hypothesize that CpC DNA-stimulated DCs will prime a more potent anti-tumor immune response than non- stimulated DCs. Tn year 2 of this proposal, our 2 specific aims are 1) to study the mechanism of antitumor immunity mediated by the vaccination of TS/A mammary tumor-bearing BALB/c mice with CpG DNA-stimulated DCs primed in vitro withnecrotic TS/A cells and 2) to determine optimal conditions for CpC DNA stimulation and tumor priming of human DCs.
DTIC
Cancer; Crystal Structure; Dendritic Crystals; Deoxyribonucleic Acid; Mammary Glands; Modulation

20040078867 New South Wales Univ., Sydney

Formulated Delivery of Enzyme/Pro-Drug and Cytokine Gene Therapy to Promote Immune Reduction of Treated and Remote Tumors in Mouse Models of Prostate Cancer

Russell, Pamela J.; Jan. 2004; 41 pp.; In English; Original contains color illustrations

Report No.(s): AD-A423384; DAMD17-02-1-0107; No Copyright; Avail: CASI; A03, Hardcopy

Prostate cancer is now the second highest cause of cancer death in men in Western society. Early disease is treatable by surgery and radiation, but once late stage disease becomes refractory to hormone removal, patient care is limited to pain management. New treatment strategies are needed. The subject of this work is a study of gene therapy, used alone and in combination with hormones called cytokines that stimulate the immune system. These genes will be delivered using lentivirus vectors. The concept is that delivering a cell-killing agent to an accessible tumor, coupled with help from the immune system can promote tumor reduction both at the treatment site and at remote locations. In this therapy, a gene (a fusion of cytosine deaminase and uracil phosphoribosyltransferase (CDUPRT)) is delivered to a cancer cell so that harmless bacterial proteins are made. When a pro-drug, 5 fluorocytosine (5-FC), is then given, cancer cells producing CDUPRT convert 5-FC to a toxin that kills the original cell and others nearby. This system works in slow growing tumors like prostate cancer. Killing the tumor cells attracts immune cells. The scope of the work involves preparation of the gene vectors, optimizing the conditions required for delivering the genes of interest using lentivims vectors, and identification of the immune cells that infiltrate the tumor when gene therapy is used. We will identity these cells and use cytokine genes delivered into the tumor to attract more of them into tumors. We will then compare the effects of delivering the cytokine gene therapy alone, the suicide gene therapy alone, or a combination of both into mice that carry a murine prostate cancer cell line, RM1 cells, grown in the prostate.

DTIC

Cancer; Drugs; Enzymes; Gene Therapy; Mice; Neoplasms; Prostate Gland; Tumors

20040078870 Army Research Inst. of Environmental Medicine, Natick, MA

Altitude Acclimatization Guide

Muza, Stephen R.; Fulco, Charles S.; Cymerman, Allen; Mar. 2004; 18 pp.; In English

Report No.(s): AD-A423388; USARIEM-TN-04-05; No Copyright; Avail: CASI; A03, Hardcopy

Rapid ascent of low altitude residents to altitudes above 6,000 ft (1,600 m) increases individual susceptibility to altitude illness and decreases physical and cognitive work performance. Altitude acclimatization allows Soldiers to decrease their susceptibility to altitude illness and optimize physical and cognitive performances for the altitude to which they are acclimatized. Altitude acclimatization consists of physiological adaptations that develop in a time-dependent manner during continuous or repeated intermittent exposure to hypoxia. The purpose of this guide is to provide the user with quantitative estimations of the health and performance decrements as a function of altitude, the degree of improvements in health and performance resulting from altitude acclimatization, and several methods for inducing altitude acclimatization.

DTIC

Altitude Acclimatization; Hypoxia

20040078871 Army War Coll., Carlisle Barracks, PA

Sustaining AMEDD Professional Strength in the Reserve Components

Fetter, James M., III; May 3, 2004; 38 pp.; In English

Report No.(s): AD-A423389; No Copyright; Avail: CASI; A03, Hardcopy

Reserve components of the U.S. Army are a strategically valuable resource to U.S. military policymakers. Within these components are the majority of professional medical personnel. As of July 2002 the AMEDD consisted of 19% Army National Guard 34% Army Reserve and 47% active component. In 2000 concerns were raised about dwindling numbers of doctors dentists physician assistants and nurse anesthetist officers in Army Reserve and Army National Guard (Selected Reserve SELRES) that without intervention would result in projected shortfalls through 2005. Also in 2000 significant increases were projected in the percentage of retirement letter eligible Medical Corps, Dental Corps, Army Nurse Corps and Physician Assistants. This has potential risk in light of the changing nature of activations and increased OPTEMPO. Potential effects of mobilization and deployment on recruitment retention and other related issues are explored. Suggestions for improving recruitment and retention are discussed.

DTIC

Military Personnel; Reserves

20040078872 Baylor Coll. of Medicine, Houston, TX

Mechanism of Transcriptional Regulation by Androgen Receptor and its Coactivators in the Context of Chromatin

Wong, Jiemin; Jan. 2004; 62 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAMD17-00-1-0522

Report No.(s): AD-A423390; No Copyright; Avail: CASI; A04, Hardcopy

Androgens play important roles in the differentiation, development and maintenance of male reproductive functions, as well as in the etiology of prostate cancer. The biological effects of androgens are believed to be mediated through the intracellular androgen receptor (AR), which belongs to the nuclear receptor (NR) superfamily of ligand-regulated transcription factors. Like other NRs, the actions of AR are subject to modulation, either positively or negatively, by an increasing number of co-regulatory proteins, termed coactivators or corepressors. Coactivators are believed to function either as bridging factors between receptors and basal transcription machinery to enhance recruitment of the basal transcription machinery and/or as factors that have capacity to actively remodel repressive chromatin. The purpose of this research is to study the mechanism by which coactivators modulate AR activity in chromatin, the physiological template of transcriptional regulation. In this progress report, we report that we have analyzed how SRC family coactivators, p300, ARA24 and ARA70 modulate AR activity in the context of chromatin using Xenopus oocyte as a model system. We show that expression of SRC-1 and p300 in Xenopus oocytes can significantly enhance both hormone- dependent and independent activation by AR. While ARA24 can stimulate modestly the AR activation, no coactivator activity can be observed for ARA70. We demonstrate that p300 requires both its histone acetyltransferase activity and interaction with SRC family coactivators to stimulate AR activity. By using chromatin immunoprecipitation assay, we demonstrated that R1881-stimulated transcriptional activation by AR is associated with the promoter targeting of multiple cofactors including the SRC-1, p300, SWI/SNF and TRAP/Mediator complex. An increased histone acetylation over the promoter region was also observed.

DTIC

Cancer; Hormones; Males; Prostate Gland; Proteins; Transcription (Genetics)

20040078875 Army Research Inst. of Environmental Medicine, Natick, MA

Cysteinyl Leukotriene Blockade Does Not Prevent Acute Mountain Sickness

Muza, S. R.; Kaminsky, D.; Fulco, C. S.; Banderet, L. E.; Cymerman, A.; Jul. 2002; 9 pp.; In English

Report No.(s): AD-A423394; No Copyright; Avail: CASI; A02, Hardcopy

MOUNTAIN sickness (AMS)is a syndrome that is characterized by headache, anorexia, nausea, vomiting, insomnia, lassitude, and malaise. There is individual variation in susceptibility to the syndrome; however, the hypoxia-induced symptoms are most common in unacclimatized low- altitude residents who rapidly ascend to terrestrial elevations exceeding 2,500 m (10). In addition, the development of AMS appears to be promoted by engaging in physical activities at high altitude (7). The symptoms of AMS commonly appear within 4 to 24 h of exposure, and usually resolve after several days as acclimatization to hypoxia is achieved. AMS is usually self-limited, but may progress into high altitude cerebral edema (HACE) or high altitude pulmonary edema (HAPE), both of which are potentially life threatening.

DTIC

Altitude Sickness; Cysteine; Leukocytes

20040078878 Uniformed Services Univ. of the Health Sciences, Bethesda, MD

15TH Conference on Military Medicine, "A Challenge to Readiness: Maintaining Currency in Military Education"

Cloonan, Clifford C.; Palma, Joseph .; Jan. 2002; 77 pp.; In English

Report No.(s): AD-A423402; No Copyright; Avail: CASI; A05, Hardcopy

The Uniformed Services University of the Health Sciences (USHUS) is proud to offer this report of the 5th Conference on Military Medicine, "A Challenge to Readiness: Maintaining Currency in Military Medical Education." These Proceedings serve as a record of the Service's Surgeons General nominees' contributions toward predicting the changes that will affect military medical practice over the next twenty to thirty years and of their recommendations rewarding the changes needed in military health care education to prepare today's students to practice in the future. The Uniformed Services University, as the nation's pre-eminent center of military medical education, is committed to ensure that its students are prepared to practice in our rapidly changing world. To this end, Dr. Val Hemming, Dean of the School of Medicine (SOM), directed that this conference be conducted and its proceedings be published. The specific focus of this conference was to identify the anticipated changes in military health care practice and the new educational objectives needed to properly prepare military health care practitioners for the next twenty to thirty years.

DTIC

Conferences; Education; Medical Services; Military Operations

20040078883 Pittsburgh Univ., Pittsburgh, PA
Estrogens, Genetic Polymorphins and Breast Cancer Risk
Okobia, Michael N.; Bunker, Clareann H.; Jul. 2003; 6 pp.; In English
Contract(s)/Grant(s): DAMD17-02-1-0551
Report No.(s): AD-A423412; No Copyright; Avail: CASI; A02, Hardcopy

Although the precise cause of most breast cancer cases is unknown, much attention has been focused on the role of estrogen metabolism in mammary carcinogenesis. Aromatase, estrogen hydroxylase, and catechol-O-methyltransferase are key steps in the three major enzyme systems involved in the biosynthesis and degradation of estrogen. We hypothesize that polymorphisms in genes encoding these three enzymes are associated with breast cancer risk in Nigerian women. Specific Aims: 1) To determine the presence of polymorphisms in genes encoding aromatase, estrogen hydroxylase, and catechol-O-methyltransferase in Nigerian women with breast cancer; 2) To determine the role of polymorphisms in these genes in the susceptibility to breast cancer; 3) To compare our findings with that in African American women and Caucasians. Cases will be 250 women with confirmed breast cancer recruited from hospitals in Midwestern and Southeastern Nigeria. Population-based age-matched controls without hormonal disease or cancerous lesions will be recruited from the same environment as cases. Genotyping will be conducted at the University of Pittsburgh. Our long term goal is to increase our understanding of the etiology of breast cancer, and to reduce the burden of breast cancer by identifying susceptible women for earlier diagnosis and appropriate preventive measures and treatment.
DTIC
Cancer; Estrogens; Genetics; Mammary Glands; Risk

20040078885 Texas Univ., Houston, TX
A Novel Mitochondria-Dependent Apoptotic Pathway (MAP) in Prostate Cancer (Pca) Cells
Chandra, Dhyan; Jan. 2004; 49 pp.; In English
Contract(s)/Grant(s): DAMD17-02-1-0083
Report No.(s): AD-A423414; No Copyright; Avail: CASI; A03, Hardcopy

First, I observed that early during apoptosis induction by a wide spectrum of stimuli, there is a prominent mitochondrial activation, which is characterized by increased mitochondrial respiration, electron transport, and upregulation of multiple respiration-related genes, in particular, cytochrome c. This early mitochondrial activation may represent a defensive mechanism against apoptotic stimulation. In support, many mitochondrially-localized, non- respiration proteins with pro-survival functions including HSP60, Bcl-2, and Bcl-X(sub L) are also up-regulated (Chandra et al., J. Biol. Chem., 277, 50842-54; 2002). Later, when the apoptotic machinery is activated, I notice that there is prominent localization of active caspase-9 and -3 in the mitochondria. The accumulated cytochrome c in the mitochondria early during apoptosis raises a possibility that the mitochondrially-localized caspase-9 might be activated in the organelle in an Apaf-1/cytochrome c-dependent manner. My subsequent biochemical characterizations exclude this possibility and show that the majority of the mitochondrially- localized active caspases, including caspase-9 and caspase-3, result from translocation from the cytosol. The resulting mitochondrial active caspases may function as a positive feedback mechanism to further activate other or residual mitochondrial procaspases, degrade mitochondrial constituents, and disintegrate mitochondrial functions (Chandra and Tang, J. Biol. Chem., 278, 17408-20; 2003). Recently, I observed that active caspase-8 also becomes associated with the mitochondria/ER -enriched membranes and caspase-8 activation plays a critical role in initiating etoposide-induced cell death.
DTIC
Apoptosis; Cancer; Mitochondria; Prostate Gland

20040078886 Fox Chase Cancer Center, Philadelphia, PA
Testing Whether Defective Chromatin Assembly in S- Phase Contributes to Breast Cancer
Adams, Peter D.; Oct. 2003; 23 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-02-1-0726
Report No.(s): AD-A423415; No Copyright; Avail: CASI; A03, Hardcopy

Cancer cells characteristically have a high frequency of genome rearrangements. Although these genome rearrangements are likely to contribute to the defective proliferation control that is characteristic of cancer cells, the cause of rearrangement is poorly understood. We used a dominant negative mutant of (chromatin assembly factor-I) CAF1, a complex that assembles newly synthesized DNA into nucleosomes, to inhibit S-phase chromatin assembly and found that this induced S-phase arrest. Arrest was accompanied by DNA damage. These results show, for the first time, that I human cells CAF1 activity is required for completion of S- phase and defects in chromatin assembly induce DNA damage. We propose that error in chromatin assembly, occurring spontaneously or cause d by genetic mutations or environmental agents, contribute to genome instability

and cancer. Consistent with this idea, preliminary evidence indicates that chromatin assembly factors are mutated in some human cancers.
DTIC
Cancer; Defects; Deoxyribonucleic Acid; Mammary Glands; Proteins

20040078890 Air Force Inst. of Tech., Wright-Patterson AFB, OH
Keys to Successful Implementation and Sustainment of Managed Maintenance for Healthcare Facilities
Waggoner, Elizabeth A.; Mar. 23, 2004; 131 pp.; In English; Original contains color illustrations
Report No.(s): AD-A423439; AFIT/GAQ/ENV/04M-12; No Copyright; Avail: CASI; A07, Hardcopy

Health care providers are faced with two critical issues in today's evolving marketplace: lowering operational costs and achieving more efficient, cost-effective methods to deliver high quality patient care. The rising costs of healthcare and decreasing budgets have placed additional strain on the USA Air Force Medical Service to aggressively lower its facilities' costs. With fewer funds and less personnel, the Air Force medical service is re-evaluating its current maintenance outsourclng implementation practices and reexamining how these strategies might be implemented and sustained more successfully. This research offers some of the foundational needs for designing, implementing and sustaining any type of outsourcing effort. Additionally this study highlighted some DoD specific issues to program management, focusing on some of the unique attributes associated with successfully managing and sustaining a DoD medical facility maintenance program. Content analysis was used to determine the ingredients for successful outsourcing implementation and sustainment.
DTIC
Maintenance; Management Systems; Medical Services

20040078892 Air Force Logistics Management Center, Gunter AFS, AL
Air Force Journal of Logistics. Volume 16, Number 4, Fall 1992
Jan. 1992; 44 pp.; In English
Report No.(s): AD-A423443; No Copyright; Avail: CASI; A03, Hardcopy

The Air Force Journal of Logistics provides an open forum for the presentation of issues, ideas, research, arid information of concern to logisticians who plan, acquire, maintain, supply, transport, and provide supporting engineering and services for military aerospace forces. It is a non-directive, quarterly periodical published under AFR 5-7. Views expressed in the articles are those of the author and do not necessarily represent the established policy of the Department of Defense, the Department of the Air Force, the Air Force Logistics Management Agency, or the organization where the author works. Topics of the articles in this issue concern logistics management, air force technology, medical logistics, the budgets for the military's healthcare system, imaging support and logistics software tools.
DTIC
Logistics; Logistics Management; Medical Services; Military Operations

20040078897 Army Research Inst. of Environmental Medicine, Natick, MA
Exertional Heat Injury and Gene Expression Changes: A DNA Microarray Analysis Study
Sonna, Larry A.; Wenger, C. B.; Flinn, Scott; Sheldon, Holly K.; Sawka, Michael N.; Feb. 20, 2004; 12 pp.; In English
Report No.(s): AD-A423450; M03-35; No Copyright; Avail: CASI; A03, Hardcopy

This study examined gene expression changes associated with exertional heat injury (EHI) in vivo and compared these changes to in vitro heat shock responses previously reported by our laboratory. Peripheral blood mononuclear cell (PBMC) RNA was obtained from four malc Marine recruits (ages 17-19 yr) who presented with symptoms consistent with EHI, core temperatures ranging from 39.3 to 42. 5 deg C, and elevations in serum enzymes such as creatine kinase. Controls were age- and gender-matched Marines from whom samples were obtained before and several days after an intense field-training exercise in the heat ("The Crucible"). Expression analysis was performed on Affymetrix arrays (containing 12,600 sequences) from pooled samples obtained at three times for EHI group (at presentation, 2-3 h after cooling, and 1-2 days later) and compared with control values (average signals from two chips representing pre- and post- Crucible samples). After post hoc filtering, the analysis identified 361 transcripts that had twofold or greater increases in expression at one or more of the time points assayed and 331 transcripts that had twofold or greater decreases in expression. The affected transcripts included sequences previously shown to be heat-shock responsive in PBMCs in vitro (including both heat shock proteins and non- heat shock proteins), a number of sequences whose changes in expression bad not previously been noted as a result of in vitro heat shock in PBMCs (including several interferon- induced sequences), and several nonspecific stress response genes (including ubiquitin C and dual-specificity phosphatase- 1). We conclude that EHI produces a broad stress response that is detectable in

PBMCs and that heat stress perse can only account for some of the observed changes in transcript expression.
DTIC
Deoxyribonucleic Acid; Gene Expression; Genes; Heat Tolerance; Injuries; Stress (Physiology)

20040078902 Freie Univ., Berlin
Prodrug Therapy for Breast Cancer Targeted by Single-Chain Antibodies F19 and 3S193
Deckert, Peter M.; Oct. 2003; 52 pp.; In English
Contract(s)/Grant(s): DAMD17-99-1-9370
Report No.(s): AD-A423458; No Copyright; Avail: CASI; A04, Hardcopy

In Antibody-Directed Enzyme-Prodrug Therapy (ADEPT), antibody - enzyme constructs localize to tumor tissue the toxification of non-toxic prodrugs. Recombinant fusion proteins are expected to overcome the limitations of chemical conjugates. We have constructed fusion proteins of antibodies against the tumor antigens A33, Lewis-Y and fibroblast associated protein (FAP) with cytosine deaminase (CD), which converts 5-fluorocytosine (5-FC) into cytotoxic 5-fluorouracil (5-FU). After initial inefficient expression in an E. coli system, the intended use of a Pichia pastoris system made necessary the replacement of E.coli CD with the yeast isoenzyme. In addition, a second line of fusion constructs with green fluorescent protein instead of cytosine deaminase was designed for histological and intracellular distribution studies. With the A33 antibody construct as a pilot project, the desired fusion proteins were cloned, expressed in E. coli and purified. In vitro function assays confirmed bispecific activity of the fusion proteins. Based on these results, experimental mice tumor models were established based on antigen-positive cell lines, and tumor targeting and biodistribution experiments were completed again with A33 as the pilot system. These experiments showed good tumor localization and favorable biodistribution, but little anti-tumor effect, which may be due to particular conditions of this pilot system. Encouraged by these results, additional animal experiments are currently underway.
DTIC
Antibodies; Cancer; Cells (Biology); Mammary Glands; Therapy

20040078903 Vanderbilt Univ. Medical Center, Atlanta, GA
Molecular Markers of Estrogen Metabolism and Progression From High-Grade Prostatic Intraepithelial Neoplasia (HGPIN) to Prostate Cancer
Fowke, Jay H.; Mar. 2004; 11 pp.; In English
Contract(s)/Grant(s): DAMD17-02-1-0139
Report No.(s): AD-A423460; No Copyright; Avail: CASI; A03, Hardcopy

The purpose of this case-control study is to investigate the association between genetic and encocrine markers of estrogen metabolism and prostate cancer progression. Androgens (e.g., testerone) may be critical in prostate cancercinogenesis, but there is accumulating evidence that estrogens facilitate progress during the later stages of prostate cancer formation (1-4). To explore the role of estrogens in human prostate carcinogenesis, we proposed to investigate the association between genetic and endocrine markers of estrogen metabolism and the detection of high-grade prostatic intraepithelial neoplasia (HGPIN) and stage I/II/III prostate cancer. While the first project year included protocol development and IRB approval, the second year of this study focused on subject recruitment and data collection. Specific accomplishments include recruitment of 146 subjects to the protocol (85% of eligible), with complete data collected form 129 subjects. We have expanded the recruitment base to the Veterans Hospitals, refined data collection materials, and are pilot testing our laboratory procedures. We anticipate successful project completion, and further details provided below are in parallel with the statement of work.
DTIC
Cancer; Estrogens; Markers; Metabolism; Prostate Gland

20040078904 Naval Health Research Center, San Diego, CA
Body Heat Storage and Work in the Heat
Hodgdon, James A.; May 2003; 5 pp.; In English
Contract(s)/Grant(s): MIPR2DCJWP2055
Report No.(s): AD-A423463; No Copyright; Avail: CASI; A01, Hardcopy

The development of heat injury during military ground operations in hot environments is a serious risk, particularly when operations in chemical defense ensembles are required. The objective of the research is to develop a model of body heat storage from readily available field and clinical measures that can be used to predict response to work in the heat, with or without the inclusion of impermeable or semi- impermeable garments. Unique aspects of these models will be the use of a

three-compartment approach, in which muscle-mass temperature will be measured in addition to skin and non- muscle core temperature values, and measurement of heat storage by direct and indirect calorimetry.
DTIC
Body Temperature; Heat Storage; Human Performance

20040078905 Georgetown Univ. Hospital, Washington, DC
Insulin Like Growth Factor I Receptor Function in Estrogen Receptor Negative Breast Cancer. Addendum
Veselik, David; Jul. 2003; 10 pp.; In English
Contract(s)/Grant(s): DAMD17-99-1-9194
Report No.(s): AD-A423464; No Copyright; Avail: CASI; A02, Hardcopy

The mammary gland is unique in that it grows and develops throughout the lifetime of a reproductive female and ovarian steroids play a central role in this growth and development. Estrogens are responsible primarily for stimulating ductal and stromal proliferation, The effects of estrogens are due, in part, to their ability to induce the local synthesis of growth factors such as insulin like growth factor-I (IGF-I). In turn, IGF-I activates ER-alpha through a hormone independent mechanism, however, the precise mechanism as well as the signal transduction pathways involved in the cross talk between IGF-I and ER-alpha are poorly defined. In fact, the ras-MAPK and the PI3K-AKT pathways has been shown-to mediate the effects of IGF-I on ER-alpha activity. The original proposal was to test the hypothesis that the downstream mediator of these pathways is p70/S6 kinase. However, early results showed that the effects of IGF-I were not mediated by p70/S6 kinase. The revised aim was to test the hypothesis that the effects of IGF-I were mediated through the activation of nitric oxide synthetase by Akt. Preliminary results show that nitrite and nitrates, the breakdown products of nitric oxide, activate ER-alpha suggesting that the effects of IGF-I are mediated, in part, by activation of nitric oxide synthetase.
DTIC
Cancer; Estrogens; Insulin; Mammary Glands

20040078907 Brigham and Women's Hospital, Boston, MA
The Role of IQGAP1 in Neoplastic Growth and Metastasis
Roy, Monideepa; Sacks, David; Jun. 2003; 10 pp.; In English
Contract(s)/Grant(s): DAMD17-02-1-0304
Report No.(s): AD-A423466; No Copyright; Avail: CASI; A02, Hardcopy

The purpose of this proposal is to evaluate the role of IQGAPl in neoplastic transformation and metastasis of breast epithelial cells. The main emphasis is on whether IQGAP is involved in invasion and metastasis of transformed breast epithelial cells, as well as the possible involvement of IQGAPl in regulating b-catenin function. Major findings to date are: (i) there is a high level of expression of IQGAPl in breast epithelium; and (ii) overexpression of IQGAP1 in mammalian cells enhances cell migration and proliferation. These data reveal that IQGAPl has a fundamental role in cell motility and invasion in breast epithelium. This information could have potential therapeutic implications in patients with breast cancer.
DTIC
Cancer; Cells (Biology); Mammary Glands; Metastasis

20040078908 Duke Univ., Durham, NC
PET Imaging of Breast Cancer Using F-18 Labeled Choline Analogs
Soo, Mary S.; DeGrado, Timothy; Rosen, Eric L.; Turkington, Tim; Coleman, R. E.; Nov. 2003; 6 pp.; In English
Contract(s)/Grant(s): DAMD17-01-1-0515
Report No.(s): AD-A423467; No Copyright; Avail: CASI; A02, Hardcopy

Mammography has proven effective for reducing mortality from breast cancer, however detection of some lesions is limited by dense breast tissue that obscures the tumor, and the specificity of mammography is low. Functional imaging with positron emission tomography (PET) may help improve detection and diagnosis of breast cancer, although, the diagnostic accuracy of primary breast tumors has been found to be hindered by low glycolytic rates, and nonspecific uptake by nonmalignant breast tissue. Imaging with fluorocholine (FCH) may help to overcome these limitations. An efficient and practical synthesis of FCH has been developed at our institution. The purpose of the study is to evaluate the potential utility of F-18 labeled choline (FCH) as a positron emission tomography (PET) radiotracer for detection and diagnosis of breast cancer in women with highly suspicious breast lesions. Our goals are to determine: 1) the correlation between FCH uptake in primary breast cancer tumors and the histologic tumor type from subsequent pathology; 2) how FCH uptake in breast cancer tumors compares to F-18 2-fluoro-2- deoxy-glucose (FDG) (which is the current standard cancer imaging agent for PET)

uptake in breast cancer tumors; and 3) if FCH can improve local staging of the breast in patients with recently diagnosed breast cancer (invasive or in situ).
DTIC
Cancer; Choline; F-18 Aircraft; Imaging Techniques; Mammary Glands; Positrons; Tomography

20040078910 Georgetown Univ., Washington, DC
Detection of Mitochondrial DNA Mutations in Mammary Epithelial Cells in Nipple Aspirate Fluid
Haddad, Bassem R.; Sep. 2003; 15 pp.; In English
Contract(s)/Grant(s): DAMD17-01-1-0525
Report No.(s): AD-A423469; No Copyright; Avail: CASI; A03, Hardcopy

Because optimal methods have not been established for screening and early detection of breast cancer in premenopausal women, there is an urgent need for a variety of new approaches that can augment mammographic screening. We describe a method for the idolation of free DNA from ductal lavage (DL) and nipple aspirate fluid (NAF), and its evaluation for the presence of mitochondrial DNA (mtDNA) mutations at the D3l0 marker, to improve early detection of breast cancer. We evaluated 26 DL and six NAF samples form 14 women of known BRCAl status, who have no clinical evidence of breast tumors: nine mutation carriers and five non-carriers. The mitochondrial studies were possible in all 26 DL samples and a somatic mutation was found in 3/9 carriers and in none of the non-carriers. MTDNA mutation evaluation was possible in 4/6 NAF samples. The NAF and DL results were concordant. One NAF sample from a BRCAl patient showed a mtDNA mutation. Our data demonstrates the feasibility of performing these studies using the free DNA present in the ductal fluid, while the intact cells can be used for cytologic studies.
DTIC
Cancer; Deoxyribonucleic Acid; Mammary Glands; Mitochondria; Mutations

20040078914 University of Southern California, Los Angeles, CA
Improving Detection of Axillary Lymph Nodes by Computer-Aided Kinetic Feature Identification in Positron Emission Tomography
Yu, Xiaoli; Aug. 2003; 11 pp.; In English
Contract(s)/Grant(s): DAMD17-99-1-9379
Report No.(s): AD-A423474; No Copyright; Avail: CASI; A03, Hardcopy

The goal of this project is to improve the detection of metastatic axillary breast cancer through sophisticated physiological modeling and statistical signal processing techniques. The major focus of Year 4 (no-cost extension) was the assessment of the developed methodology in feature identification, extraction/estimation, and early detection with digital phantom, animal study and a small amount of patient data. The methods we tested include (i) adding the factor analysis to the conventional ROI averaging method for feature extraction/ estimation and (ii) to develop the optimal feature-guided filtering criteria for early lesion detection. The objective is to suppress the interference-plus- noise in dynamic data proceeding to applying the hypothesis test detection criteria. Two types of filters presented in the last annual report, with/without using the physiological features extracted from normal tissues, were further tested with digital phantom, animal study and patient data. The results of phantom study demonstrated that the accuracy of feature extraction in the modified method can be dramatically improved compared to the conventional ROI analysis and that the feature-guided space-temporal filters can enhance the SNR in invisible lesion and make it become detectable. The assessment of non-invasive blood time activity extraction was also performed with patient data selected from our clinical database. All findings in theory and simulations will be continued in the extended year 5 when more clinical data will become available.
DTIC
Cancer; Computer Techniques; Lymphatic System; Mammary Glands; Positrons; Tomography

20040078915 Minnesota Univ., Minneapolis, MN
A Model DOD Systems Approach for Tobacco Cessation
Lando, Harry A.; Oct. 2003; 11 pp.; In English
Contract(s)/Grant(s): DAMD17-00-1-0586
Report No.(s): AD-A423476; No Copyright; Avail: CASI; A03, Hardcopy

While tobacco use in the military costs over $584 million per year in health related expenses, 29.9% of our enlisted forces continue to smoke (Helyer, Brehm, & Perino, 1995; Bray, Sanchez, Ornstein, et al., 1999). The primary objective of this study is to evaluated the efficacy o a community initiative on smoking prevalence among active duty personnel and TRICARE

Prime beneficiaries. Sixteen military installations (eight each from the Air Force and Army) have been assigned to either an intervention or delayed intervention condition. At the end of the third year of the study, project accomplishments include implementing, monitoring and modifying the intervention at four Air Force sites, creating all the necessary components of the community campaign, identifying and randomly assigning Army and remaining Air Force sites.
DTIC
Military Personnel; Smoke; Tobacco

20040078918 Alabama Univ., Birmingham, AL
Dietary Genistein and Prostate Cancer Chemoprevention
Lamartiniere, Coral A.; Apr. 2004; 6 pp.; In English
Contract(s)/Grant(s): DAMD17-02-1-0662
Report No.(s): AD-A423480; No Copyright; Avail: CASI; A02, Hardcopy

The disease of cancer is usually attacked at time of diagnosis, and even chemoprevention is not usually considered until adulthood. Our hypothesis is that windows of development hold the key for chemoprevention of prostate cancer. We have previously demonstrated that genistein is bioavailable to the rat prostate and that life-time exposure to physiological concentrations of genistein suppressed the development of chemically-induced prostate cancer. The purpose of our research is to determine if there is a developmental window for this chemoprevention and the mechanism(s) of chemoprevention. We have demonstrated that neonatal and prepubertal exposure to genistein via the diet does not alter development of the prostate buds in 21 and 35 day old rats. More recently, we have demonstrated that prepubertal, as well as adult and lifetime, exposure to genistein in the diet down regulated androgen receptor, but not estrogen receptors alpha and beta, expression in the dorsolateral prostate of rats. Down regulated androgen receptor is consistent with genistein suppressing prostate cancer development. Short term exposure to genistein having a permanent effect on androgen receptor expression is hypothesized to occur via androgen receptor promoter DNA methylation. Tumorigenesis studies are completed and are in the process of being evaluated for histopathology.
DTIC
Cancer; Chemotherapy; Diets; Prostate Gland

20040078919 Notre Dame Univ., IN
Apoptosis and Tumor Progression in Prostate Cancer
Tenniswood, Martin P.; Feb. 2004; 80 pp.; In English
Contract(s)/Grant(s): DAMD17-02-1-0114
Report No.(s): AD-A423481; No Copyright; Avail: CASI; A05, Hardcopy

In the period covered by this application, we have established that the PC-346CRFP can be used as a suitable model for androgen dependent localized prostate cancer. We have shown that orthotopic tumors derived from PC-346CRFP cells (inoculated in growth factor replete Matrigel into the ventral prostate of nude mice) are responsive to Asodex, and undergo tumor regression as a consequence of an increase in apoptosis and a decrease in proliferation rate. LNCap cells selected on the basis of their invasive potential in vitro however do not respond to Casodex and do not metastasize to other organs. We attribute this to the presence of a mutated Androgen receptor in the LNCaP cells which responds to the adrenal steroid dehydroepiandrosterone (DHEA), overriding the effects of Casodex, and to the high levels of growth factors. When inoculated in growth factor depleted Matrigel PC-346CRFP cells form primary tumors, and after extended treatment with Casodex, show evidence of metastatic progression after treatment with Casodex, although the data has not yet reached statistical relevance. Micro-array and macro-array techniques are being used to characterize the expression of genes induced by Casodex in this tumor to identify the genes that may underlie tumor progression.
DTIC
Apoptosis; Cancer; Prostate Gland; Tumors

20040078920 Lawrence Livermore National Lab., Livermore, CA
Repair Machinery for Radiation-Induced DNA Damage
Thompson, Lawrence H.; Nov. 2003; 14 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-99-1-9252
Report No.(s): AD-A423482; No Copyright; Avail: CASI; A03, Hardcopy

Understanding the DNA repair mechanisms for ionizing radiation (IR)-induced DNA damage and having prior knowledge of a patient's lR-specific repair capacity will help to determine how patients will respond to radiation therapy and to design

more effective treatments. Our prior objective to construct a mutant cell line for the APEl nuclease gene was not met despite numerous experiments and multiple approaches. Therefore, we initiated two new objectives dealing with other enzymatic cellular components that are essential for IR damage recognition and repair. First, we evaluated the new technology of siRNA knockdown of gene expression for both APEl and polynucleotide kinase (PNK), a protein that plays a major role in processing the termini of DNA breaks. The APEl experiments were unsuccessful, for unknown reasons, but experiments with PNK look promising based prior experience with human tumor cells. Second and most important, we have shown that we can use immuno-fluorescence to detect the sites of doublestrand breaks (DSBs) caused by IR in immortalized normal human fibroblasts. The assay is extremely sensitive, with low background, and is linear with dose from 0 to 90 cGy. This immuno-detection system has as wide application to studying the mechanisms of DSB repair and - will be used extensively in future studies.
DTIC
Cancer; Deoxyribonucleic Acid; Ionizing Radiation; Maintenance; Mammary Glands; Radiation Damage; Radiation Effects

20040078926 Spatial Integrated Systems, Inc., Rockville, MD
A Neuroprosthesis System Utilizing Optical Spatial Feedback Control
Mar. 19, 2004; 186 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): N00014-02-C-0384
Report No.(s): AD-A423495; SIS-R-202-04; No Copyright; Avail: CASI; A09, Hardcopy

The development of a neuroprosthesis system utilizing spatial feedback control is presented in this project final report. During this phase, the RobotEyes (TradeMark) Functional Electrical Stimulation System (REFES) was developed as an intelligent vision based system. The system has capabilities in image capture and processing within a related small working environment. The working environment can be a fixed working table or a platform that satisfies varied conditions. The successful development of the REFES System during this phase is in fact a result of the application of a collection of advanced technologies that include real time image capture and processing, 3D surface reconstruction, 3D modeling and target recognition, camera calibration, robot control, intelligent trajectory planning, obstacle identification and avoidance, dynamic system identification, motion recovery and prediction, and position feedback control. The capabilities that REFES System provide is an effective user interface and optical spatial feedback controller for a neuroprosthesis for individuals with high tetraplegia resulting from high cervical spinal cord injury. It also provides for the command interface for rehabilitation robots that are commonly used by individuals with high tetraplegia, muscular dystrophy, amyotrophic lateral sclerosis (i.e., "Lou Gehrig's disease"), and other nerological or musculoskeletal disease.
DTIC
Feedback Control; Optical Control; Robotics; Stimulation

20040079772 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Detecting Pyrolysis Products from Bacteria in a Mars Soil Analogue
Glavin, D. P.; Cleaves, H. J.; Schubert, M.; Aubrey, A.; Buch, A.; Mahaffy, P. R.; Bada, J. L.; 2004; 2 pp.; In English; Goldschmidt Geochemistry Conference, 5-11 Jun. 2004, Copenhagen, Denmark; Copyright; Avail: Other Sources; Abstract Only

One of the primary objectives of the 1976 Viking missions was to determine whether organic compounds, possibly of biological origin, were present in the Martian surface soils. The Viking gas chromatography mass spectrometry (GCMS) instruments found no evidence for any organic compounds of Martian origin above a few parts per billion in the upper 10 cm of surface soil, suggesting the absence of a widely distributed Martian biota. However, it is now known that key organic compounds important to biology, such as amino acids, carboxylic acids and nucleobases, would likely have been missed by the Viking GCMS instruments. In this study, a Mars soil analogue that was inoculated with approx. 10 billion Escherichia coli cells was heated at 500 C under Martian ambient pressure to release volatile organic compounds from the sample. The pyrolysis products were then analyzed for amino acids and nucleobases using high performance liquid chromatography (HPLC) and GCMS. Our experimental results indicate that at the part per billion level, the degradation products generated from several million bacterial cells per gram of Martian soil would not have been detected by the Viking GCMS instruments. Upcoming strategies for Mars exploration will require in-situ analyses by instruments that can assess whether any organic compounds, especially those that might be associated with life, are present in Martian surface samples.
Author
Organic Compounds; Bacteria; Mars Surface; Escherichia; Activity (Biology)

20040081045 NASA Ames Research Center, Moffett Field, CA, USA

Morphology of the Vestibular Utricule in Toadfish, Opsanus Tau

Bass, L.; Smith, J.; Twombly, A.; Boyle, Richard; Varelas, Ehsanian J.; Johanson, C.; [2003]; 1 pp.; In English; Society for Neuroscience Meeting, 8-12 Nov. 2003, New Orleans, LA, USA

Contract(s)/Grant(s): NIDCD-DC-1837; No Copyright; Avail: Other Sources; Abstract Only

The uticle is an otolith organ in the vertebrate inner ear that provides gravitoinertial acceleration information into the vestibular reflex pathways. The aim of the present study was to provide an anatomical description of this structure in the adult oyster toadfish, and establish a morphological basis for interpretation of subsequent functional studies. Light, scanning electron and transmission electron microscopy were applied to visualize the sensory epithelium and its neural innervation. Electrophysiological techniques were used to identify utricular afferents by their response to translation stimuli. Similar to nerve afferents supplying the semicircular canals and lagena, utricular afferents commonly exhibit a short-latency increase of firing rate in response to electrical activation of the central efferent pathway. Afferents were labeled with biocytin either intraaxonally or with extracellular bulk deposits. Light microscope images of serial thick sections were used to make three-dimensional reconstructions of individual labeled afferents to identify the dendritic morphology with respect to epithelial location. Scanning electron microscopy was used to visualize the surface of the otolith mass facing the otolith membrane, and the hair cell polarization patterns of strioler and extrastriolar regions. Transmission electron micrographs of serial thin sections were compiled to create a three-dimensional reconstruction of the labeled afferent over a segment of its dendritic field and to examine the hair cell-afferent synaptic contacts.

Author

Electrophysiology; Morphology; Otolith Organs; Vestibules; Neurology; Vertebrates

20040081079 NASA Ames Research Center, Moffett Field, CA, USA

The Effect of Feeding Purified versus Chow Diet on Bone Changes Produced by Hindlimb Suspension of Female Rats

Tou, Janet; Arnaud, Sara B.; Grindeland, Richard; Wade, Charles; March 04, 2004; 1 pp.; In English; FASEB 2004, 2004

Contract(s)/Grant(s): 121-10-30; 121-10-40; 121-10-50; No Copyright; Avail: Other Sources; Abstract Only

Spaceflight simulation studies use chow diets while spaceflight studies use a semi-purified &et. To determine whether the differences in these diets would affect the changes in unweighted bone, we compared the effects of purified vs chow diet on bone parameters, urinary calcium, plasma estradiol, and urinary corticosterone (CORT) in sexually mature female Sprague-Dawley rats. Rats fed purified AIN-93G or chow diet were kept ambulatory (AMB) or subjected to a spaceflight simulation model of unweighted hindlimbs (HLS) for 38 days. Body mass of treatment groups was similar although food intake and caloric density of the diets differed. Both HLS diet groups showed similar decreases in bone mineral content and mechanical strength in unweighted femurs compared to AMB (p<0.05). However, femur length was lower (p<0.05) in the chow-fed than AIN-93G fed groups. Urinary calcium excretion was greater in chow than AIN-93G fed rats, consistent with the higher level of calcium in the diet. Plasma estradiol was lower in HLS than in AMB fed AIN-93G, but similar in HLS and AMB chow fed groups. Femur mineral content was related to plasma estradiol (r(sup 2) =0.91, p<0.00l). Urinary CORT excretion was increased during initial HLS and elevated in HLS/chow-fed rats. Diets did not appear to affect the osteopenia induced by unweighting, but effects on bone growth, calcium excretion, plasma estradiol and urinary CORT do not support the view that these diets can by used interchangeably in bone studies.

Author

Bone Demineralization; Food Intake; Calcium; Bone Mineral Content; Rats

20040081087 Search for Extraterrestrial Intelligence Inst., Moffett Field, CA, USA

Prebiotic Synthesis of Autocatalytic Products From Formaldehyde-Derived Sugars as the Carbon and Energy Source

Weber, Arthur L.; August 06, 2003; 2 pp.; In English; Exobiology P.I. Symposium, 25-29 Aug. 2003, Toronto, Canada

Contract(s)/Grant(s): RTOP 344-58-22-14; No Copyright; Avail: Other Sources; Abstract Only

Our research objective is to understand and model the chemical processes on the primitive Earth that generated the first autocatalytic molecules and microstructures involved in the origin of life. Our approach involves: (a) investigation of a model origin-of-life process named the Sugar Model that is based on the reaction of formaldehyde- derived sugars (trioses and tetroses) with ammonia, and (b) elucidation of the constraints imposed on the chemistry of the origin of life by the fixed energies and rates of C,H,O-organic reactions under mild aqueous conditions. Recently, we demonstrated that under mild aqueous conditions the Sugar Model process yields autocatalytic products, and generates organic micropherules (2-20 micron dia.) that exhibit budding, size uniformity, and chain formation. We also discovered that the sugar substrates of the Sugar Model are capable of reducing nitrite to ammonia under mild aqueous conditions. In addition studies done in collaboration with Sandra Pizzarrello (Arizona State University) revealed that chiral amino acids (including meteoritic isovaline) catalyze

both the synthesis and specific handedness of chiral sugars. Our systematic survey of the energies and rates of reactions of C,H,O-organic substrates under mild aqueous conditions revealed several general principles (rules) that govern the direction and rate of organic reactions. These reactivity principles constrain the structure of chemical pathways used in the origin of life, and in modern and primitive metabolism.
Author
Biological Evolution; Carbon; Synthesis (Chemistry); Chemical Evolution

20040081088 NASA Ames Research Center, Moffett Field, CA, USA
Quantitative Relationships between Photosynthetic, Nitrogen Fixing, and Fermentative H2 Metabolism in a Photosynthetic Microbial Mat
Hoehler, Tori M.; Albert, Daniel B.; Bebout, Brad M.; Turk, Kendra A.; DesMarais, David J.; February 06, 2004; 1 pp.; In English; 2004 Astrobiology Science Conference, 28 Mar. - 1 Apr. 2004, Moffett Field, CA, USA
Contract(s)/Grant(s): RTOP 344-38-32-06; No Copyright; Avail: Other Sources; Abstract Only

The ultimate potential of any microbial ecosystem to contribute chemically to its environment - and therefore, to impact planetary biogeochemistry or to generate recognizable biosignatures - depends not only on the individual metabolic capabilities of constituent organisms, but also on how those capabilities are expressed through interactions with neighboring organisms. This is particularly important for microbial mats, which compress an extremely broad range of metabolic potential into a small and dynamic system. H2 participates in many of these metabolic processes, including the major elemental cycling processes of photosynthesis, nitrogen fixation, sulfate reduction, and fermentation, and may therefore serve as a mediator of microbial interactions within the mat system. Collectively, the requirements of energy, electron transfer, and biomass element stoichiometry suggest quantitative relationships among the major element cycling processes, as regards H2 metabolism We determined experimentally the major contributions to 32 cycling in hypersaline microbial mats from Baja California, Mexico, and compared them to predicted relationships. Fermentation under dark, anoxic conditions is quantitatively the most important mechanism of H2 production, consistent with expectations for non-heterocystous mats such as those under study. Up to 16% of reducing equivalents fixed by photosynthesis during the day may be released by this mechanism. The direct contribution of nitrogen fixation to H2 production is small in comparison, but this process may indirectly stimulate substantial H2 generation, by requiring higher rates of fermentation. Sulfate reduction, aerobic consumption, diffusive and ebulitive loss, and possibly H2-based photoreduction of CO2 serve as the principal H2 sinks. Collectively, these processes interact to create an orders-of-magnitude daily variation in H2 concentrations and fluxes, and thereby in the oxidation-reduction potential that is imposed on microbial processes occuring within the mat matrix.
Author
Fermentation; Hydrogen; Metabolism; Microorganisms; Nitrogenation; Photosynthesis; Biogeochemistry

20040081089 NASA Ames Research Center, Moffett Field, CA, USA
Insights into the Processing of Carbon by Early Microbial Ecosystems
DesMarais, D.; Bebout, B.; Carpenter, S.; Discipulo, S.; Londry, K.; Habicht, K.; Turk, K.; August 06, 2003; 2 pp.; In English; Exobiology P.I. Symposium, 25-29 Aug. 2003, Toronto, Canada
Contract(s)/Grant(s): RTOP 344-50-92-02; No Copyright; Avail: Other Sources; Abstract Only

Interactions between Earth and the biosphere that were crucial for early biological evolution also influenced substantially the processes that circulate C between its reservoirs in the atmosphere, ocean, crust and mantle. The C-13 C-12 values of crustal carbonates and organics have recorded changes both in biological discrimination and in the relative rates of burial of organics and carbonates. A full interpretation of these patterns needs further isotopic studies of microbial ecosystems and individual anaerobes. Thus we measured carbon isotope discrimination during autotrophic and heterotrophic growth of pure cultures of sulfate-reducing bacteria and archaea (SRB and SRA). Discrimination during CO2 assimilation is significantly larger than during heterotrophic growth on lactate or acetate. SRB grown lithoautotrophically consumed less than 3% of available CO2 and exhibited substantial discrimination, as follows: Desulfobacterium autotrophicum (alpha 1.0100 to 1.0123), Desulfobacter hydrogenophilus (alpha = 0.0138), and Desulfotomuculum acetoxidans (alpha = 1.0310). Mixotrophic growth of Desulfovibrio desulfuricans on acetate and CO2 resulted in biomass with delta C-13 composition intermediate to that of the substrates. We have recently extended these experiments to include the thermophilic SRA Archeoglobus spp. Ecological forces also influence isotopic discrimination. Accordingly, we quantified the flow of C and other constituents in modern marine cyanobacterial mats, whose ancestry extends back billions of years. Such ecosystem processes shaped the biosignatures that entered sediments and atmospheres. At Guerrero Negro, BCS, Mexico, we examined mats dominated by Microcoleus (subtidal) and Lyngbya (intertidal to supratidal) cyanobacteria. During 24 hour cycles, we observed the exchange of O2 and dissolved inorganic C (DIC) between mats and the overlying water. Microcoleus mats assimilated near-equal amounts of DIC

during the day as they released at night, but Lyngbya mats typically showed net uptake of DIC over the diel cycle. Patterns of O2 daytime release and nighttime uptake mirrored these DIC trends in both mat types. Nighttime DIC effluxes from Microcoleus mats were equivalent in the presence versus absence of O2, whereas nighttime DIC effluxes from Lyngbya mats dropped markedly in the absence of O2. Thus aerobic diagenesis was more important in Lyngbya mats than in Microcoleus mats, perhaps because trapped O2 bubbles persist only in Lyngbya mats at night and thus sustain populations of aerbes. In both mat types, effluxes of H2, CH4 and short-chain fatty acids were much greater at night in the absence of 02, emphasizing the importance of fermentation. Differences observed between Microcoleus versus Lyngbya mats forecast differences in their microbial populations and in their patterns of gene expression.
Author
Carbon Dioxide; Biological Evolution; Ecosystems; Carbon 12; Carbon 13

20040081091 NASA Ames Research Center, Moffett Field, CA, USA
Lipid Biomarkers for a Hypersaline Microbial Mat Community
Jahnke, Linda L.; Embaye, Tsege; Turk, Kendra A.; August 06, 2003; 1 pp.; In English; Presentation: Exobiology P.I. Symposium, 25-29 Aug. 2003, Moffett Field, CA, USA
Contract(s)/Grant(s): RTOP 344-38-32-03; No Copyright; Avail: Other Sources; Abstract Only

The use of lipid biomarkers and their carbon isotopic compositions are valuable tools for establishing links to ancient microbial ecosystems. As witnessed by the stromatolite record, benthic microbial mats grew in shallow water lagoonal environments where microorganisms had virtually no competition apart from the harsh conditions of hypersalinity, desiccation and intense light. Today, the modern counterparts of these microbial ecosystems find appropriate niches in only a few places where extremes eliminate eukaryotic grazers. Answers to many outstanding questions about the evolution of microorganisms and their environments on early Earth are best answered through study of these extant analogs. Lipids associated with various groups of bacteria can be valuable biomarkers for identification of specific groups of microorganisms both in ancient organic-rich sedimentary rocks (geolipids) and contemporary microbial communities (membrane lipids). Use of compound specific isotope analysis adds additional refinement to the identification of biomarker source, so that it is possible to take advantage of the 3C-depletions associated with various functional groups of organisms (i.e. autotrophs, heterotrophs, methanotrophs, methanogens) responsible for the cycling of carbon within a microbial community. Our recent work has focused on a set of hypersaline evaporation ponds at Guerrero Negro, Baja California Sur, Mexico which support the abundant growth of Microcoleus-dominated microbial mats. Specific biomarkers for diatoms, cyanobacteria, archaea, green nonsulfur (GNS), sulfate reducing, and methanotrophic bacteria have been identified. Analyses of the ester-bound fatty acids indicate a highly diverse microbial community, dominated by photosynthetic organisms at the surface.
Derived from text
Lipids; Biomarkers; Microorganisms; Carbon Isotopes; Ecosystems

20040081093 NASA Ames Research Center, Moffett Field, CA, USA
Methane Production by Microbial Mats Under Low Sulfate Concentrations
Bebout, Brad M.; Hoehler, Tori M.; Thamdrup, Bo; Albert, Dan; Carpenter, Steven P.; Hogan, Mary; Turk, Kendra; DesMarais, David J.; December 09, 2003; 19 pp.; In English
Contract(s)/Grant(s): RTOP 344-58-21-01; Copyright; Avail: CASI; A03, Hardcopy

Cyanobacterial mats collected in hypersaline salterns were incubated in a greenhouse under low sulfate concentrations ([SO4]) and examined for their primary productivity and emissions of methane and other major carbon species. Atmospheric greenhouse warming by gases such as carbon dioxide and methane must have been greater during the Archean than today in order to account for a record of moderate to warm paleoclemates, despite a less luminous early sun. It has been suggested that decreased levels of oxygen and sulfate in Archean oceans could have significantly stimulated microbial methanogenesis relative to present marine rates, with a resultant increase in the relative importance of methane in maintaining the early greenhouse. We maintained modern microbial mats, models of ancient coastal marine communities, in artificial brine mixtures containing both modern [SO4=] (ca. 70 mM) and "Archean" [SO4] (less than 0.2 mM). At low [SO4], primary production in the mats was essentially unaffected, while rates of sulfate reduction decreased by a factor of three, and methane fluxes increased by up to ten-fold. However, remineralization by methanogenesis still amounted to less than 0.4 % of the total carbon released by the mats. The relatively low efficiency of conversion of photosynthate to methane is suggested to reflect the particular geometry and chemical microenvironment of hypersaline cyanobacterial mats. Therefore, such mats w-ere probably relatively weak net sources of methane throughout their 3.5 Ga history, even during periods of low- environmental levels oxygen and sulfate.
Author
Methane; Productivity; Microorganisms; Sulfates; Concentration

20040081094 NASA Ames Research Center, Moffett Field, CA, USA

Structure, Function, Self-Assembly and Origin of Simple Membrane Proteins

Pohorille, Andrew; August 25, 2003; 1 pp.; In English; Centre Europeen de Calcul Atomique et Moleculaire Meeting, 20-22 Oct. 2003, Madison, WI, USA

Contract(s)/Grant(s): RTOP 344-53-92; No Copyright; Avail: Other Sources; Abstract Only

Integral membrane proteins perform such essential cellular functions as transport of ions, nutrients and waste products across cell walls, transduction of environmental signals, regulation of cell fusion, recognition of other cells, energy capture and its conversion into high-energy compounds. In fact, 30-40% of genes in modem organisms codes for membrane proteins. Although contemporary membrane proteins or their functional assemblies can be quite complex, their transmembrane fragments are usually remarkably simple. The most common structural motif for these fragments is a bundle of alpha-helices, but occasionally it could be a beta-barrel. In a series of molecular dynamics computer simulations we investigated self-organizing properties of simple membrane proteins based on these structural motifs. Specifically, we studied folding and insertion into membranes of short, nonpolar or amphiphatic peptides. We also investigated glycophorin A, a peptide that forms sequence-specific dimers, and a transmembrane aggregate of four identical alpha-helices that forms an efficient and selective voltage-gated proton channel was investigated. Many peptides are attracted to water-membrane interfaces. Once at the interface, nonpolar peptides spontaneously fold to a-helices. Whenever the sequence permits, peptides that contain both polar and nonpolar amino also adopt helical structures, in which polar and nonpolar amino acid side chains are immersed in water and membrane, respectively. Specific identity of side chains is less important. Helical peptides at the interface could insert into the membrane and adopt a transmembrane conformation. However, insertion of a single helix is unfavorable because polar groups in the peptide become completely dehydrated upon insertion. The unfavorable free energy of insertion can be regained by spontaneous association of peptides in the membrane. The first step in this process is the formation of dimers, although the most common are aggregates of 4-7 helices. The helices could arrange themselves such that they formed pores capable of transporting ions and small molecules across membranes. Stability of transmembrane aggregates of simple proteins is often only marginal and, therefore, it can be regulated by environmental signals or small sequence modifications in the region of interhelical interactions. A key step in the earliest evolution of membrane proteins was the emergence of selectivity for specific substrates. Many channels could become selective if one or only a few properly chosen amino acids are properly placed along the channel, acting as filters or gates. This is a convenient evolutionary solution because it does not require imposing conditions on the whole sequence.

Author

Proteins; Membranes; Ions; Transferring; Self Assembly; Structural Analysis

20040081095 NASA Ames Research Center, Moffett Field, CA, USA

Records of our Early Biosphere Illuminate our Origins and Guide our Search for Life Beyond Earth

DesMarais, David J.; August 23, 2003; 1 pp.; In English; AGU Conference, December 2003, San Francisco, CA, USA

Contract(s)/Grant(s): RTOP 344-53-92-00; No Copyright; Avail: Other Sources; Abstract Only

A scientific "mission of exploration to early Earth" will help us chart the distribution of life elsewhere. We must discriminate between attributes of biospheres that are universal versus those attributes that represent principally the outcomes of long-term survival specifically on Earth. In addition to the basic physics and chemistry of matter, the geologic evolution of rocky habitable planets and their climates might be similar elsewhere in the Universe. Certain key agents that drive long-term environmental change (e.g., stellar evolution, impacts, geothermal heat flow, tectonics, etc.) can help us to reconstruct ancient climates and to compare their evolution among populations of Earth- like planets. Early Earth was tectonically more active than today and therefore it exhaled reduced chemical species into the more oxidized surface environment at greater rates. This tectonic activity thus sustained oxidation-reduction reactions that provided the basis for the development of biochemical pathways that harvest chemical energy ("bioenergetics"). Most examples of bioenergetics today that extract energy by reacting oxidized and reduced chemicals in the environment were likely more pervasive among our microbial ancestors than are the presently known examples of photosynthesis. The geologic rock record indicates that, as early as 3.5 billion years ago (3.5 Ga), microbial biofilms were widespread within the coastal environments of small continents and tectonically unstable volcanic islands. Non oxygen-producing (non-oxygenic) photosynthesis preceded oxygenic photosynthesis, but all types of photosynthesis contributed substantially to the long-term increase in global primary biological productivity. Evidence of photosynthesis is tentative by 3.5 Ga and compelling by 2.7 Ga. Evidence of oxygenic photosynthesis is strong by 2.7 Ga and compelling by 2.3 Ga. These successive innovations transformed life from local communities that survived principally by catalyzing chemical equilibration to a globally dominant agent that created and sustained widespread chemical disequilibria in the environment and shallow crust. Major biogeochemical perturbations ca. 2.3 to 2.0 Ga, 1.3 Ga, and also 0.8 to 0.6 Ga, contributed to the irreversible oxidation of the global environment and perhaps also

triggered evolutionary innovations (e.g., the development of multi-cellular biota) that became the foundations of our modern biosphere. Understanding the nature and timing of this ascent of life is crucial for discerning our o m beginnings. This understanding also empowers OUT search for the origins, evolution and distribution of life elsewhere in our solar system and beyond.
Author
Biosphere; Biological Evolution; Biochemistry; Extraterrestrial Life

20040081097 Search for Extraterrestrial Intelligence Inst., Moffett Field, CA, USA
The Stable Isotope Fractionation of Abiotic Reactions: A Benchmark in the Detection of Life
Summers, David P.; August 6, 2003; 1 pp.; In English; Presentation: Exobiology PI Symposium, 25-29 Aug. 2003, USA
Contract(s)/Grant(s): RTOP 344-58-21-11; No Copyright; Avail: Other Sources; Abstract Only

One very important tool in the analysis of biogenic, and potentially biogenic, samples is the study of their stable isotope distributions. The isotope distribution of a sample depends on the process(es) that created it. One important application of the analysis of C & N stable isotope ratios has been in the determination of whether organic matter in a sample is of biological origin or was produced abiotically. For example, the delta C-13 of organic material found embedded in phosphate grains was cited as a critical part of the evidence for life in 3.8 billion year old samples. The importance of such analysis in establishing biogenicity was highlighted again by the role this issue played in the recent debate over the validity of what had been accepted as the Earth s earliest microfossils. These kinds of analysis imply a comparison with the fractionation that one would have seen if the organic material had been produced by alternative, abiotic, pathways. Could abiotic reactions account for the same level of fractionation? Additionally, since the fractionation can vary between different abiotic reactions, understanding their fractionations can be important in distinguishing what reactions may have been significant in the formation of different abiological samples (such as extraterrestrial samples). There is however, a scarcity of data on the fractionation of carbon and nitrogen by abiotic reactions. In order to interpret properly what the stable isotope ratios of samples tell us about their biotic or abiotic nature, more needs to be known about how abiotic reactions fractionate C and N. Carbon isotope fractionations have been studied for a few abiotic processes. These studies presumed the presence of a reducing atmosphere, focusing on reactions involving spark discharge, W photolysis of reducing gas mixtures, and cyanide polymerization in the presence of ammonia. They did find that the initial products showed a depletion in I3C with values in the range of a few per mil to as low as -60 % (potentially comparable to that which accompanies the biosynthesis of organic matter). We need to understand what kind of fractionations are observed with reactions under the non-reducing or mildly reducing conditions now thought to be present on the early Earth. While nitrogen is receiving increased attention as a tool for these kinds of analyses, almost nothing is known about the isotope fractionation that one would expect for abiotic sources of fixed/reduced nitrogen. This project will measure the fixation from a series of abiotic reactions that may have been present on the early Earth (and other terrestrial planets) and produced organic material that could have ended up in the rock record. The work will look at a number of reactions, under a non- reducing, or mildly reducing, atmosphere, covering sources of prebiotic organic C & N from shock heating, to photochemistry, to hydrothermal reactions. Some reactions that we plan to study are; Shock heating of a non-reducing atmosphere to produce CO and NO (in collaboration with Chris McKay), formation of formaldehyde (and related compounds) from COY the formation of ammonia from nitrogen oxides (ultimately from NO) by ferrous iron reduction, and the hydrothermal synthesis of compounds including the hydrocarboxylation/hydrocarbonylation reaction (in collaboration with George Cody), reactions of oxalate to form hydrocarbons and other oxygenated compounds and the formation of lipids from oxalic/formic acid (in collaboration with Tom McCollom), and reactions of carbon monoxide & carbon dioxide with N2, ammonia or nitritehitrate to form hydrogen cyanide, nitriles, ammonia/amines and nitrous
Author
Isotope Ratios; Biosynthesis; Carbon Isotopes; Microorganisms; Extraterrestrial Life

20040081213 NASA Johnson Space Center, Houston, TX, USA
Preservation of Liquid Biological Samples
Putcha, Lakshmi, Inventor; Nimmagudda, Ramalingeshwara, Inventor; April 06, 2004; 12 pp.; In English
Patent Info.: Filed 28 Jul. 2000; US-Patent-6,716,392; US-Patent-Appl-SN-630979; US-Patent-Appl-SN-630979; US-Patent-Appl-SN-007239; NASA-Case-MSC-22616-3; No Copyright; Avail: CASI; A03, Hardcopy

The present invention related to the preservation of a liquid biological sample. The biological sample is exposed to a preservative containing at least about 0.15 g of sodium benzoate and at least about 0.025 g of citric acid per 100 ml of sample. The biological sample may be collected in a vessel or an absorbent mass. The biological sample may also be exposed to a substrate and/or a vehicle.
Author
Liquids; Biology; Samples; Preserving

20040081225 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Patterns and Variability in Global Ocean Chlorophyll: Satellite Observations and Modeling

Gregg, Watson; 2004; 1 pp.; In English; Presentation: Geophysical Fluid Dynamics Laboratory, 18 Mar. 2004, Princeton, NJ, USA; No Copyright; Avail: Other Sources; Abstract Only

Recent analyses of SeaWiFS data have shown that global ocean chlorophyll has increased more than 4% since 1998. The North Pacific ocean basin has increased nearly 19%. These trend analyses follow earlier results showing decadal declines in global ocean chlorophyll and primary production. To understand the causes of these changes and trends we have applied the newly developed NASA Ocean Biogeochemical Assimilation Model (OBAM), which is driven in mechanistic fashion by surface winds, sea surface temperature, atmospheric iron deposition, sea ice, and surface irradiance. The model utilizes chlorophyll from SeaWiFS in a daily assimilation. The model has in place many of the climatic variables that can be expected to produce the changes observed in SeaWiFS data. This enables us to diagnose the model performance, the assimilation performance, and possible causes for the increase in chlorophyll. A full discussion of the changes and trends, possible causes, modeling approaches, and data assimilation will be the focus of the seminar.

Author

Chlorophylls; Ocean Models; Data Processing

20040081229 NASA Ames Research Center, Moffett Field, CA, USA

Molecular Ecological and Stable Isotopic Studies of Nitrogen Fixation in Modern Microbial Mats

Bebout, B. M.; Crumbliss, L. L.; DesMarais, D. J.; Hogan, M. E.; Omoregie, E.; Turk, K. A.; Zehr, J. P.; August 06, 2003; 1 pp.; In English; Presentation: Exobiology P.I. Symposium, 25-29 Aug. 2003, Moffett Field, CA, USA; No Copyright; Avail: Other Sources; Abstract Only

Nitrogen is usually the element limiting biological productivity in the marine environment. Microbial mats, laminated microbial communities analogous to some of the oldest forms of life on Earth, are often the sites of high rates of N fixation (the energetically expensive conversion of atmospheric dinitrogen into a biologically useful form). The N fixing enzyme nitrogenase is generally considered to be of ancient origin, and is widely distributed throughout the Bacterial and Archaeal domains of life, indicating an important role for this process over evolutionary time. The stable isotopic signature of N fixation is purportedly recognizable in organic matter (ancient kerogens as well as present-day microbial mats) as a delta (15)N(sub organic) near zero. We studied two microbial mats exhibiting different rates of N fixation in order to better understand the impact of N fixation on the delta (15)N (sub organic) of the mats, as well as what organisms are important in this process. Mats dominated by the cyanobacterium Microcoleus chthonoplastes grow in permanently submerged hypersaline salterns, and exhibit low rates of N fixation, whereas mats dominated by the cyanobacterium Lyngbya spp grow in an intertidal area, and exhibit rates of N fixation an order of magnitude higher. To examine successional stages in mat growth, both developing and established mats at each location were sampled. PCR and RT-PCR based approaches were used to identify, respectively, the organisms containing nifH (one of the genes that encode nitrogenase) as well as those expressing nifH in these mats. Both mats exhibited a distinct diel cycle of N fixation, with highest rates occurring at night. The delta (15)N(sub organic) of the subtidal Microcoleus mats is near zero whereas the delta (15)N(sub organic) is slightly more positive (+ 2-3%), in the intertidal Lyngbya mats, an interesting difference in view of the fact that overall rates of activity in the intertidal mats are much higher that those in the submerged hypersaline mats. Developing mats in both the subtidal and intertidal locations had delta (15)N(sub organic) values very near those of the established mats. Further work is necessary in order to determine the importance of other transformations of nitrogen on the delta (15)N(sub organic) signature of the mats.

Author (revised)

Biochemistry; Microorganisms; Nitrogenation; Nitrogen Isotopes

20040081243 NASA Ames Research Center, Moffett Field, CA, USA

Cellular Mechanisms Underlying Bone-Forming Cell Proliferative Response to Hypergravity

Vercoutere, W.; Parra, M.; DaCosta, M.; Wing, A.; Roden, C.; Damsky, C.; Holton, E.; Searby, N.; Globus, R.; Almeida, E.; March 28, 2004; 1 pp.; In English; Astrobiology Conference, 28 Mar. - 1 Apr. 2004

Contract(s)/Grant(s): NASA-00-OBPR-01-066; No Copyright; Avail: Other Sources; Abstract Only

Life on Earth has evolved under the continuous influence of gravity (1-g). As humans explore and develop space, however, we must learn to adapt to an environment with little or no gravity. Studies indicate that lack of weightbearing for vertebrates occurring with immobilization, paralysis, or in a microgravity environment may cause muscle and bone atrophy through cellular and subcellular level mechanisms. We hypothesize that gravity is needed for the efficient transduction of cell growth and survival signals from the extra-cellular matrix (ECM) (consisting of molecules such as collagen, fibronectin, and laminin) in mechanosensitive tissues. We test for the presence of gravity-sensitive pathways in bone-forming cells

(osteoblasts) using hypergravity applied by a cell culture centrifuge. Stimulation of 50 times gravity (50-g) increased proliferation in primary rat osteoblasts for cells grown on collagen Type I and fibronectin, but not on laminin or uncoated surfaces. Survival was also enhanced during hypergravity stimulation by the presence of ECM. Bromodeoxyuridine incorporation in proliferating cells showed an increase in the number of actively dividing cells from about 60% at 1-g to over 90% at 25-g. Reverse transcription-polymerase chain reaction was used to test for all possible integrins. Our combined results indicate that beta1 and/or beta3 integrin subunits may be involved. These data indicate that gravity mechanostimulation of osteoblast proliferation involves specific matrix-integrin signalling pathways which are sensitive to g-level. Further research to define the mechanisms involved will provide direction so that we may better adapt and counteract bone atrophy caused by the lack of weightbearing.
Author
Osteoblasts; Gravitational Effects; High Gravity Environments; Cell Division

20040081249 NASA Langley Research Center, Hampton, VA, USA
Method and Apparatus for Determining Changes in Intracranial Pressure Utilizing Measurement of the Circumferential Expansion or Contraction of a Patient's Skull
Yos, William T., Inventor; Cantrell, John H., Jr., Inventor; June 08, 2004; 6 pp.; In English
Patent Info.: Filed 4 Apr. 2002; US-Patent-6,746,410; US-Patent-Appl-SN-121932; US-Case-LAR-15943-1; No Copyright; Avail: CASI; A02, Hardcopy

A method and apparatus for measuring changes in intracranial pressure (ICP) utilizing the variation of the surface wave propagation parameters of the patient's skull to determine the change in ICP. In one embodiment, the method comprises the steps of transmitting an ultrasonic bulk compressional wave onto the surface of the skull at a predetermined angle with respect to the skull so as to produce a surface wave, receiving the surface wave at an angle with respect tn the skull which is substantially the same as the predetermined angle and at a location that is a predetermined distance from where the ultrasonic bulk compressional wave was transmitted upon the skull, determining the retardation or advancement in phase of the received surface wave with respect to a reference phase, and processing the determined retardation or advancement in phase to determine circumferential expansion or contraction of the skull and utilizing the determined circumferential change to determine the change in intracranial pressure.
Author
Compression Waves; Intracranial Pressure; Pressure Measurement

20040081278 NASA Ames Research Center, Moffett Field, CA, USA
Beta-1 Integrin Signaling and Function in MLO-Y4 Osteocyte-Like Cells
Searby, N. D.; vanderMeulen, M. C. H.; Dovi, J.; Roden, C.; Banerjee, I.; Kim, J.-B.; Damsky, C. D.; Almeida, E. A. C.; Globus, R. K.; March 03, 2004; 10 pp.; In English; NASA Cell Science Conference, 26-28 Feb. 2004, Palo Alto, CA, USA
Contract(s)/Grant(s): NASA-00-)BPR-01-066; NASA-00-HEDS-02; NASA-DDF-02-1; NAGW-4625; No Copyright; Avail: CASI; A02, Hardcopy

In osteocyte-like cells, disruption of beta-1 integrin signaling by the Beta-1 tail construct: 1) Altered cell morphology; 2) Reduced cell motility; 3) Increased proliferation and final cell density; 4) Reduced cell's ability to maintain shape when subjected to uniaxial strain (1%, 30 min). Thus, beta-1 integrin is important in the response of osteocytic cells to mechanical loading.
Derived from text
Proteins; Cells (Biology); Loads (Forces); Bones

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*.

20040078852 Missouri Univ., Saint Louis, MO
Luminous Efficiency Functions at Higher Intensities
Harrington, Lawrence K.; Apr. 2004; 66 pp.; In English
Report No.(s): AD-A423348; CI04-352; No Copyright; Avail: CASI; A04, Hardcopy

Two psychophysical measurement techniques, flicker photometry and successive heterochromatic brightness matching, were used to measure changes in luminance efficiency functions with increasing levels of light adaptation. Both measurement techniques were performed using the same optical system and the same seven healthy adults as subjects. Measurements were taken at four reference stimulus intensities, 1, 10, 100 and 1000 foot-lamberts. Luminous efficiency was found to depend on both the technique and the reference stimulus intensity with which the measurements were taken. For heterochromatic brightness matching, luminous efficiency increased for longer wavelengths as reference intensity increased. Peak luminous efficiency shifted from approximately 540nm to greater than 6OOnm with increasing intensity for all seven subjects. Peak luminous efficiency was constant for flicker photometry across all intensities but the function narrowed slightly at 100 foot-lamberts.
DTIC
Adaptation; Luminance; Luminosity; Photometry; Physiological Responses; Radiometers; Weighting Functions

20040078898 Army Research Inst. of Environmental Medicine, Natick, MA
Going Against the Grain: Flaws in the Zone Diet
Cheuvront, S. N.; Apr. 2004; 5 pp.; In English
Report No.(s): AD-A423452; MISC-02/13; No Copyright; Avail: CASI; A01, Hardcopy
The Zone Diet is an eating plan claiming to maintain an "ideal" hormone balance and improve health through the manipulation of dietary carbohydrate and protein. While popular, the diet's health claims are based on dubious information, misinterpreted scientific facts, and it ultimately remains unsubstantiated.
DTIC
Defects; Diets; Nutrition

53
BEHAVIORAL SCIENCES

Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric research.

20040081039 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Verification of Emergent Behaviors in Swarm-based Systems
Rouff, Christopher; Vanderbilt, Amy; Hinchey, Mike; Truszkowski, Walt; Rash, James; [2004]; 6 pp.; In English; IEEE ECBS/EASE 2004, 24-27 May 2004, Brno, Czech Republic; Original contains black and white illustrations; Copyright; Avail: CASI; A02, Hardcopy
The emergent properties of swarms make swarm-based missions powerful, but at the same time more difficult to design and to assure that the proper behaviors will emerge. We are currently investigating formal methods and techniques for verification and validation of swarm-based missions. The Autonomous Nano-Technology Swarm (ANTS) mission is being used as an example and case study for swarm-based missions to experiment and test current formal methods with intelligent swarms. Using the ANTS mission, we have evaluated multiple formal methods to determine their effectiveness in modeling and assuring swarm behavior. This paper introduces how intelligent swarm technology is being proposed for NASA missions, and gives the results of a comparison of several formal methods and approaches for specifying intelligent swarm-based systems and their effectiveness for predicting emergent behavior.
Author
Autonomy; NASA Programs; Predictions; Insects

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*.

20040077362 Oak Ridge National Lab., TN, USA
Remote Maintenance Design Guide for Compact Processing Units
Draper, J. V.; Kress, R. L.; Aug. 2000; In English
Report No.(s): DE2003-816185; ORNL/TM-2000/124; No Copyright; Avail: National Technical Information Service (NTIS)
This document provides guidance to designers of equipment that must be maintained by remote handling systems. It is

specifically aimed towards the requirements of remote maintenance for compact processing units (CPUs), which were developed as part of the underground storage tank (UST) remediation projects.
NTIS
Remote Handling; Storage Tanks

20040078786 Army Test and Evaluation Command, Aberdeen Proving Ground, MD
General Performance Tests of Combat Uniforms and Ptotective Clothing
Apr. 26, 2004; 37 pp.; In English
Report No.(s): AD-A423072; TOP-10-2-021; No Copyright; Avail: CASI; A03, Hardcopy

This TOP provides guidance for planning performance and durability tests of combat uniforms, nuclear, biological, chemical (NBC) protective clothing, and other types of clothing worn by the soldier. Items covered include, but are not limited to, uniforms, caps, undergarments, over garments, clothing liners, hoods, masks, gloves, socks and boots. Tests include laboratory analyses, functional performance over special design or wear test courses described in the appendixes, and field testing. This TOP does not include chemical, ballistic, or other protection testing, but does provide the procedures for "conditioning" the "used" items for these tests as a follow-on to verify performance after durability testing. This TOP does not address natural environments testing of clothing.
DTIC
Clothing; Combat; Performance Tests; Protective Clothing

20040078816 Civil Aeromedical Inst., Oklahoma City, OK
Validation of the JANUS Technique: Causal Factors of Human Error in Operational Errors
Pounds, Julia; Isaac, Anne; Dec. 2003; 12 pp.; In English
Report No.(s): AD-A423271; DOT/FAA/AM-03/21; No Copyright; Avail: CASI; A03, Hardcopy

Human error has been identified as a dominant risk factor in safety-oriented industries such as air traffic control (ATC). However, little is known about the factors leading to human errors in current ATM systems, in particular those human errors contributing to violation of separation standards. This paper reports on work conducted jointly by Eurocontrol and the FAA as part of Action Plan 12 - Management and Reduction of Human Error in Air Traffic Management (ATM). The goal of this phase of work was to test JANUS, a technique for identifying incident causal factors, and to assess the technique's value in relation to current investigation methods. FAA and Eurocontrol scientists worked with air traffic personnel to analyze several incident cases and to test the technique against several validation criteria. Taken together, the Eurocontrol and FAA results yield converging evidence that the JANUS technique appears to be more sensitive, useful, comprehensive, and practical than the current processes to identify incident causal factors.
DTIC
Error Analysis; Errors; Human Factors Engineering; Human Performance; Janus

20040078900 Army Research Inst. of Environmental Medicine, Natick, MA
Biotelemetry Transmitter Implantation in Rodents: Impact on Growth and Circadian Rhythms
Leon, Lisa R.; Walker, Larry D.; DuBose, David A.; Stephenson, Lou A.; Jan. 15, 2004; 9 pp.; In English
Report No.(s): AD-A423454; M03-39; No Copyright; Avail: CASI; A02, Hardcopy

The implantation of a biotelemetry transmitter for core body temperature (Tc) and motor activity (MA) measurements is hypothesized to have effects on growth and circadian rhythmicity depending on animal body-to-transmitter (B:T) size ratio. This study examined the impact of transmitter implantation (TM) on body weight., food intake (FI), water intake (WI). and circadian Tc and MA rhythms in mice (23.8 +/- 0.04 g) and rats (311.5 +/- 5.1 g) receiving no treatment (NT), anesthesia, laparotomy (LAP), and TM. The B:T size ratio was 6:1 and 84:1 for mice and rats, respectively. In mice, body weight required 14 days to recover to presurgical levels and never attained the level of the other groups. FI recovered in 3 days, whereas WI never reached presurgical levels. Rat body weight did not decrease below presurgical levels. Fl and WI recovered to presurgical levels in rats by day 2 postsurgery. Anesthesia decreased mouse body weight for 1 wk, but was without effect in rats. LAP significantly decreased body weight for 5 days in mice and 1 day in rats, showing a significant effect of the surgical procedure in the absence of TM in both species. Circadian Tc and MA rhythms were evident within the first week in both species, indicating dissociation between circadian rhythmicity and recovery of growth variables. Cosinor analysis showed a TM effect on Tc min, Tc max, mesor, amplitude, and period of mice, whereas only the amplitude of the rhythm was affected in rats. These data indicate that a large B:T size ratio is associated with minimization of the adverse effects of surgical implantation. We recommend that B:T size ratio, recovery of presurgical body weight, and display of a robust circadian Tc

and MA rhythm be established before collection of biotelemetry data collection under an experimental paradigm.
DTIC
Biotelemetry; Circadian Rhythms; Implantation; Rodents; Transmitters

20040079637
Tools and Software Support for Operator-Controlled Platform Cooperation
Stroemberg, D.; Lantz, F.; Sep. 2003; In Swedish; In English
Report No.(s): PB2004-104594; FOI-R-0932-SE; No Copyright; Avail: National Technical Information Service (NTIS)

Operators in mobile platforms must often cooperate with operators in other platforms in order to fulfill their tasks, for example in task-oriented special forces. This is only possible if the operator is able to perform platform interaction. One example of such a co-operation is resource sharing, where an operator exploits sensors on other platforms. This must occur in ways that these platforms allow. How such a strategy for allowance can be formulated in a technically feasible way is discussed in part 1 of this report. Complex combat platforms of different types - in a network centered defense force-have to be able to cooperate with each other in new ways. This requires a new type of command and control system on the platform level, built upon common principles. Each individual platform might become a member in a team. New functions for platform interaction must be introduced, interaction must be able to perform between many different types of platforms and all types of interaction have to be supervised by the operators. In order to shape these abilities, new super platform level and platform independent principles for platform interaction are required. The OODA-loop (Observe-Orient-Decie-Act) may be used as a bases for these types of systems. Part 2 in the report describes how it might be done.
NTIS
Command and Control; Platforms

20040079821 NASA Goddard Space Flight Center, Greenbelt, MD, USA
How Systems Engineering and Risk Management Defend Against Murphy's Law and Human Error
Bay, Michael; Connley, Warren; [2004]; 11 pp.; In English; Space Systems Engineering and Risk Management Symposium, Manhattan Beach, CA, USA; No Copyright; Avail: CASI; A03, Hardcopy

Systems Engineering and Risk Management processes can work synergistically to defend against the causes of many mission ending failures. Defending against mission ending failures is facilitated by fostering a team that has a healthy respect for Murphy's Law and a team with a of curiosity for how things work, how they can fail, and what they need to know. This curiosity is channeled into making the unknowns known or what is uncertain more certain. Efforts to assure mission success require the expenditure of energy in the following areas: 1. Understanding what defines Mission Success as guided by the customer's needs, objectives and constraints. 2. Understanding how the system is supposed to work and how the system is to be produced, fueled by the curiosity of how the system should work and how it should be produced. 3. Understanding how the system can fail and how the system might not be produced on time and within cost, fueled by the curiosity of how the system might fail and how production might be difficult. 4. Understanding what we need to know and what we need learn for proper completion of the above three items, fueled by the curiosity of what we might not know in order to make the best decisions.
Author
Risk; Systems Engineering; Errors; Human Performance

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EXOBIOLOGY

Includes astrobiology; planetary biology; and extraterrestrial life. For the biological effects of aerospace environments on humans see *52 Aerospace Medicine*; on animals and plants see *51 Life Sciences*. For psychological and behavioral effects of aerospace environments see *53 Behavioral Sciences*.

20040081043 NASA Ames Research Center, Moffett Field, CA, USA
Identifying Organic Molecules in Space: The AstroBiology Explorer (ABE) Mission Concept
Ennico, Kimberly; Sandford, S.; Allamandola, L.; Bregman, J.; Cohen, M.; Cruikshank, D.; Dumas, C.; Greene, T.; Hudgins, D.; Kwok, S., et al.; April 13, 2004; 1 pp.; In English; SPIE Meeting on Astronomical Telescopes and Instrumentation, 21-25 Jun. 2004, Glasgow, Scotland, UK
Contract(s)/Grant(s): X0050
Report No.(s): ATP-139; No Copyright; Avail: Other Sources; Abstract Only

The AstroBiology Explorer (ABE) mission concept consists of a modest dedicated space observatory having a 60 cm class primary mirror cooled to T less than 50 K equipped with medium resolution cross-dispersed spectrometers having cooled large format near- and mid-infrared detector arrays. Such a system would be capable of addressing outstanding problems in Astrochemistry and Astrophysics that are particularly relevant to Astrobiology and addressable via astronomical observation. The mission's observaticxiai program woiild make fundamental scieztific: prngress in establishing the nature, distribution, formation and evolution of organic and other molecular materials in the following extra-terrestrial environments: 1) The Outflow of Dying Stars; 2) The Diffuse Interstellar Medium (DISM); 3) Dense Molecular Clouds, Star Formation Regions, and Young Stellar/Planetary Systems; 4) Planets, Satellites, and Small Bodies within the Solar System; and 5) The Interstellar Media of Other Galaxies ABE could make fundamental progress in all of these area by conducting a 1 to 2 year mission to obtain a coordinated set of infrared spectroscopic observations over the 2.5 - 20 micron spectral range at a spectral resolution of R greater than 2500 of about 1500 galaxies, stars, planetary nebulae, young stellar objects, and solar system objects.
Author
Exobiology; Organic Compounds; Space Missions; Interstellar Matter; Aerospace Environments; Solar System

20040081230 NASA Ames Research Center, Moffett Field, CA, USA
Non-Genomic Origins of Proteins and Metabolism
Pohorille, Andrew; August 06, 2003; 1 pp.; In English; Presentation: "Bridging Nonliving and Living Matter" Workshop, 9-11 Sep. 2003, Los Alamos, NM, USA
Contract(s)/Grant(s): RTOP 344-50-92-02; No Copyright; Avail: Other Sources; Abstract Only

It is proposed that evolution of inanimate matter to cells endowed with a nucleic acid- based coding of genetic information was preceded by an evolutionary phase, in which peptides not coded by nucleic acids were able to self-organize into networks capable of evolution towards increasing metabolic complexity. Recent findings that truly different, simple peptides (Keefe and Szostak, 2001) can perform the same function (such as ATP binding) provide experimental support for this mechanism of early protobiological evolution. The central concept underlying this mechanism is that the reproduction of cellular functions alone was sufficient for self-maintenance of protocells, and that self- replication of macromolecules was not required at this stage of evolution. The precise transfer of information between successive generations of the earliest protocells was unnecessary and, possibly, undesirable. The key requirement in the initial stage of protocellular evolution was an ability to rapidly explore a large number of protein sequences in order to discover a set of molecules capable of supporting self- maintenance and growth of protocells. Undoubtedly, the essential protocellular functions were carried out by molecules not nearly as efficient or as specific as contemporary proteins. Many, potentially unrelated sequences could have performed each of these functions at an evolutionarily acceptable level. As evolution progressed, however proteins must have performed their functions with increasing efficiency and specificity. This, in turn, put additional constraints on protein sequences and the fraction of proteins capable of performing their functions at the required level decreased. At some point, the likelihood of generating a sufficiently efficient set of proteins through a non-coded synthesis was so small that further evolution was not possible without storing information about the sequences of these proteins. Beyond this point, further evolution required coupling between proteins and informational polymers that is characteristic to all known forms of life. The emergence of such coupling must be postulated in any scenario of the origin of life, no matter whether it starts with RNA or proteins. To examine the evolutionary potential of non-genomic systems, a simple, computationally tractable model, which is still capable of capturing the essential features of the real system, has been studied computationally. Both constructive and destructive processes have been introduced into the model in a stochastic manner. Instead of assuming random reaction sets, only a suite of protobiologically plausible reactions has been considered. Peptides have been explicitly considered as protoenzymes and their catalytic efficiencies have been assigned on the basis of biochemical principles and experimental estimates. Simulations have been carried out using a novel approach (The Next Reaction Method) that is appropriate even for very low concentrations of reactants. Studies have focused on global autocatalytic processes and their diversity.
Author
Protein Metabolism; Protobiology; Biochemistry; Cytology; Abiogenesis

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*.

20040074496 Helsinki Univ. of Technology, Espoo, Finland
Model Checking Safety Properties
Latvala, T.; 2002; 72 pp.; In English
Report No.(s): PB2004-105782; HUT-TCS-A76; No Copyright; Avail: CASI; A04, Hardcopy

Safety properties are an interesting subset of general temporal properties for systems. In the linear time paradigm, model checking of safety properties is simpler than the general case, because safety properties can be captured by finite automata. This work discusses the theoretical and some of the practical issues related to model checking LTL properties. Our first contribution is a theorem relating abstraction for Colored Petri nets as defined by Lakos and preservation of safety properties. We show that a subset of the safety properties are preserved for this abstraction framework. Our other contribution is an efficient algorithm for translating LTL safety properties to finite automata. Minor contributions include new proofs for some old complexity results regarding LTL and safety properties. The implementation of the translation algorithm is also experimentally evaluated. Experiments support the feasibility of the approach. In many tests the implementation is quite competitive when compared to algorithms translating full LTL to Buchi automata. The implementation can also check if an LTL formula is pathologic. The check performs well according to experiments.
NTIS
Algorithms; Automata Theory; Pathology

20040077309 Lawrence Livermore National Lab., Livermore, CA
Identifying and Exploiting Spatial Regularity in Data Memory References
Mohan, T.; de Supinski, B. R.; McKee, S. A.; Mueller, F.; Yoo, A.; Jul. 24, 2003; In English
Report No.(s): DE2003-15004432; UCRL-JC-154597; No Copyright; Avail: National Technical Information Service (NTIS)

The growing processor/memory performance gap causes the performance of many codes to be limited by memory accesses. If known to exist in an application, strided memory accesses forming streams can be targeted by optimizations such as prefetching, relocation, remapping, and vector loads. Undetected, they can be a significant source of memory stalls in loops. Existing stream-detection mechanisms either require special hardware, which may not gather statistics for subsequent analysis, or are limited to compile-time detection of array accesses in loops. Formally, little treatment has been accorded to the subject; the concept of locality fails to capture the existence of streams in a program's memory accesses. The contributions of this paper are as follows. First, we de- fine spatial regularity as a means to discuss the presence and effects of streams. Second, we develop measures to quantify spatial regularity, and we design and implement an on-line, parallel algorithm to detect streams - and hence regularity - in running applications. Third, we use examples from real codes and common benchmarks to illustrate how derived stream statistics can be used to guide the application of profile-driven optimizations. Overall, we demonstrate the benefits of our novel regularity metric as a low-cost instrument to detect potential for code optimizations affecting memory performance.
NTIS
On-Line Systems; Data Storage; Memory (Computers)

20040077334 Lawrence Livermore National Lab., Livermore, CA
Multi-Resolution Data Structure for Two-Dimensional Morse Functions
Bremer, P. T.; Edelsbrunner, H.; Hamann, B.; Pascucci, V.; Jul. 30, 2003; In English
Report No.(s): DE2003-15005010; UCRL-JC-154014; No Copyright; Avail: National Technical Information Service (NTIS)

The efficient construction of simplified models is a central problem in the field of visualization. We combine topological and geometric methods to construct a multi-resolution data structure for functions over two-dimensional domains. Starting with the Morse- Smale complex we build a hierarchy by progressively canceling critical points in pairs. The data structure supports mesh traversal operations similar to traditional multi-resolution representations.
NTIS
Data Structures; Critical Point; Domains

20040077354 Lawrence Livermore National Lab., Livermore, CA
Integrated Performance Visualizer for MPI/OpenMP Programs
Hoeflinger, J.; Kuhn, B.; Petersen, P.; Rajic, H.; Shah, S.; Feb. 25, 2001; In English
Report No.(s): DE2003-15005336; UCRL-JC-142829; No Copyright; Avail: National Technical Information Service (NTIS)

The main goals of the VGV project are to create an integrated MPI/OpenMP performance analysis tool that is easy to use and that scales well to even the largest systems currently available. This new tool is largely based on the existing Vampir and GuideView tools. The purpose of this paper is to describe this tool, how it may be used, and how it can help pin-point the source of performance problems in MPI/OpenMP programs.
NTIS
Pins; Point Sources; Reliability Analysis

20040077358 California Univ., Lawrence Berkeley National Lab., Berkeley, CA, USA, Virginia Univ., Charlottesville, VA, USA, Utah Univ., Salt Lake City, UT, USA
Sort-First, Distributed Memory Parallel Visualization and Rendering
Bethel, E. W.; Humphreys, G.; Paul, B.; Brederson, J. D.; 2003; In English
Report No.(s): DE2003-816073; No Copyright; Avail: National Technical Information Service (NTIS)

While commodity computing and graphics hardware has increased in capacity and dropped in cost, it is still quite difficult to make effective use of such systems for general-purpose parallel visualization and graphics. We describe the results of a recent project that provides a software infrastructure suitable for general-purpose use by parallel visualization and graphics applications. Our work combines and extends two technologies: Chromium, a stream-oriented framework that implements the OpenGL programming interface; and OpenRM Scene Graph, a pipelined-parallel scene graph interface for graphics data management. Using this combination, we implement a sort-first, distributed memory, parallel volume rendering application. We describe the performance characteristics in terms of bandwidth requirements and highlight key algorithmic considerations needed to implement the sort-first system. We characterize system performance using a distributed memory parallel volume rendering application, a nd present performance gains realized by using scene specific knowledge to accelerate rendering through reduced network bandwidth. The contribution of this work is an exploration of general-purpose, sort-first architecture performance characteristics as applied to distributed memory, commodity hardware, along with a description of the algorithmic support needed to realize parallel, sort-first implementations.
NTIS
Distributed Memory; Algorithms

20040079356 NASA Ames Research Center, Moffett Field, CA, USA
Product Distribution Theory and Semi-Coordinate Transformations
Airiau, Stephane; Wolpert, David H.; [2004]; 7 pp.; In English; Copyright; Avail: CASI; A02, Hardcopy

Product Distribution (PD) theory is a new framework for doing distributed adaptive control of a multiagent system (MAS). We introduce the technique of "coordinate transformations" in PD theory gradient descent. These transformations selectively couple a few agents with each other into "meta-agents". Intuitively, this can be viewed as a generalization of forming binding contracts between those agents. Doing this sacrifices a bit of the distributed nature of the MAS, in that there must now be communication from multiple agents in determining what joint-move is finally implemented However, as we demonstrate in computer experiments, these transformations improve the performance of the MAS.
Author
Coordinate Transformations; Distributed Parameter Systems; Active Control; Adaptive Control

20040079456 Lawrence Livermore National Lab., Livermore, CA
Enhancing Scalability of Parallel Structured AMR Calculations
Wissink, A. M.; Hysom, D.; Hornung, R. D.; May 08, 2003; In English
Report No.(s): DE2003-15004399; UCRL-JC-151791-R1; No Copyright; Avail: National Technical Information Service (NTIS)

We discuss parallel performance of structured adaptive mesh refinement calculations using the SAMRAI library. We focus on fundamental aspects of adaptive gridding and dynamic computation of changing data dependencies. Previous analysis of performance of large-scale parallel adaptive calculations revealed poor scaling in these operations. This paper describes

subsequent developments involving graph- and tree-based algorithms that reduce runtime complexity and substantially increase scalability.
NTIS
Computational Grids; Grid Generation (Mathematics); Parallel Processing (Computers)

20040079457 Lawrence Livermore National Lab., Livermore, CA
Enhancing Scalability of Parallel Structured AMR Calculations
Wissink, A. M.; Hysom, D.; Hornung, R. D.; Feb. 10, 2003; In English
Report No.(s): DE2003-15004398; UCRL-JC-151791; No Copyright; Avail: National Technical Information Service (NTIS)
This paper discusses parallel scaling performance of large scale parallel structured adaptive mesh refinement (SAMR) calculations in SAMRAI. This work describes algorithms we have developed to enhance the efficiency of the adaptive gridding operations. Performance of the algorithms is evaluated for two adaptive benchmarks run on up 512 processors and of an IBM SP system.
NTIS
Algorithms; Parallel Processing (Computers); Computational Grids; Structured Grids (Mathematics)

20040079458 Helsinki Univ. of Technology, Espoo, Finland
Object-Based Modelling for Representing and Processing Speech Corpora
Altosaar, T.; 2001; 104 pp.; In English
Report No.(s): PB2004-105759; REPT-63; No Copyright; Avail: CASI; A06, Hardcopy
This thesis deals with modelling data existing in large speech corpora using an object-oriented paradigm which captures important linguistic structures. Information from corpora is transformed into objects and are assigned properties regarding their behaviour. These objects, called speech units, are placed onto a multi-dimensional framework and have their relationships to other units explicitly defined through the use of links. Frameworks that model temporal utterances or atemporal information like speaker characteristics and recording conditions can be searched efficiently for contextual matches. Speech units that match desired contexts are the result of successful linguistically motivated queries and can be used in further speech processing tasks in the same computational environment. This allows for empirical studies of speech and its relation to linguistic structures to be carried out, and for the training and testing of applications like speech recognition and synthesis.
NTIS
Speech Recognition; Object-Oriented Programming; Verbal Communication

20040079658 Lawrence Livermore National Lab., Livermore, CA
Efficient Error Calculation for Multiresolution Texture-based Volume Visualization
LaMar, E. C.; Hamann, B.; Joy, K. I.; Oct. 16, 2001; In English
Report No.(s): DE2004-15005932; UCRL-JC-145831; No Copyright; Avail: National Technical Information Service (NTIS)
Multiresolution texture-based volume visualization is an excellent technique to enable interactive rendering of massive data sets. Interactive manipulation of a transfer function is necessary for proper exploration of a data set. However, multiresolution techniques require assessing the accuracy of the resulting images, and re-computing the error after each change in a transfer function is very expensive. They extend their existing multiresolution volume visualization method by introducing a method for accelerating error calculations for multiresolution volume approximations. Computing the error for an approximation requires adding individual error terms. One error value must be computed once for each original voxel and its corresponding approximating voxel. For byte data, i.e., data sets where integer function values between 0 and 255 are given, they observe that the set of error pairs can be quite large, yet the set of unique error pairs is small. instead of evaluating the error function for each original voxel, they construct a table of the unique combinations and the number of their occurrences. To evaluate the error, they add the products of the error function for each unique error pair and the frequency of each error pair. This approach dramatically reduces the amount of computation time involved and allows them to re-compute the error associated with a new transfer function quickly.
NTIS
Computation; Error Functions; Transfer Functions

20040079719 Swedish Defence Research Establishment, Linkoeping, Sweden
Sensors to Decisions - Towards Improved Situation Awareness in a Network Centric Defence
Jungert, E.; Groenwall, C.; Dec. 2003; 50 pp.; In English
Report No.(s): PB2004-104646; FOI-R-1041-SE; No Copyright; Avail: CASI; A03, Hardcopy

In this report a project called information system for target recognition is presented. This report describes an information system for recognition of ground targets, basically various types of vehicles. The main goal is to cover the complete process of target recognition, from the sensors to the decision support in a command and control system. The main applications will be concerned with surveillance and intelligence. The main goals of the project have been to: develop signal- and image-processing methods for target recognition; demonstrate target recognition of ground targets, mainly military vehicles; demonstrate improved target recognition using data fusion; develop an information system for target recognition based on a query language, with a powerful visual user interface, for heterogeneous sensor data sources; and to demonstrate how the decision support tool in the information system can support situation analysis.
NTIS
Target Recognition; Information Systems; Situational Awareness

20040079726 National Inst. of Standards and Technology, Gaithersburg, MD, USA
Matching Performance for the US-VISIT IDENT System Using Flat Fingerprints
Wilson, C. L.; Garris, M. D.; Watson, C. I.; May 2004; In English
Report No.(s): PB2004-105958; NISTIR-7110; No Copyright; Avail: National Technical Information Service (NTIS)
This report discusses the flat-to-flat matching performance of the US-VISIT fingerprint matching system. Both one-to-many matching used to detect duplicate visa enrollments and one-to-one matching used to verify the identity of the visa holder are discussed. With the proper selection of an operating point, the one-to-many accuracy for a two-finger comparison against a database of 6,000,000 subjects is 95% with a false match rate of 0.08%. Using two fingers, the one-to-one matching accuracy is 99.5% with a false accept rate of 0.1%.
NTIS
Matching; Fingers; Identities

20040079729 Lawrence Livermore National Lab., Livermore, CA
Using Graphs for Fast Error Term Approximation of Time-Varying Datasets
Nuber, C.; LaMar, E. C.; Pascucci, V.; Hamann, B.; Joy, K. I.; Feb. 27, 2003; In English
Report No.(s): DE2003-15004402; UCRL-JC-151965; No Copyright; Avail: National Technical Information Service (NTIS)
We present a method for the efficient computation and storage of approximations of errors tables used for error estimation of a region between different time steps in time-varying datasets. The error between two time steps is defined as the distance between the data of these time steps. Error tables are used to look up the error between different time steps of a time-varying datasets, especially when run time error computation is expensive.
NTIS
Computation; Error Analysis; Computer Storage Devices

20040079750 General Accounting Office, Washington, DC
Technology Assessment: Cybersecurity for Critical Infrastructure Protection
May 2004; 228 pp.; In English
Report No.(s): PB2004-105536; GAO-04-321; No Copyright; Avail: CASI; A11, Hardcopy
Computers are crucial to the operations of government and business. Computers and networks essentially run the critical infrastructures that are vital to our national defense, economic security, and public health and safety. Unfortunately, many computer systems and networks were not designed with security in mind. As a result, the core of our critical infrastructure is riddled with vulnerabilities that could enable an attacker to disrupt operations or cause damage to these infrastructures. Critical infrastructure protection (CIP) involves activities that enhance the security of our nations cyber and physical infrastructure. Defending against attacks on our information technology infrastructure cybersecurityis a major concern of both the government and the private sector. Consistent with guidance provided by the Senates Fiscal Year 2003 Legislative Branch Appropriations Report (S. Rpt. 107-209), GAO conducted this technology assessment on the use of cybersecurity technologies for CIP in response to a request from congressional committees. This assessment addresses the following questions: (1) What are the key cybersecurity requirements in each of the CIP sectors; (2) What cybersecurity technologies can be applied to CIP; (3) What are the implementation issues associated with using cybersecurity technologies for CIP, including policy issues such as privacy and information sharing.
NTIS
Computer Security; Technology Assessment

20040079769 Lawrence Livermore National Lab., Livermore, CA
IEEE 802.11 Wireless LAN Security White Paper
King, J. S.; Oct. 22, 2001; In English
Report No.(s): DE2004-15005940; UCRL-ID-147478; No Copyright; Avail: National Technical Information Service (NTIS)

Given the increased productivity and growing popularity of wireless communications in general, and wireless data communications in particular, this paper outlines the protocols, security implications, and architectures of IEEE Std. 802.11-1999 wireless LANs (WLANs) and makes recommendations regarding a phased implementation of WLANs at LLNL. This project is driven by the need for convenient and secure access to the Internet for Laboratory visitors and to the internal network for Laboratory employees. A solid architecture designed with a priority on security will allow LLNL to offer network access in areas where it is traditionally hard to deploy wired networks. It will also enable such services as wireless access for inventory control and convenient network access for conference rooms around LLNL. Wireless network access has the potential to increase productivity by enabling instant access to information.
NTIS
Protocol (Computers); Local Area Networks; Communication Networks; Data Transmission

20040079771 Lawrence Livermore National Lab., Livermore, CA
PlotStuff Graphics Post Processor for Overture, User Guide, Version 1.00
Henshaw, W. D.; Apr. 20, 2000; In English
Report No.(s): DE2004-15006865; UCRL-MA-138730; No Copyright; Avail: National Technical Information Service (NTIS)

This document explains how to use plotStuff, a program for plotting results from Overture programs. plotStuff reads data-base files created by Overture that contain information about the grid and solutions, a "show file". plotStuff has features for plotting contours, cutting planes, streamlines, iso-surfaces and grids. It can also be used to plot various derived quantities such as derivatives of the solution components. This document describes the class Derived Functions which is used to compute these derived quantities.
NTIS
User Manuals (Computer Programs); Plotting; Data Bases

20040081104 NASA Langley Research Center, Hampton, VA, USA
Textbook Multigrid Efficiency for Leading Edge Stagnation
Diskin, Boris; Thomas, James L.; Mineck, Raymond E.; May 5, 2004; 49 pp.; In English
Contract(s)/Grant(s): 762-45-CA
Report No.(s): NASA/TM-2004-213037; L-19023; No Copyright; Avail: CASI; A03, Hardcopy

A multigrid solver is defined as having textbook multigrid efficiency (TME) if the solutions to the governing system of equations are attained in a computational work which is a small (less than 10) multiple of the operation count in evaluating the discrete residuals. TME in solving the incompressible inviscid fluid equations is demonstrated for leading-edge stagnation flows. The contributions of this paper include (1) a special formulation of the boundary conditions near stagnation allowing convergence of the Newton iterations on coarse grids, (2) the boundary relaxation technique to facilitate relaxation and residual restriction near the boundaries, (3) a modified relaxation scheme to prevent initial error amplification, and (4) new general analysis techniques for multigrid solvers. Convergence of algebraic errors below the level of discretization errors is attained by a full multigrid (FMG) solver with one full approximation scheme (FAS) cycle per grid. Asymptotic convergence rates of the FAS cycles for the full system of flow equations are very fast, approaching those for scalar elliptic equations.
Author
Leading Edges; Stagnation Flow; Multigrid Methods; Inviscid Flow; Flow Equations

20040081114 NASA Ames Research Center, Moffett Field, CA, USA
GPC-Based Stable Reconfigurable Control
Soloway, Don; Shi, Jian-Jun; Kelkar, Atul; [2004]; 42 pp.; In English
Contract(s)/Grant(s): NAG2-1471; No Copyright; Avail: CASI; A03, Hardcopy

This paper presents development of multi-input multi-output (MIMO) Generalized Pre-dictive Control (GPC) law and its application to reconfigurable control design in the event of actuator saturation. A Controlled Auto-Regressive Integrating Moving Average (CARIMA) model is used to describe the plant dynamics. The control law is derived using input-output description of the system and is also related to the state-space form of the model. The stability of the GPC control law without reconfiguration is first established using Riccati-based approach and state-space formulation. A novel reconfiguration strategy

is developed for the systems which have actuator redundancy and are faced with actuator saturation type failure. An elegant reconfigurable control design is presented with stability proof. Several numerical examples are presented to demonstrate the application of various results.
Author
Mimo (Control Systems); Mathematical Models; Siso (Control Systems); Actuators; Reconfigurable Hardware

20040081195 NASA Ames Research Center, Moffett Field, CA, USA
Inference of Stochastic Nonlinear Oscillators with Applications to Physiological Problems
Smelyanskiy, Vadim N.; Luchinsky, Dmitry G.; [2004]; 11 pp.; In English; Copyright; Avail: CASI; A03, Hardcopy

A new method of inferencing of coupled stochastic nonlinear oscillators is described. The technique does not require extensive global optimization, provides optimal compensation for noise-induced errors and is robust in a broad range of dynamical models. We illustrate the main ideas of the technique by inferencing a model of five globally and locally coupled noisy oscillators. Specific modifications of the technique for inferencing hidden degrees of freedom of coupled nonlinear oscillators is discussed in the context of physiological applications.
Author
Nonlinearity; Oscillators; Stochastic Processes; Physiology; Nonlinear Equations; Inference; Mathematical Models

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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*.

20040068137 NASA Ames Research Center, Moffett Field, CA, USA
A Performance Evaluation of the Cray X1 for Scientific Applications
Oliker, Leonid; Biswas, Rupak; Borrill, Julian; Canning, Andrew; Carter, Jonathan; Djomehri, M. Jahed; Shan, Hongzhang; Skinner, David; December 13, 2004; 14 pp.; In English
Contract(s)/Grant(s): DE-AC03-76SF-00098; DTTS59-99-D-00437; NASA Order A-61812-D; WBS 302-15-41; No Copyright; Avail: CASI; A03, Hardcopy

The last decade has witnessed a rapid proliferation of superscalar cache-based microprocessors to build high-end capability and cost effectiveness. However, the recent development of massively parallel vector systems is having a significant effect on the supercomputing landscape. In this paper, we compare the performance of the recently released Cray X1 vector system with that of the cacheless NEC SX-6 vector machine, and the superscalar cache-based IBM Power3 and Power4 architectures for scientific applications. Overall results demonstrate that the X1 is quite promising, but performance improvements are expected as the hardware, systems software, and numerical libraries mature. Code reengineering to effectively utilize the complex architecture may also lead to significant efficiency enhancements.
Author
Cray Computers; Performance Tests; Computer Systems Performance

20040079380 NASA Goddard Space Flight Center, Greenbelt, MD, USA
A Comparative Study of Heavy Ion and Proton Induced Bit Error Sensitivity and Complex Burst Error Modes in Commercially Available High Speed SiGe BiCMOS
Marshall, Paul; Carts, Marty; Campbell, Art; Reed, Robert; Ladbury, Ray; Seidleck, Christina; Currie, Steve; Riggs, Pam; Fritz, Karl; Randall, Barb, et al.; [2004]; 25 pp.; In English; Single Event Effects Symposium, 27-29 Apr. 2004, Manhattan Beach, CA, USA; Original contains color illustrations; No Copyright; Avail: CASI; A03, Hardcopy

A viewgraph presentation that reviews recent SiGe bit error test data for different commercially available high speed SiGe BiCMOS chips that were subjected to various levels of heavy ion and proton radiation. Results for the tested chips at different operating speeds are displayed in line graphs.
CASI
Cmos; Protons; Radiation Damage; Ionizing Radiation; Bit Error Rate; Error Analysis

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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.

20040068138 Research Inst. for Advanced Computer Science, Moffett Field, CA, USA
Adding Concrete Syntax to a Prolog-Based Program Synthesis System
Fischer, Bernd; Visser, Eelco; Logic-Based Program Synthesis and Transformation: LOPSTER 2003, Revised; [2003]; 2 pp.; In English; Copyright; Avail: Other Sources; Abstract Only

Program generation and transformation systems work on two language levels, the object-level (i e., the language of the manipulated programs), and the meta-level (i.e., the implementation language of the system itself). The meta-level representations of object-level program fragments are usually built in an essentially syntax-free fashion using the operations provided by the meta-language. However, syntax matters and a large conceptual distance between the two languages makes it difficult to maintain and extend such systems. Here we describe how an existing Prolog-based system can gradually be retrofitted with concrete object-level syntax, thus shrinking this distance.
Author
Syntax; Object-Oriented Programming

20040078863 Naval Research Lab., Washington, DC
Simulation Environment for Onboard Fire Network Model Version 1.0 - Theory Manual
Haupt, Thomasz A.; Shulga, Dmitry; Sura, Bhargavi; Durvasula, Shravan K.; Tatem, Patricia A.; May 12, 2004; 36 pp.; In English; Original contains color illustrations
Report No.(s): AD-A423374; NRL/MR/6180--04-8800; No Copyright; Avail: CASI; A03, Hardcopy

The collaborative work of Hughes Associates, Inc. (HAI), the Naval Research Laboratory (NRL), and a group at Mississippi State University (MSU) resulted in developing a simulation system including Graphical User Interface (GUI) and visualization capabilities. The system is intended to provide real-time information to assist an emergency response team. The GUI must be relatively simple and straightforward to use. The design platform is Windows NT/XP. The general system design is developed with help of Unified Modeling Language (UML). The GUI is written with ANSI C** programming language and Microsoft Foundation Classes (MFC) library. Windows API provides functionality for multithreading. OpenOL and mySQL are used for implementing visualizations and database, respectively. This report is organized as follows. The overall system design is presented in Section 2. Section 3 explains the structure of the code, and Section 4 discusses the database schema. Section 5 describes the process of populating the GUI data structures with data from the database, which is critical for the overall performance of the system. The information provided in Sections 2 through 5 is summarized in Section 6 that describes the resulting 3D model of the ship. Section 7 provides details of the runtime environment, including implementation of GUI elements for interactive control of the ship state and setting the network model parameters. The visualization of the network model output is described in Section S. Finally, Section 9 summarizes the project.
DTIC
Dynamic Structural Analysis; Fire Prevention; Fires; Marine Technology; Simulation; Systems Engineering

20040078873 SRI International Corp., Menlo Park, CA
Automated Dynamic Assembly of Dependable System Architectures
Riemenschneider, R. A.; Apr. 2004; 77 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F30602-00-C-0199; Proj-DASA
Report No.(s): AD-A423392; AFRL-IF-RS-TR-2004-111; No Copyright; Avail: CASI; A05, Hardcopy

This project was part of the DARPA Dynamic Assembly for Systems Adaptability, Dependability, and Assurance (DASADA) Program. The DASADA program objective was to develop dynamic gauges or measures of component composability or interoperability. As military software systems become more complex, it is evident that they must be able to change themselves by swapping or modifying components, changing component interaction protocols, or changing topology. Particularly for critical military systems, we need to enable changes to be made predictably to ensure safety and reliability. The objective of this project was to develop technology for generating custom dependability gauges which monitor dependability properties (e.g., security, safety, fault tolerance) of a complex, evolving software architecture at runtime. This project's principal innovation consists of focusing on abstractions rather than refinement, and on automatic updating of abstractions and analyses developed at design time after making small well-structured changes to architectural requirements and the system architecture. Their dependability gauge technology is complementary to the more fine-grained runtime analysis

that can be performed by monitoring events at component interfaces and within connectors that are being developed by other DASADA contractors.
DTIC
Architecture (Computers); Human-Computer Interface

20040078924 McDonald Research Associates, Inc., Winterpark, FL
Preliminary Evaluation of the Control Interface for a Training Simulation System
Weeks, Joseph L.; McDonald, L. B.; Sep. 2003; 20 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F41624-97-D-5000; Proj-4924
Report No.(s): AD-A423487; AFRL-HE-AZ-TP-2003-0002; No Copyright; Avail: CASI; A03, Hardcopy

The USA Air Force Research Laboratory is conducting research and development of a computer-based, simulation capability to support training in decision making and team coordination for security forces ground operations. The simulation capability allows an instructor to start and control a simulation exercise on trainee computer workstations connected via a local area network. Simulation software supports the interaction of trainees with each other and with computer-generated forces (CGFs) that initiate behavior of enemy, neutral, and friendly troops and civilians. For the security forces simulation capability, the goal is to design a control interface that instructors can learn to use in two hours and trainees can learn to use in thirty minutes. To achieve this goal, a Windows-based control interface was adopted as the initial point of departure. Menu options were developed to correspond to the standard mission planning procedures used by security forces and drag-and-drop functions were developed to replace menu options to contribute to usability. This paper describes the emerging control interface, the approach to and outcomes from a field evaluation of the interface to include actual times required for instructors and trainees to learn to use the system and instructors' acceptability evaluations. Summary conclusions shed light on critical human-machine interface design issues for computer- based training simulations.
DTIC
Combat; Computer Assisted Instruction; Computerized Simulation; Education; Simulation

20040078938 Science Applications International Corp., San Diego, CA
CATS User's Manual
Kaul, Dean; Bruno, John; Roberts, James; Mar. 2004; 300 pp.; In English
Contract(s)/Grant(s): DNA-0001-94-C-0135; Proj-AF
Report No.(s): AD-A423521; SAIC-00/1010; DTRA-TR-00-9; No Copyright; Avail: CASI; A13, Hardcopy

The Consequences Assessment Tool Set (CATS) addresses the need to predict damage and analyze consequences from natural and technological disasters. Winner of numerous awards, including the 1996 Ford Foundation Innovations in American Government Award, CATS employs a suite of hazard, casualty and damage assessment modules to estimate and analyze effects of natural phenomena, such as hurricanes and earthquakes, and technological disasters, such as terrorist incidents, involving weapons of mass destruction, and industrial accidents. CATS depicts damage extent, probabilities and numbers of fatalities and injuries, and mitigative resource allocation. CATS operates on Pentium PCs running Windows 95/ 98/NT 4.0, and is integrated within the commercially available Arcview(Registered) Geographic Information System (GIS). CATS uses the power of the GIS to display and analyze hazard predictions, perform consequences assessment, facilitate resource management and create pictorial and textual reports. This report provides user instructions and a technical description of the code architecture.
DTIC
Cats; Damage Assessment; User Manuals (Computer Programs)

20040079293 Aerospace Corp., El Segundo, CA
Documentation of a Computer Code by HKC Research to Calculate the Transmission of a Sonic Boom Through a Wavy Ocean Surface
Moody, D. M.; Griffice, C. P.; Dec. 18, 2003; 34 pp.; In English
Contract(s)/Grant(s): FA8802-04-C-0001
Report No.(s): AD-A423533; TR-2004(8506)-1; SMC/EL-TR-04-13; No Copyright; Avail: CASI; A03, Hardcopy

A "sonic boom wavy surface" computer code was developed by HKC Research at the University of Southern California (USC) over the last few years. It was distributed in April 2003 via CD through PARSONS, Pasadena, to the Air Force. A final report was also distributed. The problem addressed by this code is that of a sonic boom passing over a wavy ocean surface. The pressure wave transmitted through the wavy interface is the primary output of this code. The theory upon

which this code is based is presented in a USC Report authored by H. K. Cheng and C. J. Lee. The purpose of the current report is to document the code by explaining the calculations performed therein, and placing the numerical routines in correspondence with the equations which appear in the USC Report. Code results from a sample input set are also presented in order to provide a benchmark for future users and against which to compare possible future releases of this code by Cheng and Lee. The emphasis of this report is on code documentation. No assessment nor interpretation of the theory is offered. Although the Cheng and Lee code is not currently in standard use for predicting sonic boom transmission into the ocean, this document may hasten its adoption as a standard tool for this purpose.
DTIC
Computer Programs; Ocean Surface; Sonic Booms

20040079299 Naval Facilities Engineering Service Center, Port Hueneme, CA
Final Cost and Performance Report Application of Flow and Transport Optimization Codes to Groundwater Pump and Treat Systems
Zhang, Yan; Greenwald, Robert; Minsker, Barbara; Peralta, Richard; Zheng, Chunmiao; Jan. 2004; 44 pp.; In English; Original contains color illustrations
Report No.(s): AD-A423258; NFESC-TR-2238-ENV; No Copyright; Avail: CASI; A03, Hardcopy

This ESTCP project evaluated the benefits and utility of applying transport optimization algorithms operable on desktop computers versus a traditional trial-&-error approach. The focus was on groundwater pump and treat (P&T) systems. The transport optimization algorithms link mathematical optimization techniques with simulations of groundwater flow and contaminant transport to determine the best combination of well locations and pumping rates for a P&T system. These mathematical algorithms can potentially contribute to long-term operating cost reduction and/or improved performance of these systems with respect to compliance objectives (e.g. achieve cleanup standards in less time).
DTIC
Costs; Ground Water

20040079346 NASA Ames Research Center, Moffett Field, CA, USA
Putting Priors in Mixture Density Mercer Kernels
Srivastava, Ashok N.; Schumann, Johann; Fischer, Bernd; 2004; 9 pp.; In English; No Copyright; Avail: CASI; A02, Hardcopy

This paper presents a new methodology for automatic knowledge driven data 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. We describe a new method called Mixture Density Mercer Kernels to learn kernel function directly from data, rather than using predefined kernels. These data adaptive kernels can en- code prior knowledge in the kernel using a Bayesian formulation, thus allowing for physical information to be encoded in the model. We compare the results with existing algorithms on data from the Sloan Digital Sky Survey (SDSS). The code for these experiments has been generated with the AUTOBAYES tool, which automatically generates efficient and documented C/C++ code from abstract statistical model specifications. The core of the system is a schema library which contains template for learning and knowledge discovery algorithms like different versions of EM, or numeric optimization methods like conjugate gradient methods. The template instantiation is supported by symbolic- algebraic computations, which allows AUTOBAYES to find closed-form solutions and, where possible, to integrate them into the code. The results show that the Mixture Density Mercer-Kernel described here outperforms tree-based classification in distinguishing high-redshift galaxies from low- redshift galaxies by approximately 16% on test data, bagged trees by approximately 7%, and bagged trees built on a much larger sample of data by approximately 2%.
Author
Nonlinearity; Mathematical Models; Knowledge Based Systems; Conjugate Gradient Method; C++ (Programming Language); Bayes Theorem

20040079802 NASA Goddard Space Flight Center, Greenbelt, MD, USA
James Webb Space Telescope: Supporting Multiple Ground System Transitions in One Year
Detter, Ryan; Fatig, Curtis; Steck, Jane; [2004]; 10 pp.; In English; SPIE Conference, 19-26 Jun. 2004, Glasgow, Scotland, UK; No Copyright; Avail: CASI; A02, Hardcopy

Ideas, requirements, and concepts developed during the very early phases of the mission design often conflict with the reality of a situation once the prime contractors are awarded. This happened for the James Webb Space Telescope (JWST) as

well. The high level requirement of a common real-time ground system for both the Integration and Test (I&T), as well as the Operation phase of the mission is meant to reduce the cost and time needed later in the mission development for re-certification of databases, command and control systems, scripts, display pages, etc. In the case of JWST, the early Phase A flight software development needed a real-time ground system and database prior to the spacecraft prime contractor being selected. To compound the situation, the very low level requirements for the real-time ground system were not well defined. These two situations caused the initial real-time ground system to be switched out for a system that was previously used by the Bight software development team. To meet the high-!evel requirement, a third ground system was selected based on the prime spacecraft contractor needs and JWST Project decisions. The JWST ground system team has responded to each of these changes successfully. The lessons learned from each transition have not only made each transition smoother, but have also resolved issues earlier in the mission development than what would normally occur.
Author
James Webb Space Telescope; Software Engineering; Applications Programs (Computers); Certification; Command and Control; Computer Programming; Real Time Operation

20040081057 NASA Ames Research Center, Moffett Field, CA, USA
Adaptive, Distributed Control of Constrained Multi-Agent Systems
Bieniawski, Stefan; Wolpert, David H.; [2004]; 8 pp.; In English; Copyright; Avail: CASI; A02, Hardcopy

Product Distribution (PO) theory was recently developed as a broad framework for analyzing and optimizing distributed systems. Here we demonstrate its use for adaptive distributed control of Multi-Agent Systems (MASS), i.e., for distributed stochastic optimization using MAS s. First we review one motivation of PD theory, as the information-theoretic extension of conventional full-rationality game theory to the case of bounded rational agents. In this extension the equilibrium of the game is the optimizer of a Lagrangian of the (Probability dist&&on on the joint state of the agents. When the game in question is a team game with constraints, that equilibrium optimizes the expected value of the team game utility, subject to those constraints. One common way to find that equilibrium is to have each agent run a Reinforcement Learning (E) algorithm. PD theory reveals this to be a particular type of search algorithm for minimizing the Lagrangian. Typically that algorithm i s quite inefficient. A more principled alternative is to use a variant of Newton's method to minimize the Lagrangian. Here we compare this alternative to RL-based search in three sets of computer experiments. These are the N Queen s problem and bin-packing problem from the optimization literature, and the Bar problem from the distributed RL literature. Our results confirm that the PD-theory-based approach outperforms the RL-based scheme in all three domains.
Author
Distributed Parameter Systems; Algorithms; Information Theory; Information Retrieval

20040081067 NASA Ames Research Center, Moffett Field, CA, USA
Synthesizing Safety Conditions for Code Certification Using Meta-level Programming
Eusterbrock, Jutta; 2004; 1 pp.; In English; No Copyright; Avail: Other Sources; Abstract Only

In code certification the code consumer publishes a safety policy and the code producer generates a proof that the produced code is in compliance with the published safety policy. In this paper, a novel viewpoint approach towards an implementational re-use oriented framework for code certification is taken. It adopts ingredients from Necula's approach for proof-carrying code, but in this work safety properties can be analyzed on a higher code level than assembly language instructions. It consists of three parts: (1) The specification language is extended to include generic pre-conditions that shall ensure safety at all states that can be reached during program execution. Actual safety requirements can be expressed by providing domain-specific definitions for the generic predicates which act as interface to the environment. (2) The Floyd-Hoare inductive assertion method is refined to obtain proof rules that allow the derivation of the proof obligations in terms of the generic safety predicates. (3) A meta-interpreter is designed and experimentally implemented that enables automatic synthesis of proof obligations for submitted programs by applying the modified Floyd-Hoare rules. The proof obligations have two separate conjuncts, one for functional correctness and another for the generic safety obligations. Proof of the generic obligations, having provided the actual safety definitions as context, ensures domain-specific safety of program execution in a particular environment and is simpler than full program verification.
Author
Program Verification (Computers); Certification; Assembly Language; Computer Programs

20040081136 NASA Ames Research Center, Moffett Field, CA, USA

Explanation Constraint Programming for Model-based Diagnosis of Engineered Systems

Narasimhan, Sriram; Brownston, Lee; Burrows, Daniel; 2004; 7 pp.; In English; 2004 IEEE Aerospace Conference, 6-13 Mar. 2003, Big Sky, MT, USA; Original contains black and white illustrations

Report No.(s): IEEE-AC-Paper 1139; No Copyright; Avail: CASI; A02, Hardcopy

We can expect to see an increase in the deployment of unmanned air and land vehicles for autonomous exploration of space. In order to maintain autonomous control of such systems, it is essential to track the current state of the system. When the system includes safety-critical components, failures or faults in the system must be diagnosed as quickly as possible, and their effects compensated for so that control and safety are maintained under a variety of fault conditions. The Livingstone fault diagnosis and recovery kernel and its temporal extension L2 are examples of model-based reasoning engines for health management. Livingstone has been shown to be effective, it is in demand, and it is being further developed. It was part of the successful Remote Agent demonstration on Deep Space One in 1999. It has been and is being utilized by several projects involving groups from various NASA centers, including the In Situ Propellant Production (ISPP) simulation at Kennedy Space Center, the X-34 and X-37 experimental reusable launch vehicle missions, Techsat-21, and advanced life support projects. Model-based and consistency-based diagnostic systems like Livingstone work only with discrete and finite domain models. When quantitative and continuous behaviors are involved, these are abstracted to discrete form using some mapping. This mapping from the quantitative domain to the qualitative domain is sometimes very involved and requires the design of highly sophisticated and complex monitors. We propose a diagnostic methodology that deals directly with quantitative models and behaviors, thereby mitigating the need for these sophisticated mappings. Our work brings together ideas from model-based diagnosis systems like Livingstone and concurrent constraint programming concepts. The system uses explanations derived from the propagation of quantitative constraints to generate conflicts. Fast conflict generation algorithms are used to generate and maintain multiple candidates whose consistency can be tracked across multiple time steps.

Author

Automatic Control; Algorithms; Error Analysis; Computer Programs

20040081221 North Carolina State Univ., Raleigh, NC, USA

Characterizing the Preturbulence Environment for Sensor Development, New Hazard Algorithms and NASA Experimental Flight Planning

Kaplan, Michael L.; Lin, Yuh-Lang; April 2004; 11 pp.; In English

Contract(s)/Grant(s): NAG1-02007; No Copyright; Avail: CASI; A03, Hardcopy

During the grant period, several tasks were performed in support of the NASA Turbulence Prediction and Warning Systems (TPAWS) program. The primary focus of the research was on characterizing the preturbulence environment by developing predictive tools and simulating atmospheric conditions that preceded severe turbulence. The goal of the research being to provide both dynamical understanding of conditions that preceded turbulence as well as providing predictive tools in support of operational NASA B-757 turbulence research flights. The advancements in characterizing the preturbulence environment will be applied by NASA to sensor development for predicting turbulence onboard commercial aircraft. Numerical simulations with atmospheric models as well as multi-scale observational analyses provided insights into the environment organizing turbulence in a total of forty-eight specific case studies of severe accident producing turbulence on commercial aircraft. These accidents exclusively affected commercial aircraft. A paradigm was developed which diagnosed specific atmospheric circulation systems from the synoptic scale down to the meso-y scale that preceded turbulence in both clear air and in proximity to convection. The emphasis was primarily on convective turbulence as that is what the TPAWS program is most focused on in terms of developing improved sensors for turbulence warning and avoidance. However, the dynamical paradigm also has applicability to clear air and mountain turbulence. This dynamical sequence of events was then employed to formulate and test new hazard prediction indices that were first tested in research simulation studies and then ultimately were further tested in support of the NASA B-757 turbulence research flights. The new hazard characterization algorithms were utilized in a Real Time Turbulence Model (RTTM) that was operationally employed to support the NASA B-757 turbulence research flights. Improvements in the RTTM were implemented in an effort to increase the accuracy of the operational characterization of the preturbulence environment. Additionally, the initial research necessary to create a statistical evaluation scheme for the characterization indices utilized in the RTTM was undertaken. Results of all components of this research were then published in NASA contractor reports and scientific journal papers.

Author

Atmospheric Models; Warning Systems; Turbulence Models; Prediction Analysis Techniques

20040081250 NASA Ames Research Center, Moffett Field, CA, USA

System, Method and Apparatus for Discovering Phrases in a Database

McGreevy, Michael W., Inventor; April 13, 2004; 75 pp.; In English

Patent Info.: Filed 2 Mar. 2001; US-Patent-6,721,728; US-Patent-Appl-SN-800310; NASA-Case-ARC-14515-1; No Copyright; Avail: CASI; A04, Hardcopy

A phrase discovery is a method of identifying sequences of terms in a database. First, a selection of one or more relevant sequences of terms. such as relevant text, is provided. Next, several shorter sequences of terms, such as phrases, are extracted from the provided relevant sequences of terms. The extracted sequences of terms are then reduced through a culling process. A gathering process then emphasizes the more relevant of the extracted and culled sequences of terms and de-emphasizes the more generic of the extracted and culled sequences of terms. The gathering process can also include iteratively retrieving additional selections of relevant sequences (e.g.. text). extracting and culling additional sequences of terms (e.g.. phrases). emphasizing and de-emphasizing extracted and culled sequences of terms and accumulating all gathered sequences of terms. The resulting gathered sequences of terms are then output.

Author

Data Bases; Identifying; Texts; Computer Programs

20040081264 NASA Goddard Space Flight Center, Greenbelt, MD, USA

The Development of Two Science Investigator-led Processing Systems (SIPS) for NASA's Earth Observation System (EOS)

Tilmes, Curt; [2004]; 1 pp.; In English; IEEE International Geoscience and Remote Sensing Symposium 2004, 20-24 Sep. 2004, Anchorage, AK, USA; No Copyright; Avail: Other Sources; Abstract Only

In 2001, NASA Goddard Space Flight Center's Laboratory for Terrestrial Physics started the construction of a science Investigator-led Processing System (SIPS) for processing data from the Ozone Monitoring Instrument (OMI) which will launch on the Aura platform in mid 2004. The Ozone Monitoring Instrument (OMI) is a contribution of the Netherlands Agency for Aerospace Programs (NIVR) in collaboration with the Finnish Meteorological Institute (FMI) to the Earth Observing System (EOS) Aura mission. It will continue the Total Ozone Monitoring System (TOMS) record for total ozone and other atmospheric parameters related to ozone chemistry and climate. OMI measurements will be highly synergistic with the other instruments on the EOS Aura platform. The LTP previously developed the Moderate Resolution Imaging Spectrometer (MODIS) Data Processing System (MODAPS), which has been in full operations since the launches of the Terra and Aqua spacecrafts in December, 1999 and May, 2002 respectively. During that time, it has continually evolved to better support the needs of the MODIS team. We now run multiple instances of the system managing faster than real time reprocessings of the data as well as continuing forward processing. The new OMI Data Processing System (OMIDAPS) was adapted from the MODAPS. It will ingest raw data from the satellite ground station and process it to produce calibrated, geolocated higher level data products. These data products will be transmitted to the Goddard Distributed Active Archive Center (GDAAC) instance of the Earth Observing System (EOS) Data and Information System (EOSDIS) for long term archive and distribution to the public. The OMIDAPS will also provide data distribution to the OMI Science Team for quality assessment, algorithm improvement, calibration, etc. We have taken advantage of lessons learned from the MODIS experience and software already developed for MODIS. We made some changes in the hardware system organization, database and software to adapt the system for OMI. We replaced the fundamental database system, Sybase, with an Open Source RDBMS called PostgreSQL, and based the entire OMIDAPS on a cluster of Linux based commodity computers rather than the large SGI servers that MODAPS uses. Rather than relying on a central I/O server host, the new system distributes its data archive among multiple server hosts in the cluster. OMI is also customizing the graphical user interfaces and reporting structure to more closely meet the needs of the OMI Science Team. Prior to 2003, simulated OMI data and the science algorithms were not ready for production testing. We initially constructed a prototype system and tested using a 25 year dataset of Total Ozone Mapping Spectrometer (TOMS) and Solar Backscatter Ultraviolet Instrument (SBUV) data. This prototype system provided a platform to support the adaptation of the algorithms for OMI, and provided reprocessing of the historical data aiding in its analysis. In a recent reanalysis of the TOMS data, the OMIDAPS processed 108,000 full orbits of data through 4 processing steps per orbit, producing about 800,000 files (400 GiB) of level 2 and greater data files. More recently we have installed two instances of the OMIDAPS for integration and testing of OM1 science processes as they get delivered from the Science Team. A Test instance of the OMIDAPS has also supported a series of "Interface Confidence Tests" (ICTs) and End-to-End Ground System tests to ensure the launch readiness of the system. This paper will discuss the high-level hardware, software, and database organization of the OMIDAPS and how it builds on the MODAPS heritage system. It will also provide

an overview of the testing and implementation of the production OMIDAPS.
Author
Earth Observing System (Eos); Eos Data and Information System; Functional Design Specifications; Ozone

20040081282 Computer Sciences Corp., USA
Automated File Transfer and Storage Management Concepts for Space
Hogie, Keith; Criscuolo, Ed; Parise, Ron; [2004]; 1 pp.; In English; Space Internet Workshop-4, 8-10 Jun. 2004, Hanover, MD, USA
Contract(s)/Grant(s): NASA Order S-43981-G; No Copyright; Avail: Other Sources; Abstract Only

This presentation will summarize work that has been done to prototype and analyze approaches for automated file transfer and storage management for space missions. The concepts were prototyped in an environment with data files being generated at the target mission rates and stored in onboard files. The space-to-ground link was implemented using a channel simulator to introduce representative mission delays and errors. The system was operated for days with data files building up on the spacecraft and periodically being transferred to ground storage during a limited contact time. Overall performance was measured to identify limits under which the entire data volume could be transferred automatically while still fitting into the mission s limited contact time. The overall concepts, measurements, and results will be presented.
Author
Automatic Control; Management Systems; Storage; Files

62
COMPUTER SYSTEMS

Includes computer networks and distributed processing systems. For information systems see *82 Documentation and Information Science*. For computer systems applied to specific applications, see the associated category.

20040078847 Army War Coll., Carlisle Barracks, PA
Implications of Network Centric Warfare
Bailey, Alvin L.; May 3, 2004; 28 pp.; In English
Report No.(s): AD-A423336; No Copyright; Avail: CASI; A03, Hardcopy

This paper will examine Network Centric Warfare the centerpiece of Transformation. This form of warfare depends heavily on computer networks the Internet communications and sensors. These areas of dependence also provide numerous vulnerabilities. This paper will focus specifically on Network Centric Warfare's vulnerabilities in terms of sensors cyberterrorism/ Electro-Magnetic Pulse (EMP) and bandwidth/ frequency. The assessment of the areas listed above and the other strategic implications will lead to a conclusion as to its efficacy of Network Centric Warfare as the centerpiece of Transformation.
DTIC
Computer Networks; Warfare

20040078861 Institute for the Study of Learning and Expertise, Palo Alto, CA
Research on the Knowledge Plane: Distributed Learning and Reasoning About Network Outages
Langley, Pat; Bay, Stephen D.; Apr. 2004; 12 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F30602-03-2-0198; Proj-Q182
Report No.(s): AD-A423360; AFRL-IF-RS-TR-2004-107; No Copyright; Avail: CASI; A03, Hardcopy

This report summarizes experiences developing a demonstration system to perform distributed detection of network failures. A simple system was developed based on probabilistically inferring failed nodes from observations on requested traffic and propagated error messages. Simulations verified that network failures could be automatically detected with limited memory and communication overhead.
DTIC
Computer Networks; Errors; Message Processing

20040078911 Naval Postgraduate School, Monterey, CA
Amplifying Security Education in the Laboratory
Irvine, Cynthia E.; Jun. 1999; 9 pp.; In English
Report No.(s): AD-A423470; No Copyright; Avail: CASI; A02, Hardcopy

Computer and network security have become concerns for enterprises ranging from sole proprietorships run from home offices to global corporations and government agencies with hundred of thousands of employees. These concerns are reflected in the growing demand for computer security professionals to design, manage, and administer systems. Here a case is built for significant use of laboratory work to complement classroom and reading activities in computer security education.
DTIC
Amplification; Computer Information Security; Education; Security

20040078925 Naval Postgraduate School, Monterey, CA
Data Integrity Limitations in Highly Secure Systems
Irvine, Cynthia E.; Levin, Timothy E.; Mar. 2001; 8 pp.; In English
Report No.(s): AD-A423489; No Copyright; Avail: CASI; A02, Hardcopy

We discuss a class of computer/network architectures that supports multilevel security while utilizing commercial-off-the-shelf (COTS) workstations and COTS productivity software applications. We show that a property of these architectures is that, while supporting multilevel confidentiality policies, they do not generally support partially ordered integrity policies: specifically, these architectures do not support the maintenance of data that is higher in integrity than the integrity level of the COTS components.
DTIC
Client Server Systems; Computer Information Security

20040078937 Naval Postgraduate School, Monterey, CA
Monterey Security Enhanced Architecture Project
Irvine, Cynthia; Shifflett, David; Clark, Paul; Levin, Timothy; Dinolt, George; Apr. 2003; 7 pp.; In English
Report No.(s): AD-A423514; No Copyright; Avail: CASI; A02, Hardcopy

This research project has produced an innovative architecture and corresponding engineering prototype consisting of trusted security services and integrated operations system mechanisms for the protection of distributed multi-domain computing environments from malicious code and other attacks. These security services and mechanisms extend and interoperate with existing workstations, applications and open source operating systems, providing new capabilities for composing secure distributed system using commercial off-the- shelf (COTS) components. The latter construct results from the realizations that unless a secure system offers users comfortable and familiar interfaces for handling routine information, the secure system will fail due to lack of user acceptability.
DTIC
Architecture (Computers); Security

20040078942 Naval Postgraduate School, Monterey, CA
The Benefits of Student Research in Information Systems Security Education
Irvine, Cynthia E.; May 1999; 6 pp.; In English
Report No.(s): AD-A423526; No Copyright; Avail: CASI; A02, Hardcopy

In ten to fifteen years, computers will be even more ubiquitous than they are today. Computer security will remain an important hidden factor in maintaining personal privacy, enterprise competitiveness, and national security Academe will need new teachers to conduct research and lead students into the unknown. Industry will need individuals who can address enterprise-level information systems security problems. Research-based academic efforts foster the atmosphere in which we can nurture those individuals who will create the future.
DTIC
Computers; Education; Information Systems; Research; Security

20040078944 Naval Postgraduate School, Monterey, CA
The Reference Monitor Concept as a Unifying Principle in Computer Security Education
Irvine, Cynthia E.; Jun. 1999; 12 pp.; In English
Report No.(s): AD-A423529; No Copyright; Avail: CASI; A03, Hardcopy

For over twenty-five years the Reference Monitor Concept has proved itself to be a useful tool for computer security practioners. It can also be used as a conceptual tool in computer security education. This paper describes a computer security education at the Naval Postgraduate School that has used the Reference Monitor concept as a unifying principle for courses laboratory work and student research. The intent of the program is to produce graduates who will think critically about the

design and implementation of systems intended to enforce security policies.
DTIC
Computer Information Security; Education; Security

20040081101 NASA Ames Research Center, Moffett Field, CA, USA
Grid Technology Provides a Cyber Infrastructure Applicable to NASA Applications
Hinke, Thomas H.; March 26, 2004; 21 pp.; In English; Ground Systems Architectures Workshop, 31 Mar. 2004, Manhattan Beach, CA, USA; No Copyright; Avail: CASI; A03, Hardcopy

This viewgraph presentation describes: 1) What grids provide and why they are useful to NASA; 2) NASA's role in grids and grid services; 3) Example applications.
Derived from text
Computer Systems Design; Client Server Systems

20040081174 Computer Sciences Corp., USA
Space-Based Telemetry and Range Safety (STARS) Study
Hogie, Keith; Crisuolo, Ed; Parise, Ron; [2004]; 1 pp.; In English; Space Internet Workshop-4, 8-10 Jun. 2004, Hanover, MD, USA
Contract(s)/Grant(s): NASA Order S-43981-G; No Copyright; Avail: Other Sources; Abstract Only

This presentation will describe the design, development, and testing of a system to collect telemetry, format it into UDP/IP packets, and deliver it to a ground test range using standard IP technologies over a TDRSS link. This presentation will discuss the goal of the STARS IP Formatter along with the overall design. It will also present performance results of the current version of the IP formatter. Finally, it will discuss key issues for supporting constant rate telemetry data delivery when using standard components such as PCI/104 processors, the Linux operating system, Internet Protocols, and synchronous serial interfaces.
Author
Telemetry; Ground Tests; Tdr Satellites; Range Safety; Protocol (Computers)

63
CYBERNETICS, ARTIFICIAL INTELLIGENCE AND ROBOTICS

Includes feedback and control theory, information theory, machine learning, and expert systems. For related information see also *54 Man/System Technology and Life Support*.

20040068135 NASA Ames Research Center, Moffett Field, CA, USA
DDD: Dynamic Database for Diatomics
Schwenke, David; 2004; 1 pp.; In English; APS Meeting: Spectroscopy and Dynamics of Single Molecules and Nanoparticles, 22-26 Mar. 2004, Montreal, Quebec, Canada; No Copyright; Avail: Other Sources; Abstract Only

We have developed as web-based database containing spectra of diatomic moiecuies. All data is computed from first principles, and if a user requests data for a molecule/ion that is not in the database, new calculations are automatically carried out on that species. Rotational, vibrational, and electronic transitions are included. Different levels of accuracy can be selected from qualitatively correct to the best calculations that can be carried out. The user can view and modify spectroscopic constants, view potential energy curves, download detailed high temperature linelists, or view synthetic spectra.
Author
Data Bases; Diatomic Molecules; World Wide Web; Spectroscopy

20040078947 California Univ., Santa Cruz, CA
Marine Mammals as Models for Cost Efficient AUVs: Specifications of Oscillating Hydrofoils
Williams, Terrie M.; Apr. 5, 2004; 138 pp.; In English
Contract(s)/Grant(s): N00014-00-1-0761
Report No.(s): AD-A423539; No Copyright; Avail: CASI; A07, Hardcopy

This study determined the efficiency and performance limitations of oscillating hydrofoils used in nature. Specific studies compared the kinematics and energetics associated with the transition from terrestrial to aquatic performance by semi-aquatic mammals, and evaluated cost-saving strategies of obligate marine mammals using dorso- ventral or lateral undulatory propulsion. A laboratory component was conducted with bottlenose dolphins (Tursiops truncatus) , California sea lions

(Zalophus californianus), river otters (Lontra canadensis), and sea otters (Enhydra lutris) to assess the mechanical operation and energetic cost of oscillating hydrofoils performing in controlled environments. The second component used field tests on freely swimming and diving dolphins, phocid seals, and sea otters to evaluate the performance limitations of hydrofoils under open water conditions. Routine locomotor speeds, preferred swimming gaits, and stroking mechanics were measured. In the third component, the authors combined the results of their tests with data for terrestrial, semi-aquatic, and other marine mammals to provide a comparative synthesis of oscillating hydrofoil performance. Key factors for low-cost performance on land included the incorporation of aerial phases and elastic energy storage, particularly during high-speed transits. Likewise, the use of elastic energy storage and prolonged gliding associated with changes in hydrostatic pressure and buoyancy reduced locomotor costs by nearly 64% for some divers. These studies have provided information concerning the relationship between body design, biomechanics, and power consumption in a wide variety of aquatic organisms. The results have been applied to the design of aquatic gliders, engineering models for undulatory propulsion, and models for assessing performance limitations in free-ranging marine mammals. The findings provide new insights for improving the propulsive efficiency of large aquatic and semi-aquatic vehicles7
DTIC
Amphibia; Animals; Biodynamics; Costs; Energy Consumption; Hydrofoils; Marine Biology; Marine Mammals; Oscillations

20040079373 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Asteroid Exploration with Autonomic Systems
Truszkowski, Walt; Rash, James; Rouff, Christopher; Hinchey, Mike; [2004]; 6 pp.; In English; IEEE ECBS/EASE 2004, 24-27 May 2004, Brno, Czech Republic; No Copyright; Avail: CASI; A02, Hardcopy

NASA is studying advanced technologies for a future robotic exploration mission to the asteroid belt. The prospective ANTS (Autonomous Nano Technology Swarm) mission comprises autonomous agents including worker agents (small spacecra3) designed to cooperate in asteroid exploration under the overall authoriq of at least one ruler agent (a larger spacecraft) whose goal is to cause science data to be returned to Earth. The ANTS team (ruler plus workers and messenger agents), but not necessarily any individual on the team, will exhibit behaviors that qualify it as an autonomic system, where an autonomic system is defined as a system that self-reconfigures, self-optimizes, self-heals, and self-protects. Autonomic system concepts lead naturally to realistic, scalable architectures rich in capabilities and behaviors. In-depth consideration of a major mission like ANTS in terms of autonomic systems brings new insights into alternative definitions of autonomic behavior. This paper gives an overview of the ANTS mission and discusses the autonomic properties of the mission.
Author
Asteroid Belts; Autonomy; Nanotechnology; Space Missions; Artificial Intelligence; Spacecraft Instruments

20040079390 NASA Ames Research Center, Moffett Field, CA, USA
Bio-inspired Computing for Robots
Laufenberg, Larry; September 11, 2003; 2 pp.; In English
Contract(s)/Grant(s): UPN 704-00-00; No Copyright; Avail: CASI; A01, Hardcopy

Living creatures may provide algorithms to enable active sensing/control systems in robots. Active sensing could enable planetary rovers to feel their way in unknown environments. The surface of Jupiter's moon Europa consists of fractured ice over a liquid sea that may contain microbes similar to those on Earth. To explore such extreme environments, NASA needs robots that autonomously survive, navigate, and gather scientific data. They will be too far away for guidance from Earth. They must sense their environment and control their own movements to avoid obstacles or investigate a science opportunity. To meet this challenge, CICT's Information Technology Strategic Research (ITSR) Project is funding neurobiologists at NASA's Jet Propulsion Laboratory (JPL) and selected universities to search for biologically inspired algorithms that enable robust active sensing and control for exploratory robots. Sources for these algorithms are living creatures, including rats and electric fish.
Author (revised)
Robots; Sensory Perception; Robot Sensors; Bionics

20040081118 NASA Ames Research Center, Moffett Field, CA, USA
Precise and Efficient Static Array Bound Checking for Large Embedded C Programs
Venet, Arnaud; [2004]; 10 pp.; In English; PLDI 2004, 9-11 Jun. 2004, Washington, DC, USA
Contract(s)/Grant(s): QSS-132
Report No.(s): ACM-1-58113-807-5; Copyright; Avail: CASI; A02, Hardcopy

In this paper we describe the design and implementation of a static array-bound checker for a family of embedded programs: the flight control software of recent Mars missions. These codes are large (up to 250 KLOC), pointer intensive, heavily multithreaded and written in an object-oriented style, which makes their analysis very challenging. We designed a tool called C Global Surveyor (CGS) that can analyze the largest code in a couple of hours with a precision of 80%. The scalability and precision of the analyzer are achieved by using an incremental framework in which a pointer analysis and a numerical analysis of array indices mutually refine each other. CGS has been designed so that it can distribute the analysis over several processors in a cluster of machines. To the best of our knowledge this is the first distributed implementation of static analysis algorithms. Throughout the paper we will discuss the scalability setbacks that we encountered during the construction of the tool and their impact on the initial design decisions.
Author
C (Programming Language); Computer Systems Design; Numerical Analysis; Airborne/Spaceborne Computers; Mars Missions; Architecture (Computers)

20040081125 West Virginia Univ., Morgantown, WV, USA
Addressing Control Research Issues Leading to Piloted Simulations in Support of the IFCS F-15
Napolitano, Marcello; Perhinschi, Mario; Campa, Giampiero; Seanor, Brad; June 2004; 35 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): NCC4-159; No Copyright; Avail: CASI; A03, Hardcopy

This report summarizes the research effort by a team of researchers at West Virginia University in support of the NASA Intelligent Flight Control System (IFCS) F-15 program. In particular, WVU researchers assisted NASA Dryden researchers in the following technical tasks leading to piloted simulation of the 'Gen_2' IFCS control laws. Task #1- Performance comparison of different neural network (NN) augmentation for the Dynamic Inversion (DI) -based VCAS 'Gen_2' control laws. Task #2- Development of safety monitor criteria for transition to research control laws with and without failure during flight test. Task #3- Fine-tuning of the 'Gen_2' control laws for cross-coupling reduction at post-failure conditions. Matlab/Simulink-based simulation codes were provided to the technical monitor on a regular basis throughout the duration of the project. Additional deliverables for the project were Power Point-based slides prepared for different project meetings. This document provides a description of the methodology and discusses the general conclusions from the simulation results.
Author
Artificial Intelligence; Flight Control; Automatic Control

20040081193 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Virtual Solar Observatory Distributed Query Construction
Gurman, J. B.; Dimitoglou, G.; Bogart, R.; Davey, A.; Hill, F.; Martens, P.; [2003]; 1 pp.; In English; Virtual Solar Observatory Technical Meetings, 7-8 Dec. 2003; No Copyright; Avail: Other Sources; Abstract Only

Through a prototype implementation (Tian et al., this meeting) the VSO has already demonstrated the capability of unifying geographically distributed data sources following the Web Services paradigm and utilizing mechanisms such as the Simple Object Access Protocol (SOAP). So far, four participating sites (Stanford, Montana State University, National Solar Observatory and the Solar Data Analysis Center) permit Web-accessible, time-based searches that allow browse access to a number of diverse data sets. Our latest work includes the extension of the simple, time-based queries to include numerous other searchable observation parameters. For VSO users, this extended functionality enables more refined searches. For the VSO, it is a proof of concept that more complex, distributed queries can be effectively constructed and that results from heterogeneous, remote sources can be synthesized and presented to users as a single, virtual data product.
Author
Prototypes; Solar Observatories; Distributed Processing; Protocol (Computers)

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NUMERICAL ANALYSIS

Includes iteration, differential and difference equations, and numerical approximation.

20040077373 NASA Ames Research Center, Moffett Field, CA, USA
Innovation, Technology and Decision Making: A Perspective for Strategic Action in Firms
Mulenburg, Gerald M.; 2002; 6 pp.; In English; 11th International Conference on the Management of Technology, 10-14 Mar. 2002, Miami, FL, USA; No Copyright; Avail: CASI; A02, Hardcopy

Innovation, technology, and the making of decisions are tightly intertwined in what can generally be called, strategic decision making. Although true for all firms, it is especially true in innovative, high technology firms that operate in a turbulent, fast moving environment where strategic decisions must be made accurately and quickly to survive. This paper looks at some factors reported in the literature that affect how and why the strategic decision process is so important, especially in companies in fast-moving, competitive environments. The work of several prominent authors who looked critically at past theory and research, and the current state of knowledge and practice, provides a perspective of how firms make strategic decisions.
Author
Decision Making; Technology Assessment

20040078830 Pennsylvania Univ., Philadelphia, PA
Corticonic Networks for Higher-Level Processing
Farhat, Nabil H.; Feb. 25, 2004; 8 pp.; In English
Contract(s)/Grant(s): N00014-94-1-0931; DAAD19-01-1-0603
Report No.(s): AD-A423292; No Copyright; Avail: CASI; A02, Hardcopy

It is generally agreed that brain tissue is the most complex self-organizing matter known in the universe. In particular this applies to the cortex and all subcortical centers like the thalamus and the hippocampus with which the cortex interacts to carry out higher-level brain functions, such as perception, cognition, memory, language, control of complex motion, speech, and perhaps even awareness and consciousness. Understanding and creating models of how the cortex carries out such operations and implementing them in suitable fast and efficient algorithms or hardware will have far reaching implications for science, technology, and medicine, with the most obvious being the formulation and testing of models of higher-level brain functions and the design of future machines with brain-like intelligence. A set of equations seeking to model the way the cortex interacts with subcortical areas to produce certain higher-level brain functions is described. The equations are those of a network of parametrically coupled maps that incorporates salient properties of the cortex. Justifications for this approach and demonstration of its effectiveness for a parametrically coupled logistic map network (PCLMN) are presented. The PCLMN can self-organize under information-driven adaptation, is capable of handling dynamic (spatial-temporal) input patterns, furnishes an enormous number of attractors for inputs to choose from, plus it has other intriguing features that can be used in the design of intelligent systems. (3 figures, 4 refs.)
DTIC
Artificial Intelligence; Cerebral Cortex; Mathematical Models; Neural Nets; Self Organizing Systems

20040078933 Naval Research Lab., Bay Saint Louis, MS
A Note on Analyzing Nonlinear and Nonstationary Ocean Wave Data
Hwang, Paul A.; Huang, Norden E.; Wang, David W.; Jan. 2003; 8 pp.; In English
Report No.(s): AD-A423503; NRL/JA/7330/02/0078; No Copyright; Avail: CASI; A02, Hardcopy

The Huang-Hilbert transformation (HHT, composed of empirical mode decomposition and Hilbert transformation), can be applied to calculate the spectrum of nonlinear and nonstationary signals. The superior temporal and frequency resolutions of the HHT spectrum are illustrated by several examples in this article. The HHT analysis interprets wave nonlinearity in terms of frequency modulation instead of harmonic generation. The resulting spectrum contains much higher spectral energy at low frequency and sharper drop off at high frequency in comparison with the spectra derived from Fourier-based analysis methods (e.g., Fast Fourier Transforms and wavelet techniques). For wind-generated waves, the spectral level of the Fourier spectrum is about two orders of magnitude smaller than that of the HHT spectrum at the first subharmonic of the peak frequency. The resulting average frequency as defined by the normalized first momentum of the spectrum is about 1.2 times higher in the Fourier-based spectra than that of the HHT spectrum. (6 figures, 7 refs.)
DTIC
Frequency Modulation; High Resolution; Nonlinearity; Ocean Surface; Water Waves

20040081024 NASA Ames Research Center, Moffett Field, CA, USA
A-Posteriori Error Estimation for Hyperbolic Conservation Laws with Constraint
Barth, Timothy; 2004; 1 pp.; In English; Workshop on "Hyperbolic Conservation Laws", 4-10 Apr. 2004, Oberwolfach, Germany; No Copyright; Avail: Other Sources

This lecture considers a-posteriori error estimates for the numerical solution of conservation laws with time invariant constraints such as those arising in magnetohydrodynamics (MHD) and gravitational physics. Using standard duality

arguments, a-posteriori error estimates for the discontinuous Galerkin finite element method are then presented for MHD with solenoidal constraint. From these estimates, a procedure for adaptive discretization is outlined. A taxonomy of Green's functions for the linearized MHD operator is given which characterizes the domain of dependence for pointwise errors. The extension to other constrained systems such as the Einstein equations of gravitational physics are then considered. Finally, future directions and open problems are discussed.
Author
Conservation Laws; Magnetohydrodynamics; Error Analysis

20040081058 NASA Ames Research Center, Moffett Field, CA, USA
Product Distribution Theory for Control of Multi-Agent Systems
Lee, Chia Fan; Wolpert, David H.; [2004]; 10 pp.; In English; Copyright; Avail: CASI; A02, Hardcopy

Product Distribution (PD) theory is a new framework for controlling Multi-Agent Systems (MAS's). First we review one motivation of PD theory, as the information-theoretic extension of conventional full-rationality game theory to the case of bounded rational agents. In this extension the equilibrium of the game is the optimizer of a Lagrangian of the (probability distribution of) the joint stare of the agents. Accordingly we can consider a team game in which the shared utility is a performance measure of the behavior of the MAS. For such a scenario the game is at equilibrium - the Lagrangian is optimized - when the joint distribution of the agents optimizes the system's expected performance. One common way to find that equilibrium is to have each agent run a reinforcement learning algorithm. Here we investigate the alternative of exploiting PD theory to run gradient descent on the Lagrangian. We present computer experiments validating some of the predictions of PD theory for how best to do that gradient descent. We also demonstrate how PD theory can improve performance even when we are not allowed to rerun the MAS from different initial conditions, a requirement implicit in some previous work.
Author
Information Theory; Distributed Processing; Lagrangian Function; Probability Theory

20040081098 NASA Ames Research Center, Moffett Field, CA, USA
Coordination in Large Collectives, Chapter 1
Tumer, Kagan; [2004]; 8 pp.; In English; International Conference on Complex Systems; No Copyright; Avail: CASI; A02, Hardcopy

Finding the subset of a set of imperfect devices (e.g., nano or micro devices) that results in the best aggregate device is a challenging problem. It is an abstraction of what will likely be a major difficulty in designing and controlling systems of nano or micro-scale components, particularly when a large fraction of those components may be unreliable. Rather than approaching this as a passive search problem, we transform the problem into one of coordination in a complex system by imbuing each device with simple decision making ability. In doing so we face the challenge of determining what each component should attempt to do so that the collective behavior solves the overall problem. Furthermore, in this padicular instance, we face problems of scaling (number of components in the thousands to tens of thousands), observability (components have limited sensing capabilities), and reliability (the components are faulty). We present an approach based on deriving component goals that are aligned with the overall system goal (e.g., forming best aggregate device), and can be computed using information readily (e.g., locally) available to the components. Then, each component in such a collective uses a simple reinforcement learning algorithm to selfishly pursue its own goals. Because those goals are derived in a principled manner, there is no need to use external mechanisms to force collaboration or coordination among the components to ensure that the system reaches a globally desirable solution. The results show that not only this approach provides improvements of over an order of magnitude over both traditional search methods and traditional multi-agent methods, but that the gains increase with the size of the system. This latter result makes this method ideal for domains where the number of components is currently in the thousands and will reach millions in the near future.
Author
Reliability; Decision Making; Complex Systems

20040081204 NASA Ames Research Center, Moffett Field, CA, USA
Method of Conjugate Radii for Solving Linear and Nonlinear Systems
Nachtsheim, Philip R.; October 1999; 17 pp.; In English
Contract(s)/Grant(s): 632-30-34
Report No.(s): NASA/TM-1999-209580; A-00V0001; No Copyright; Avail: CASI; A03, Hardcopy

This paper describes a method to solve a system of N linear equations in N steps. A quadratic form is developed involving

the sum of the squares of the residuals of the equations. Equating the quadratic form to a constant yields a surface which is an ellipsoid. For different constants, a family of similar ellipsoids can be generated. Starting at an arbitrary point an orthogonal basis is constructed and the center of the family of similar ellipsoids is found in this basis by a sequence of projections. The coordinates of the center in this basis are the solution of linear system of equations. A quadratic form in N variables requires N projections. That is, the current method is an exact method. It is shown that the sequence of projections is equivalent to a special case of the Gram-Schmidt orthogonalization process. The current method enjoys an advantage not shared by the classic Method of Conjugate Gradients. The current method can be extended to nonlinear systems without modification. For nonlinear equations the Method of Conjugate Gradients has to be augmented with a line-search procedure. Results for linear and nonlinear problems are presented.
Author
Linear Equations; Nonlinear Equations; Conjugates; Radii

20040081275 Computer Sciences Corp., Lanham, MD, USA
An Algorithm for Converting Static Earth Sensor Measurements into Earth Observation Vectors
Harman, R.; Hashmall, Joseph A.; Sedlak, Joseph; 2004; 13 pp.; In English; Flight Mechanics Symposium, 28-30 Oct. 2003, Greenbelt, MD, USA; Original contains black and white illustrations; No Copyright; Avail: CASI; A03, Hardcopy

An algorithm has been developed that converts penetration angles reported by Static Earth Sensors (SESs) into Earth observation vectors. This algorithm allows compensation for variation in the horizon height including that caused by Earth oblateness. It also allows pitch and roll to be computed using any number (greater than 1) of simultaneous sensor penetration angles simplifying processing during periods of Sun and Moon interference. The algorithm computes body frame unit vectors through each SES cluster. It also computes GCI vectors from the spacecraft to the position on the Earth's limb where each cluster detects the Earth's limb. These body frame vectors are used as sensor observation vectors and the GCI vectors are used as reference vectors in an attitude solution. The attitude, with the unobservable yaw discarded, is iteratively refined to provide the Earth observation vector solution.
Author
Algorithms; Sensors; Earth Limb; Iteration; Vectors (Mathematics)

65
STATISTICS AND PROBABILITY

Includes data sampling and smoothing; Monte Carlo method; time series analysis; and stochastic processes.

20040078949 Naval Postgraduate School, Monterey, CA
Determining the Number of Iterations for Monte Carlo Simulations of Weapon Effectiveness
Driels, Morris R.; Shin, Young S.; Apr. 2004; 30 pp.; In English; Original contains color illustrations
Report No.(s): AD-A423541; NPS-MAE-04-005; No Copyright; Avail: CASI; A03, Hardcopy

Many weapon effectiveness tools are implemented using a Monte Carlo simulation approach since closed form solutions are too mathematically intractable to compute. A question that usually arises in connection with such simulations is this: how many iterations of a particular Monte Carlo simulation are needed? This report proposed the probability-based approach to computing effectiveness measures for better feedback to the user regarding the relationship between the number of iterations executed and confidence measures associated with the result. (4 tables, 4 figures)
DTIC
Confidence Limits; Iteration; Monte Carlo Method; System Effectiveness; Weapon Systems

20040079534 Helsinki Univ. of Technology, Espoo, Finland
Multivariate Regression-Techniques and Tools
Hyotyniemi, H.; Jul. 2001; In English
Report No.(s): PB2004-105753; REPT-125; No Copyright; Avail: National Technical Information Service (NTIS)

Multivariate statistical methods are powerful tools for analysis and manipulation of large data sets. This report introduces the most important statistical tools that can be used for multivariate regression in a general framework.
NTIS
Statistical Analysis; Multivariate Statistical Analysis; Data Processing

20040079697 California Univ., Lawrence Berkeley National Lab., Berkeley, CA, USA
Measure of the Goodness of Fit in Unbinned Likelihood Fits; End of Bayesianism
Raja, R.; 2004; 12 pp.; In English
Report No.(s): DE2004-821998; FERMILAB-CONF-04/012-E; No Copyright; Avail: Department of Energy Information Bridge

Maximum likelihood fits to data can be done using binned data (histograms) and unbinned data. With binned data, one gets not only the fitted parameters but also a measure of the goodness of fit. With unbinned data, currently, the fitted parameters are obtained but no measure of goodness of fit is available. This remains, to date, an unsolved problem in statistics. Using Bayes' theorem and likelihood ratios, they provide a method by which both the fitted quantities and a measure of the goodness of fit are obtained for unbinned likelihood fits, as well as errors in the fitted quantities. The quantity, conventionally interpreted as a Bayesian prior, is seen in this scheme to be a number not a distribution, that is determined from data.
NTIS
Maximum Likelihood Estimates; Goodness of Fit; Bayes Theorem

20040079733 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Renormalization Group Tutorial
Bell, Thomas L.; 2004; 1 pp.; In English; Geophysical Turbulence Program Workshop on Convection, 23-25 Feb. 2004, Boulder, CO, USA; No Copyright; Avail: Other Sources; Abstract Only

Complex physical systems sometimes have statistical behavior characterized by power- law dependence on the parameters of the system and spatial variability with no particular characteristic scale as the parameters approach critical values. The renormalization group (RG) approach was developed in the fields of statistical mechanics and quantum field theory to derive quantitative predictions of such behavior in cases where conventional methods of analysis fail. Techniques based on these ideas have since been extended to treat problems in many different fields, and in particular, the behavior of turbulent fluids. This lecture will describe a relatively simple but nontrivial example of the RG approach applied to the diffusion of photons out of a stellar medium when the photons have wavelengths near that of an emission line of atoms in the medium.
Author
Complex Systems; Quantum Theory; Renormalization Group Methods; Statistical Mechanics; Turbulence; Predictions

20040081276 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Application of a Semiparametric Statistical Method to Spacecraft Sensor and Calibration Data
Kedem, Benjamin; Thienel, Julie; Harman, Rick; 2004; 11 pp.; In English; Flight Mechanics Symposium, 28-30 Oct. 2003, Greenbelt, MD, USA; Original contains black and white illustrations; Copyright; Avail: CASI; A03, Hardcopy

A semiparametric statistical method is applied to spacecraft sensor data and spacecraft sensor residual data. The method stipulates a reference distribution and deviations from it. The problem is to estimate the reference distribution and the distorted distributions from all available data from all the sources under consideration. The problem can be solved by assuming a distortion form and independent data.
Author
Spacecraft Instruments; Statistical Analysis; Calibrating; Parameterization; Data Processing

66
SYSTEMS ANALYSIS AND OPERATIONS RESEARCH

Includes mathematical modeling of systems; network analysis; mathematical programming; decision theory; and game theory.

20040078921 Naval Postgraduate School, Monterey, CA
Expeditionary Warfare- Force Protection
Higgins, Eric J.; Higgs, Ronald Leroy; Parkins, Gregory R.; Tionquiao, Vincent S.; Wells, Christopher Kevin; Jan. 2004; 328 pp.; In English; Original contains color illustrations
Report No.(s): AD-A423483; NPS-97-04-001; No Copyright; Avail: CASI; A15, Hardcopy

In 2003, the Systems Engineering and Analysis students were tasked to develop a system of systems conceptual solution to provide force protection for the Sea Base conceptualized in the 2002 Expeditionary Warfare study. The Systems Engineering and Analysis Team used the Systems Engineering and Management process as the primary methodology to complete this multidisciplinary task. Survivability was identified as the most critical factor for evaluating the protection of the Sea Base and its transport assets. Threats to the Sea Base were reviewed, analyzed, and prioritized. System design and analysis focused on

preliminary analyses of various sensors, search concepts, and weapons. These preliminary analyses identified capability gaps that were translated into functional concepts and proposed architectures for detailed modeling and analysis. These proposed architectures were identified as either Point or Distributed. In order to adequately determine the relative performance of the proposed architectures generated by the team, a thorough and systematic design of experiments was developed and applied in the Naval Simulation System and EXTEND. Based on the results obtained, the Systems Engineering and Analysis Team determined that a Distributed Sensor and Weapons architecture would significantly increase the survivability of future Expeditionary Warfare forces.
DTIC
Navy; Protection; Warfare

20040078943 Defense Acquisition Univ., Alexandria, VA
The Risk Assessment Process Used in the Army's Health Hazard Assessment Program
Murnyak, George R.; Leggieri, Michael J., Jr.; Roberts, Welford C.; Jan. 2003; 18 pp.; In English
Report No.(s): AD-A423528; No Copyright; Avail: CASI; A03, Hardcopy

Health hazard assessment is a critical aspect of a risk management acquisition program. Past programs developed without attention to human systems integration have suffered expensive delays created long-term health and safety problems and encountered difficulty and expenses during maintenance and demilitarization/disposal. The Army Health Hazard Assessment (HHA) Program uses risk assessment techniques to characterize health hazards associated with new materiel systems. This article provides the acquisition community with an overview of the risk assessment process used in preparing HHA reports and the key roles played by Army Medical Department organizations. This paper also shows how HHA Reports are integral components of a Program Managers overall risk management plan.
DTIC
Assessments; Hazards; Health; Project Management; Risk

20040081296 NASA Ames Research Center, Moffett Field, CA, USA
A Survey of Collectives
Tumer, Kagan; Wolpert, David; [2004]; 53 pp.; In English; No Copyright; Avail: CASI; A04, Hardcopy

Due to the increasing sophistication and miniaturization of computational components, complex, distributed systems of interacting agents are becoming ubiquitous. Such systems, where each agent aims to optimize its own performance, but where there is a well-defined set of system-level performance criteria, are called collectives. The fundamental problem in analyzing/designing such systems is in determining how the combined actions of self-interested agents leads to 'coordinated' behavior on a iarge scale. Examples of artificial systems which exhibit such behavior include packet routing across a data network, control of an array of communication satellites, coordination of multiple deployables, and dynamic job scheduling across a distributed computer grid. Examples of natural systems include ecosystems, economies, and the organelles within a living cell. No current scientific discipline provides a thorough understanding of the relation between the structure of collectives and how well they meet their overall performance criteria. Although still very young, research on collectives has resulted in successes both in understanding and designing such systems. It is eqected that as it matures and draws upon other disciplines related to collectives, this field will greatly expand the range of computationally addressable tasks. Moreover, in addition to drawing on them, such a fully developed field of collective intelligence may provide insight into already established scientific fields, such as mechanism design, economics, game theory, and population biology. This chapter provides a survey to the emerging science of collectives.
Author
Complex Systems; Networks; Systems Engineering

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THEORETICAL MATHEMATICS

Includes algebra, functional analysis, geometry, topology, set theory, group theory and number theory.

20040081049 NASA Ames Research Center, Moffett Field, CA, USA
Adaptive Multi-Agent Systems for Constrained Optimization
Macready, William; Bieniawski, Stefan; Wolpert, David H.; [2004]; 6 pp.; In English; No Copyright; Avail: CASI; A02, Hardcopy

Product Distribution (PD) theory is a new framework for analyzing and controlling distributed systems. Here we

demonstrate its use for distributed stochastic optimization. First we review one motivation of PD theory, as the information-theoretic extension of conventional full-rationality game theory to the case of bounded rational agents. In this extension the equilibrium of the game is the optimizer of a Lagrangian of the (probability distribution of) the joint state of the agents. When the game in question is a team game with constraints, that equilibrium optimizes the expected value of the team game utility, subject to those constraints. The updating of the Lagrange parameters in the Lagrangian can be viewed as a form of automated annealing, that focuses the MAS more and more on the optimal pure strategy. This provides a simple way to map the solution of any constrained optimization problem onto the equilibrium of a Multi-Agent System (MAS). We present computer experiments involving both the Queen s problem and K-SAT validating the predictions of PD theory and its use for off-the-shelf distributed adaptive optimization.
Author
Optimization; Stochastic Processes; Distributed Processing; Algorithms; Information Theory

20040081102 NASA Ames Research Center, Moffett Field, CA, USA
Knowledge Driven Image Mining with Mixture Density Mercer Kernals
Srivastava, Ashok N.; Oza, Nikunj; 2004; 4 pp.; In English; ESA-EUSC 2004, 17-18 Mar. 2004, Madrid, Spain; Original contains black and white illustrations; 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; Imagery; Imaging Spectrometers

20040081117 Research Inst. for Advanced Computer Science, Moffett Field, CA, USA
Modeling Images of Natural 3D Surfaces: Overview and Potential Applications
Jalobeanu, Andre; Kuehnel, Frank; Stutz, John; 2004; 9 pp.; In English; Original contains black and white illustrations; No Copyright; Avail: CASI; A02, Hardcopy

Generative models of natural images have long been used in computer vision. However, since they only describe the of 2D scenes, they fail to capture all the properties of the underlying 3D world. Even though such models are sufficient for many vision tasks a 3D scene model is when it comes to inferring a 3D object or its characteristics. In this paper, we present such a generative model, incorporating both a multiscale surface prior model for surface geometry and reflectance, and an image formation process model based on realistic rendering, the computation of the posterior model parameter densities, and on the critical aspects of the rendering. We also how to efficiently invert the model within a Bayesian framework. We present a few potential applications, such as asteroid modeling and Planetary topography recovery, illustrated by promising results on real images.
Author
Multiscale Models; Three Dimensional Models; Scientific Visualization; Images; Surface Properties; Topography

20040081285 NASA Goddard Space Flight Center, Greenbelt, MD, USA
On the Hilbert-Huang Transform Theoretical Foundation
Kizhner, Semion; Blank, Karin; Huang, Norden E.; [2004]; 1 pp.; In English; 2nd International Conference on Computing, Communication and Control, 14-17 Aug. 2004, Austin, TX, USA; No Copyright; Avail: Other Sources; Abstract Only

The Hilbert-Huang Transform [HHT] is a novel empirical method for spectrum analysis of non-linear and non-stationary signals. The HHT is a recent development and much remains to be done to establish the theoretical foundation of the HHT algorithms. This paper develops the theoretical foundation for the convergence of the HHT sifting algorithm and it proves that the finest spectrum scale will always be the first generated by the HHT Empirical Mode Decomposition (EMD) algorithm. The

theoretical foundation for cutting an extrema data points set into two parts is also developed. This then allows parallel signal processing for the HHT computationally complex sifting algorithm and its optimization in hardware.
Author
Algorithms; Hilbert Transformation; Spectrum Analysis

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PHYSICS (GENERAL)

Includes general research topics related to mechanics, kinetics, magnetism, and electrodynamics. For specific areas of physics see *categories 71 through 77*. For related instrumentation see *35 Instrumentation and Photography*; for geophysics, astrophysics, or solar physics see *46 Geophysics, 90 Astrophysics*, or *92 Solar Physics*.

20040077287 Lockheed Martin Corp., Syracuse, NY, USA
Effect of Pressure with Wall Heating in Annular Two-Phase Flow
Kumar, R.; Trabold, T. A.; Oct. 2000; 32 pp.; In English
Report No.(s): DE2004-821307; LM-00K074; No Copyright; Avail: Department of Energy Information Bridge

The local distributions of void fraction, interfacial frequency and velocity have been measured in annular flow of R-134a through a wall-heated, high aspect ratio duct. High aspect ratio ducts provide superior optical access to tubes or irregular geometries. This work expands upon earlier experiments conducted with adiabatic flows in the same test section. Use of thin, transparent heater films on quartz windows provided sufficient electrical power capacity to produce the full range of two-phase conditions of interest. With wall vapor generation, the system pressure was varied from 0.9 to 2.4 MPa, thus allowing the investigation of flows with liquid-to-vapor density ratios covering the range of about 7 to 27, far less than studied in air-water and similar systems. There is evidence that for a given cross-sectional average void fraction, the local phase distributions can be different depending on whether the vapor phase is generated at the wall, or upstream of the test section inlet. In wall-heated flows, local void fraction profiles measured across both the wide and narrow test section dimensions illustrate the profound effect that pressure has on the local flow structure; notably, increasing pressure appears to thin the wall-bounded liquid films and redistribute liquid toward the edges of the test section. This general trend is also manifested in the distributions of mean droplet diameter and interfacial area density, which are inferred from local measurements of void fraction, droplet frequency and velocity. At high pressure, the interfacial area density is increased due to the significant enhancement in droplet concentration.
NTIS
High Pressure; Thin Walls; Vapor Pressure; Pressure Effects

20040077291 Brookhaven National Lab., Upton, NY
Design and Operation of the RHIC 80 K Cooler
Nicoletti, A.; Reuter, A.; Sidi-Yekhlef, A.; Talty, P.; Quimby, E.; 2003; 12 pp.; In English
Report No.(s): DE2004-15006699; BNL-71099-2003-CP; No Copyright; Avail: Department of Energy Information Bridge

A stand alone cryogenic system designed to maintain the magnets of the Relativistic Heavy Ion Collider (RHIC) at between 80 and 100 K during accelerator shutdown periods has been conceived and designed at Brookhaven National Laboratory and built by PHPK Technologies of Columbus, Ohio. Since most thermal contraction occurs above this temperature, this unit, referred to as the 80 K Cooler, will eliminate the stresses associated with thermal cycling. The cooling system will provide the necessary refrigeration by circulating cooled Helium gas at approximately 15 atmospheres through the RHIC heat shields and magnets. This Helium is cooled by heat exchange with liquid nitrogen and circulated via three cold centrifugal pumps. The nominal delivered cooling capacity required to maintain the magnets at temperature is approximately 36 kW, primarily intercepted at the heat shield. The system also has separate heat exchangers for use as a pre-Cooler from room temperature to 82 K. Selection of sextant or sextants for pre-cooling is designed into the RHIC cryogenic distribution system. Topics covered include Cooler design decisions, details of the Cooler as built, integration into the existing RHIC cryogenic system and initial operating experience.
NTIS
Cryogenics; Cooling Systems

20040077292 Brookhaven National Lab., Upton, NY, USA
Preliminary Results from a Simulation of Quenched QCD with Overlap Fermions on a Large Lattice
Berruto, F.; Garron, N.; Hoelbling, C.; Lellouch, L.; Rebbi, C.; 2003; 14 pp.; In English
Report No.(s): DE2004-15006698; BNL-71739-2003-CP; No Copyright; Avail: Department of Energy Information Bridge

We simulate quenched QCD with the overlap Dirac operator. We work with the Wilson gauge action at(beta)= 6 on an 18(sup 3) x 64 lattice. We calculate quark propagators for a single source point and quark mass ranging from am(sub 4)= 0.03 to 0.75. We present here preliminary results based on the propagators for 60 gauge field configurations.
NTIS
Quantum Chromodynamics; Fermions

20040077293 Brookhaven National Lab., Upton, NY, USA
Some News on Spin Physics
Vogelsang, W.; 2003; 18 pp.; In English
Report No.(s): DE2004-15006696; BNL-71735-2003-CP; No Copyright; Avail: Department of Energy Information Bridge
For many years now, spin physics has played a very prominent role in QCD. The field has been carried by the hugely successful experimental program of polarized deeply-inelastic lepton-nucleon scattering (DIS), and by a simultaneous tremendous progress in theory. This talk summarizes some of the interesting new developments in spin physics in the past roughly two years. As we will see, there have yet again been exciting new data from polarized lepton-nucleon scattering, but also from the world's first polarized pp collider, RHIC. There have been very significant advances in theory as well. It will not be possible to cover all developments. The author will select those topics that may be of particular interest to the attendees of a conference in the 'DIS' series. The author briefly reviews some of the recent developments in QCD spin physics.
NTIS
Inelastic Scattering; Spin

20040077294 Brookhaven National Lab., Upton, NY, USA
RIKEN School of QCD 'Topics on the Proton'
En'yo, H.; Hayakawa, M.; Kawai, H.; Saito, N.; Shibata, T. -A.; 2003; 178 pp.; In English
Report No.(s): DE2004-15006686; BNL-71494-2003; No Copyright; Avail: Department of Energy Information Bridge
The RIKEN School lectures on QCD titled 'Topics on the Proton' was held on March 26th, 2003 at the Nishina Memorial Hall of RIKEN, Wako, Saitama, Japan, sponsored by REEN (the Institute of Physical and Chemical Research). The school was the third of a new series with a broad perspective of hadron and nuclear physics. The organization and the size of the school were a little different from those of the previous ones. Prof. John Ellis, known as the world best theorist in particle and nuclear physics, has been appointed in RIKEN as an Eminent Scientist, which enables us to plan a collaboration with him for coming three years. As the first year activity, we asked him to give a keynote talk in the JPS spring meeting focusing on the structure of proton, and also to give lectures in RIKEN for younger Japanese scientists on the subjects related the structure of the proton. He kindly agreed on both and we then decided to have a one-day school by supplementing his course with a course on experimental aspects of the proton structure. One of us (N.S.) agreed to give the latter. This time, Theoretical Physics Laboratory joined Radiation Laboratory to organize the school. The purpose of the school was to offer young researchers an opportunity to learn theoretical aspects of the proton structure with a broad perspective including supersymmetry and the related experimental aspects. We had a theoretical course consisting of 3 one-hour lectures by Prof. Ellis and a experimental course consisting of 2 one-hour lectures by Prof. Saito.
NTIS
Quantum Chromodynamics; Nuclear Physics; Protons

20040077295 Lawrence Livermore National Lab., Livermore, CA
Influence of Conducting Plate Boundary Conditions on the Transverse Envelope Equations Describing Intense Ion Beam Transport
Lund, S. M.; Bukh, B.; Jul. 23, 2003; In English
Report No.(s): DE2003-15004426; UCRL-JC-154587; No Copyright; Avail: National Technical Information Service (NTIS)
In typical diagnostic applications, intense ion beams are intercepted by a conducting plate associated with devices used to measure beam phase-space projections. This results in the transverse space-charge field near the plate being shorted out, rendering simple envelope models with constant space-charge strength inaccurate. Here we develop corrected envelope model based on analytical calculations to account for this effect on the space-charge term of the envelope equations, thereby removing a systematic source of error in the equations and enabling more accurate comparisons with experiment.
NTIS
Space Charge; Boundary Conditions

20040077297 Lawrence Livermore National Lab., Livermore, CA
Compton Scattering and its Applications: The PLEIADES Femtosecond X-ray Source at Lawrence Livermore National Laboratory
Hartemann, F.; Brown, W.; Anderson, S. G.; Barty, C. P. J.; Betts, S. M.; May 01, 2003; In English
Report No.(s): DE2003-15004405; UCRL-JC-153189; No Copyright; Avail: National Technical Information Service (NTIS)
No abstracts available.
NTIS
X Ray Sources; Electron Scattering

20040077299 Lawrence Livermore National Lab., Livermore, CA
2000 Engineering Annual Summary
Gerich, C.; May 24, 2001; In English
Report No.(s): DE2003-15005325; UCRL-ID-131278-00; No Copyright; Avail: National Technical Information Service (NTIS)
This 'Engineering Annual Summary' describes the tasks and accomplishments for the year 2000 of the Engineering projects of the Lawrence Livermore National Laboratory.
NTIS
Nuclear Weapons; Engineering

20040077303 Brookhaven National Lab., Upton, NY
Analysis of Space Charge Driven Modulation in Electron Bunch Energy Spectra
Shaftan, T.; Yu, L. H.; 2003; 12 pp.; In English
Report No.(s): DE2004-15006684; BNL-71490-2003-CP; No Copyright; Avail: Department of Energy Information Bridge
Longitudinal space charge force in initially nonuniform bunch transforms density fluctuations into energy modulation along the bunch. For characterization of the resulted energy modulation one can chirp the bunch using accelerator section, located upstream of beam spectrometer, and record energy spectrum of such chirped bunch. Measured spectrum shows structure with parameters, depending on the bunch properties. In this paper we present analysis of the structure in the bunch energy spectrum and its connection with energy modulation along the bunch.
NTIS
Electron Bunching; Spectrometers; Modulation

20040077304 Mississippi Univ., University, MS, USA, Brookhaven National Lab., Upton, NY, University of Southern California, Los Angeles, CA
Muon Acceleration with a Very Fast Ramping Synchrotron for a Neutrino Factory
Summers, D. J.; Berg, J. S.; Palmer, R. B.; Garren, A. A.; 2003; 14 pp.; In English
Report No.(s): DE2004-15006627; BNL-71623-2003-CP; CAP-378-NUFACT-02C; No Copyright; Avail: Department of Energy Information Bridge
A 4600 Hz fast ramping synchrotron is explored as an economical way of accelerating muons from 4 to 20 GeV/c for a neutrino factory. Eddy current losses are minimized by the low machine duty cycle plus thin grain oriented silicon steel laminations and thin copper wires. Combined function magnets with high gradients alternating within single magnets form the lattice we describe. Muon survival is 83%.
NTIS
Muons; Neutrinos; Synchrotrons; Acceleration

20040077308 Brookhaven National Lab., Upton, NY, Jefferson (Thomas) Lab. Computer Center, Newport News, VA, USA
Study of Higher Order Modes in High Current Multicell SRF Cavities
Calaga, R.; Ben-Zvi, I.; Zhao, Y.; Wang, D.; Sekutowicz, J.; 2003; 12 pp.; In English
Report No.(s): DE2004-15006625; BNL-71532-2003-CP; No Copyright; Avail: Department of Energy Information Bridge
The electron cooling project for RHIC luminosity upgrade and future projects such as eRHIC (electron-ion collider) demand cavities operating at high average current and high bunch charge in CW energy recovery mode. This paper describes the investigation of Higher Order Modes (HOMs) in such a cavity. This work is part of an ongoing effort to develop a 5-cell superconducting cavity for such high current and high bunch charge energy-recovery superconducting linac. The frequency of the cavity is 703.75 MHz with an iris of 17cm and two ferrite absorbers for HOM damping. The main focus of this paper

is to identify and investigate possible trapped HOM modes that might result in multibunch instabilities. Detailed MAFIA calculations were performed using the e-module for different end cell geometries. Results from these calculations will be presented. Beam breakup results using TDBBU due to dipole HOM's will also be presented. A beam breakup threshold of above 1.8 A was calculated.
NTIS
Superconducting Cavity Resonators; Frequencies

20040077317 California Univ., Lawrence Berkeley National Lab., Berkeley, CA, USA
Beam Conditioning for FELs: Consequences and Methods
Wolski, A.; Penn, G.; Sessler, A.; Wurtele, J.; Oct. 09, 2003; In English
Report No.(s): DE2003-816794; LBNL-53899; No Copyright; Avail: National Technical Information Service (NTIS)

The consequences of beam conditioning in four example cases (VISA, a Soft X-Ray FEL, LCLS and a 'Greenfield' FEL) are examined. It is shown that in emittance limited cases, proper conditioning reduces sensitivity to the transverse emittance, and allows stronger focusing in the undulator. Simulations show higher saturation power, with gain lengths reduced up to a factor of two. The beam dynamics in a general conditioning system are studied, with matching conditions derived for achieving conditioning without growth in effective emittance. Various conditioners are considered, and expressions derived for the amount of conditioning provided in each case when the matching conditions are satisfied. We discuss the prospects for conditioners based on laser and plasma systems.
NTIS
Free Electron Lasers; Laser Plasmas

20040077323 Thomas Jefferson National Accelerator Facility, Newport News, VA, USA
Thermal Performance of the SNS Cryomodule
Daly, E. F.; Hogan, J. P.; Campisi, I. E.; Drury, M.; Machie, D.; 2003; In English
Report No.(s): DE2003-816470; No Copyright; Avail: National Technical Information Service (NTIS)

When complete, the Spallation Neutron Source (SNS) will provide a 1 GeV, 2 MW beam for experiments. One portion of the machine's linac consists of over 80 Superconducting Radio Frequency (SRF) 805 MHz cavities housed in a total of 23 cryomodules (CMs) operating at 2.1 K. Minimization of the total heat load is critical to machine performance since the refrigerator capacity is fixed. The total heat load of the cryomodules consists of the fixed static load and the dynamic heat load which is proportional to the cavity performance. The heat load of the cryomodules is the single largest load to the cooling circuits of the refrigerator. During acceptance testing at Jefferson Lab, a series of measurements have been taken on the prototype and first three production cryomodules. Calorimetric measurements of the primary heat load and shield heat load are presented and discussed.
NTIS
Neutron Sources; Cryogenics; Linear Accelerators

20040077327 Lawrence Livermore National Lab., Livermore, CA
Fusion Chamber for the 2002 Robust Point Design
Abbott, R. P.; Oct. 01, 2003; In English
Report No.(s): DE2003-15005022; UCRL-CONF-155606; No Copyright; Avail: National Technical Information Service (NTIS)

A top-level overview of the mechanical design for the 2002 Robust Point Design (RPD- 2002) fusion chamber is introduced. It is based on the HYLIFE-II design and includes modifications to the liquid pocket configuration and first structural wall (FSW), facilitates periodic maintenance or replacement of internal components, and is compliant with all other RPD-2002 parameters. This work has been carried out by constructing a parametric computer model capable of being updated as future changes become necessary.
NTIS
Computerized Simulation; Elastic Properties; Mechanical Engineering

20040077336 Lawrence Livermore National Lab., Livermore, CA
Sheath Physics and Boundary Conditions for Edge Plasmas
Cohen, R. H.; Ryutov, D. D.; Sep. 03, 2003; In English
Report No.(s): DE2003-15005006; UCRL-JC-153181; No Copyright; Avail: National Technical Information Service (NTIS)

The boundary conditions of mass, momentum, energy, and charge appropriate for fluid formulations of edge plasmas are surveyed. We re-visit the classic problem of 1-dimensional flow, and note that the 'Bohm sheath criterion' is requirement of connectivity of the interior plasma with the external world, not the result of termination of the plasma by a wall. We show that the nature of the interior plasma solution is intrinsically different for ion sources that inject above and below the electron sound speed. We survey the appropriate conditions to apply, and resultant fluxes, for a magnetic field obliquely incident on a wall, including the presence of drifts and radial transport. We discuss the consequences of toroidal asymmetries in wall properties, as well as experimental tests of such effects. Finally, we discuss boundary-condition modifications in the case of rapidly varying plasma conditions.
NTIS
Boundary Conditions; Plasmas (Physics)

20040077352 Lawrence Livermore National Lab., Livermore, CA
Visualization of Mixing and Combustion in TNT Explosions
Kuhl, A. L.; Ferguson, R. E.; Oppenheim, A. K.; Seizew, M. R.; Mar. 26, 2001; In English
Report No.(s): DE2003-15005335; UCRL-JC-141574-R1; No Copyright; Avail: National Technical Information Service (NTIS)
Numerical simulations are used to visualize the mixing and combustion induced by explosions of spherical and cylindrical TNT charges. Evolution of the exothermic energy is controlled by mixing (vorticity), which is strongly influenced by wave reflections from confining walls.
NTIS
Numerical Analysis; Explosions; Mixing; Trinitrotoluene

20040077353 Lawrence Livermore National Lab., Livermore, CA
Reactor Opportunities for the Spheromak
Hooper, E. B.; Bulmer, R. H.; Fowler, T. K.; Hill, D. N.; McLean, H. S.; Apr. 18, 2003; In English
Report No.(s): DE2003-15005037; UCRL-JC-151387; No Copyright; Avail: National Technical Information Service (NTIS)
Experimental results from the Sustained Spheromak Physics Experiment, SSPX, are reviewed and applied to published reactor configurations. The results include several important features, including low fluctuation levels, (apparent) good magnetic flux surfaces, and moderate beta. Additional features needed for an attractive reactor but not yet demonstrated experimentally are identified by comparison with the reactor designs, and possible alternatives to a fully steady-state device are discussed.
NTIS
Magnetic Flux; Reactor Design; Spheromaks

20040077360 Bechtel Nevada Corp., Las Vegas, NV, USA, Lawrence Livermore National Lab., Livermore, CA
Joint Actinide Shock Physics Experimental Research (JASPER) Facility Update
Konrad, C. H.; Miller, J.; Cowan, M.; Martinez, M.; Whitcomb, B.; 2003; In English
Report No.(s): DE2003-816101; No Copyright; Avail: National Technical Information Service (NTIS)
The objectives of the CRADA are to: Confirm that fiber-resin adhesion is responsible for the observed poor shear properties; Determine the mechanism(s) responsible for poor adhesion between carbon fibers and epoxy resins after e-beam curing; Develop and evaluate resin systems and fiber treatments to improve the properties of e-beam cured, carbon-fiber-reinforced composites; and Develop refined methods for processing e-beam cured, carbon-fiber-reinforced composites.
NTIS
Test Facilities; Carbon Fibers; Electron Beams

20040077361 Rockefeller Univ., New York, NY, USA
Underlying Event Studies at CDF
Lami, S.; Oct. 2003; In English
Report No.(s): DE2003-816135; FERMILAB-CONF-03/282-E; No Copyright; Avail: National Technical Information Service (NTIS)
We present recent studies about the 'underlying event' which originates mostly from soft spectator interactions. First Run

II data results are compared to published Run I results and to quantum chromodynamics (QCD) Monte Carlo models.
NTIS
Quantum Chromodynamics; Monte Carlo Method

20040077363 Fermi National Accelerator Lab., Batavia, IL, USA
Optimal use of Information for Measuring M(sub t) in Lepton+jets (t over bar t) Events
Estrada, J.; Feb. 23, 2003; In English
Report No.(s): DE2003-816263; No Copyright; Avail: National Technical Information Service (NTIS)

The observation of the top (t) quark served as one of the major confirmations of the validity of the standard model (SM) of particle interactions. Through radiative corrections of the SM, the mass of the top quark, along with that of the W boson, provide the best indication for the value of the mass of the hypothesized Higgs boson. The mass of the W is known to a precision of lesser than 0.1%, while the uncertainty on the mass of the top quark is at the 4% level. Improvements in both measurements are required to limit the range of mass that the Higgs boson can assume in the SM, and, of course, to check whether that agrees with expectation. It is therefore important to develop techniques for extracting the mass of the top quark that can provide the sharpest values possible.
NTIS
Leptons; Higgs Bosons; Accuracy

20040077364 California Univ., Lawrence Berkeley National Lab., Berkeley, CA, USA, California Univ., Berkeley, CA, USA
Ultrafast X-ray Science Facility at the Advanced Light Source
Schoenlein, R. W.; Falcone, R. W.; Dec. 12, 2001; In English
Report No.(s): DE2003-816276; No Copyright; Avail: National Technical Information Service (NTIS)

We propose to develop a true user facility for ultrafast x-ray science at the Advanced Light Source. This facility will be unique in the world, and will fill a critical need for the growing ultrafast x-ray research community. The development of this facility builds upon the expertise from long-standing research efforts in ultrafast x-ray spectroscopy and the development of femtosecond x-ray sources and techniques at both the Lawrence Berkeley National Laboratory and at U.C. Berkeley. In particular, the technical feasibility of a femtosecond x-ray beamline at the ALS has already been demonstrated, and existing ultrafast laser technology will enable such a beamline to operate near the practical limit for femtosecond x-ray flux and brightness from a 3rd generation synchrotron.
NTIS
Laser Applications; Light Sources; Technology Assessment; X Ray Sources; Research Facilities

20040077366 Thomas Jefferson National Accelerator Facility, Newport News, VA, USA
Surface Science Laboratory for Studying the Surfaces of Superconducting Radio Frequency Cavities
Wu, A. T.; 2003; In English
Report No.(s): DE2003-816461; No Copyright; Avail: National Technical Information Service (NTIS)

A Surface Science Laboratory (SSL) has been established at JLab to study surfaces relevant to superconducting radio frequency (SRF) cavities. Current operational facilities include a scanning electron microscope equipped with energy dispersive x-ray analysis, a secondary ion mass spectrometry, a metallographic optical microscope, a transmission electron microscope, a high precision and large scan area 3-D profilometer, a scanning field emission microscope, and a fully equipped sample preparation room. A scanning Auger microscope is being commissioned, and will be available for routine usage soon. Results from typical examples of the R&D projects on SRF cavities that were supported in the past through the use of the facilities in the SSL will be briefly reported.
NTIS
Cavities; Radio Frequencies; Microstructure

20040078812 Air Force Research Lab., Hanscom AFB, MA
On the Linear Theory of Equatorial Plasma Instability: Comparison of Different Descriptions
Basu, B.; Aug. 22, 2002; 11 pp.; In English
Contract(s)/Grant(s): Proj-2311
Report No.(s): AD-A423263; AFRL-VS-HA-TR-2004-1075; No Copyright; Avail: CASI; A03, Hardcopy

Three theoretical descriptions, namely the local description, the flux tube integrated description and the ballooning-mode

type description, of the equatorial plasma instability are presented for comparisons. On the basis of physical considerations it is argued that the ballooning-mode type description is comparatively the most accurate and complete description of plasma instability in the equatorial ionosphere where the inhomogeneous plasma is embedded in a dipole magnetic field. The growth rates obtained from the ballooning-mode type description are therefore the most accurate growth rates. In comparison, the local description overestimates the growth rates up to a certain altitude and then underestimates them, while the flux tube integrated description underestimates the growth rates at almost all altitudes where the growth rates are significant. This is shown for two sets of ionospheric plasma conditions. It is further pointed out that only the ballooning-mode type description provides useful information on the wavelength dependence of the growth rates as well as on the spatial profiles of the excited modes. The localized spatial structures of the linear modes along the magnetic field line that are found in the ballooning-mode type description are expected to impose topological constraints on the nonlinear evolution of the instability and thus to play an important role in the determination of the nonlinear state of the plasma.
DTIC
Equatorial Regions; Magnetohydrodynamic Stability; Plasmas (Physics)

20040078833
Applied Computational Electromagnetics Society Journal. Volume 18, Number 4, November 2003. Special Issue on ACES 2003 Conference. Part 1
Elsherbeni, Atef Z.; Nov. 2003; 123 pp.; In English
Report No.(s): AD-A423296; No Copyright; Avail: CASI; A06, Hardcopy

The Applied Computational Electromagnetics Society (ACES) Journal hereinafter known as the ACES Journal is devoted to the exchange of information in computational electromagnetics, to the advancement of the state-of-the art, and the promotion of related technical activities. A primary objective of the information exchange is the elimination of the need to "reinvent the wheel" to solve a previously-solved computational problem in electrical engineering, physics, or related fields of study. The technical activities promoted by this publication include code validation, performance analysis, and input/output standardization; code or technique optimization and error minimization; innovations in solution technique or in data input/output; identification of new applications for electromagnetics modeling codes and techniques; integration of computational electromagnetics techniques with new computer architectures; and correlation of computational parameters with physical mechanisms.
DTIC
Computational Electromagnetics; Conferences

20040078851 Universal Technology Corp., Dayton, OH
High Cycle Fatigue (HCF) Science and Technology Program 2002 Annual Report
Bartsch, Thomas M.; Aug. 2003; 204 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F33615-98-C-2807; Proj-APPL
Report No.(s): AD-A423347; AFRL-PR-WP-TM-2004-2040; No Copyright; Avail: CASI; A10, Hardcopy

This sixth annual report of the National Turbine Engine High Cycle Fatigue (HCF) Program is a brief review of work completed, work in progress, and technical accomplishments. This program is a coordinated effort with participation by the Air Force, the Navy, and NASA. The technical efforts are organized under seven Action Teams -- Materials Damage Tolerance Research, Forced Response Prediction, Component Analysis, Instrumentation, Passive Damping Technology, Component Surface Treatments, and Engine Demonstration -- and two Programs -- Test and Evaluation and Transitions (ENSIP). Daniel E. Thomson, AFRL/PRTC Wright- Patterson AFB, is the Program Manager.
DTIC
Aircraft Engines; Damage; Damping; Fracture Mechanics; Research and Development; Technologies; Tolerances (Mechanics)

20040078858 Air Force Research Lab., Edwards AFB, CA
Three-Dimensional Analysis of Crack in Centrally Perforated Photoelastic Cylinders under Internal Pressure
Liu, C. T.; Smith, C. W.; Feb. 12, 2004; 5 pp.; In English
Contract(s)/Grant(s): Proj-2302
Report No.(s): AD-A423355; No Copyright; Avail: CASI; A01, Hardcopy

In this study, the frozen stress photoelastic method was used to investigate the three-dimensional effect on the crack growth behavior in a centrally perforated circular cylinder under internal pressure. The inner surface of the cylinder had a star

shape, which consisted of six fins. The specimens were capped at the ends and pressurized internally above critical temperature after real cracks were introduced at the fin tip. After growing to a desired size, the pressure was reduced to stop crack growth and held through cooling. Two different types of cracks, part-through crack and long crack with the crack length nearly equal to the length of the cylinder, were considered. The experimental data were analyzed, and the results are discussed.
DTIC
Crack Propagation; Cracks; Internal Pressure; Photoelasticity

20040078912 Air Force Research Lab., Edwards AFB, CA
Effects of Confining Pressure on the Crack Growth Behavior in a Filled Elastomer Subjected to a Constant Strain Rate
Liu, C. T.; Wickham, D.; Smith, G.; Feb. 12, 2004; 6 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): Proj-2302
Report No.(s): AD-A423471; No Copyright; Avail: CASI; A02, Hardcopy

In this study the effects of different confining pressures and initial crack lengths on the crack growth behavior in a highly filled elastomer were investigated. The material under investigation contains hard particles embedded in a rubbery matrix. The specimens were strained at a constant strain rate of 16.67 in/in/min. Two confining pressures 500 psi and 1000 psi and two initial crack lengths 0.1 in. and 0.3 in. were considered. The experimental data were analyzed and the results are discussed.
DTIC
Crack Propagation; Elastomers; Pressure Effects; Strain Rate

20040078913 Air Force Research Lab., Edwards AFB, CA
Monitoring Microstructural Evolution and Crack Formation in a Solid Propellant under Incremental Strain Condition- Using Digital Radiography X-Ray Techniques
Liu, C. T.; Klynn, Lee M.; Thompson, Jay D.; Feb. 2, 2004; 7 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): Proj-2302
Report No.(s): AD-A423473; No Copyright; Avail: CASI; A02, Hardcopy

In this study, the change of microstructure and the formation of cracks in a solid propellant under an incremental strain loading condition were investigated using digital radiography x-ray techniques. Experimental findings revealed that the degree of in homogeneity of the material's microstructure and the number of non-propagating cracks increased as the applied strain was increased. Also, the strain distribution was highly non-uniform when the applied strain was high.
DTIC
Crack Initiation; Crack Propagation; Digital Techniques; Microstructure; Radiography; Solid Propellants; Stress-Strain Relationships; X Rays

20040078934 Carnegie-Mellon Univ., Pittsburgh, PA
A Laboratory for System Identification of Mistuning in Integrally Bladed Disks
Griffin, J. H.; Apr. 2004; 58 pp.; In English
Contract(s)/Grant(s): F49620-02-1-0223
Report No.(s): AD-A423506; AFRL-SR-AR-TR-04-0273; No Copyright; Avail: CASI; A04, Hardcopy

The funds received from the DURIP proposal were to be used to purchase a Polytech scanning vibrometer. The vibrometer is being used to make precise measurements of the mistuned modes and natural frequencies of integrally bladed disks (IBRs) in the Mistuning System Identification Laboratory. The resulting data is then used as input to system identification software that is being developed at CMU under a separate Air Force contract. The system identification software then determines the mistuning in each blade. This report documents the development of the vibration laboratory, the types of measurements that are being done, and the research that has been made possible through its use.
DTIC
Laboratory Equipment; System Identification; Tuning; Turbine Blades; Vibration Meters

20040079302 Stanford Research Inst., Menlo Park, CA
Prediction of Transients in Buried, Shielded Cables
Vance, Edward F.; Mar. 14, 1973; 85 pp.; In English
Contract(s)/Grant(s): DAEA18-71-A-0204; Proj-2192
Report No.(s): AD-A423536; L-29877; No Copyright; Avail: CASI; A05, Hardcopy

This report contains simple formulas and graphs that can be used to obtain quick estimates of the total current induced

in a buried cable by an incident plane-wave exponential pulse. Formulas and graphs are also given for estimating the internal voltage and current in cables with tubular shields when the total current in the cable is an exponential pulse, and when the current is that induced in the cable by the incident exponential pulse.
DTIC
Electric Current; Estimates

20040079519 Lockheed Martin Corp., Syracuse, NY, USA
Explicit Determination of Piezoelectric Eshelby Tensors for a Spheroidal Inclusion
Mikata, Y.; Jun. 2001; 38 pp.; In English
Report No.(s): DE2004-821311; LM-01K058; No Copyright; Avail: Department of Energy Information Bridge

In this paper, by systematically treating the integrals involved in the piezoelectric inclusion problem, explicit results were obtained for the piezoelectric Eshelby tensors for a spheroidal inclusion aligned along the axis of the anisotropy in a transversely isotropic piezoelectric material. This problem was first treated by Dunn and Wienecke (1996) using a Green's function approach, which closely follows Withers' approach (1989) for an ellipsoidal inclusion problem in a transversely isotropic elastic medium. The same problem was recently treated by Michelitsch and Levin (2000) also using a Green's function approach. In this paper, a different method was used to obtain the explicit results for the piezoelectric Eshelby tensors for a spheroidal inclusion. The method is a direct extension of a more unified approach, which has been recently developed by Mikata (2000), which is based on Deeg's results (1980) on a piezoelectric inclusion problem. The main advantage of this method is that it is more straightforward and simpler than Dunn and Wienecke (1996), or Michelitsch and Levin (2000), and the results are a little bit more explicit than their solutions. The key step of this paper is an analytical closed form evaluation of several integrals, which was made possible after a careful treatment of a certain bi-cubic equation.
NTIS
Spheroids; Ellipsoids; Inclusions

20040079521 Brookhaven National Lab., Upton, NY, California Univ., Lawrence Berkeley National Lab., Berkeley, CA, USA
US Neutrino Factory Studies
Ozaki, S.; Palmer, R. B.; Zisman, M. S.; 2003; 12 pp.; In English
Report No.(s): DE2004-15006617; BNL-71542-2003-CP; CAP-375-NUFACT-03C; No Copyright; Avail: Department of Energy Information Bridge

The design and simulated performance of a second feasibility study are presented. The efficiency of producing muons is(approx) 0.17(micro)/p with 24 GeV protons. This study was sponsored by the BNL Director, with BNL site specific driver and layout. It was a follow on to the First Study sponsored by the Fermilab Director, with Fermilab site specific driver and layout, and was the main US collaboration conceptual effort during the past year. Other studies, and technical work by the collaboration is reported in other papers.
NTIS
Storage Rings (Particle Accelerators); Neutrinos

20040079698 California Univ., Lawrence Berkeley National Lab., Berkeley, CA, USA
Closed Orbit Response to Quadrupole Strength Variation
Wolski, A.; Zimmerman, F.; Jan. 2004; 18 pp.; In English
Report No.(s): DE2004-821918; LBNL-54360; ATF-03-09; No Copyright; Avail: Department of Energy Information Bridge

We derive two formulae relating the variation in closed orbit in a storage ring to variations in quadrupole strength, neglecting nonlinear and dispersive effects. These formulae correct results previously reported. We compare the results of the formulae applied to the ATF with simulations using MAD, and consider their application to beam-based alignment.
NTIS
Storage Rings (Particle Accelerators); Quadrupoles

20040079720 California Univ., Lawrence Berkeley National Lab., Berkeley, CA, USA
Searches for New Physics at Tevatron
Pagliarone, C.; 2003; 10 pp.; In English
Report No.(s): DE2004-822022; FERMILAB-CONF-03/413-E; No Copyright; Avail: Department of Energy Information Bridge

This paper reviews the most recent results on searches for physics beyond the Standard Model at Tevatron. Both the collider experiments: CDF and D0 are performing a large variety of searches such as searches for scalar top and scalar bottom particles, search for new gauge bosons, search for long-lived massive particles and general searches for new particles decaying into dijets. The results, summarized here, are a selection of what obtained recently by both the collaborations using the Run II data, collected so far.
NTIS
Particle Accelerators; Bosons

20040079730 Lawrence Livermore National Lab., Livermore, CA
Particle Simulations of DARHT-II Transport System
Poole, B. R.; Chen, Y. J.; Jun. 11, 2001; In English
Report No.(s): DE2003-15005338; UCRL-JC-141921; No Copyright; Avail: National Technical Information Service (NTIS)
The DARHT-II beam line utilizes a fast stripline kicker to temporally chop a high current electron beam from a single induction LINAC and deliver multiple temporal electron beam pulses to an x-ray converter target. High beam quality needs to be maintained throughout the transport line from the end of the accelerator through the final focus lens to the x-ray converter target to produce a high quality radiographic image. Issues that will affect beam quality such as spot size and emittance at the converter target include dynamic effects associated with the stripline kicker as well as emittance growth due to the nonlinear forces associated with the kicker and various focusing elements in the transport line. In addition, dynamic effects associated with transverse resistive wall instability as well as gas focusing will affect the beam transport. A particle-in-cell code is utilized to evaluate beam transport in the downstream transport line in DARHT-II. External focusing forces are included utilizing either analytic expressions or field maps. Models for wakefields from the beam kicker, transverse resistive wall instability, and gas focusing are included in the simulation to provide a more complete picture of beam transport in DARHT-II. From these simulations, for various initial beam loads based on expected accelerator performance the temporally integrated target spot size and emittance can be estimated.
NTIS
Emittance; Linear Accelerators; Radiography

20040079731 Lawrence Livermore National Lab., Livermore, CA
Efficient Multi-ke V X-Ray Sources from Ti-Doped Aerogel Targets
Fournier, K. B.; Constantin, C.; Poco, J.; Miller, M. C.; Back, C. A.; Jul. 18, 2003; In English
Report No.(s): DE2003-15004418; UCRL-JC-151219; No Copyright; Avail: National Technical Information Service (NTIS)
No abstract available
X Ray Sources; Efficiency

20040079757 Lawrence Livermore National Lab., Livermore, CA
General MoM Solutions for Large Arrays
Fasenfest, B.; Capolino, F.; Wilton, D. R.; Jackson, D. R.; Champagne, N.; Jul. 22, 2003; In English
Report No.(s): DE2004-15006455; UCRL-JC-154844; No Copyright; Avail: National Technical Information Service (NTIS)
This paper focuses on a numerical procedure that addresses the difficulties of dealing with large, finite arrays while preserving the generality and robustness of full-wave methods. We present a fast method based on approximating interactions between sufficiently separated array elements via a relatively coarse interpolation of the Green's function on a uniform grid commensurate with the array's periodicity. The interaction between the basis and testing functions is reduced to a three-stage process. The first stage is a projection of standard (e.g., RWG) subdomain bases onto a set of interpolation functions that interpolate the Green's function on the array face. This projection, which is used in a matrix/vector product for each array cell in an iterative solution process, need only be carried out once for a single cell and results in a low-rank matrix. An intermediate stage matrix/vector product computation involving the uniformly sampled Green's function is of convolutional form in the lateral (transverse) directions so that a 2D FFT may be used. The final stage is a third matrix/vector product computation involving a matrix resulting from projecting testing functions onto the Green's function interpolation functions; the low-rank matrix is either identical to (using Galerkin's method) or similar to that for the bases projection. An effective MoM solution scheme is developed for large arrays using a modification of the AIM (Adaptive Integral Method) method. The method permits the analysis of arrays with arbitrary contours and nonplanar elements. Both fill and solve times within the MoM method are improved with respect to more standard MoM solvers.
NTIS
Computational Grids; Periodic Variations; Fast Fourier Transformations; Arrays

20040079762 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Nuclear Physics in Space: What We Can Learn From Cosmic Rays
Moskalenko, Igor V.; [2004]; 1 pp.; In English; No Copyright; Avail: Other Sources; Abstract Only

Studies and discoveries in cosmic-ray physics and generally in Astrophysics provide a fertile ground for research in many areas of Particle Physics and Cosmology, such as the search for dark matter, antimatter, new particles, and exotic physics, studies of the nucleosynthesis, origin of Galactic and extragalactic gamma-ray diffuse emission, formation of the large scale structure of the universe etc. In several years new missions are planned for cosmic-ray experiments, which will tremendously increase the quality and accuracy of cosmic-ray data. On the other hand, direct measurements of cosmic rays are possible in only one location on the outskirts of the Milky Way galaxy and present only a snapshot of very dynamic processes. It has been recently realized that direct information about the fluxes and spectra of cosmic rays in distant locations is provided by the Galactic diffuse gamma-rays, therefore, complementing the local cosmic-ray studies. A wealth of information is also contained in the isotopic abundances of cosmic rays, therefore, accurate evaluation of the isotopic production cross sections is of primary importance for Astrophysics of cosmic rays, studies of the galactic chemical evolution, and Cosmology. In this talk, I will show new results obtained with GALPROP, the most advanced numerical model for cosmic-ray propagation, which includes in a self-consistent way all cosmic-ray species (stable and long-lived radioactive isotopes from H to Ni, antiprotons, positrons and electrons, gamma rays and synchrotron radiation), and all relevant processes and reactions.
Author
Cosmic Rays; Antimatter; Chemical Evolution; Dark Matter

20040079767 Pennsylvania Transportation Inst., University Park, PA, USA
Relative Visibility of Internally and Externally Illuminated On-Premise Signs
Garvey, P. M.; Feb. 2004; 30 pp.; In English
Report No.(s): PB2004-104987; PTI-2004-11; No Copyright; Avail: CASI; A03, Hardcopy

The purpose of this study was to evaluate the relative performance of internally and externally illuminated on-premises signs. To do this, the performance of six signs that differed in model illumination, text and background colors, and contrast orientation (i.e. light letters on a darker background and dark letters on a lighter background) was evaluated. These signs were field tested with older and younger motorists in both daytime and night conditions. The two measures of effectiveness were sign recognition distance and legibility distance. Based on the results, the distance at which drivers can begin to read a sign's message as a function of the type of illumination was calculated. These distances were then converted to time at various approach speeds to determine the amount of time that motorists will have to read the sign content. Results showed that the internally illuminated signs provided significantly longer visibility distances and longer available reading times than externally illuminated signs.
NTIS
Illuminating; Symbols; Visibility

20040079774 Brookhaven National Lab., Upton, NY
Half-Lives of Long-Lived alpha Decay, beta Decay, Electron Capture Decay, Beta Beta-Decay, Proton Decay and Spontaneous Fission Decay Nuclides
Holden, N. E.; 2003; 16 pp.; In English
Report No.(s): DE2004-15006607; BNL-71595-2003-CP; No Copyright; Avail: Department of Energy Information Bridge

In his review of radionuclides for dating purposes, Roth noted that there were a large number of nuclides, normally considered ''stable'' but which are radioactive with a very long half-life. Roth suggested that I review the data on the half-life values of these long-lived nuclides for the 2001 Atomic Weights Commission meeting in Brisbane. I provided a report, BNL-NCS-68377, to fulfill Roth's request. Peiser has now made a similar suggestion that I review these data for our next Commission meeting in Ottawa for their possible inclusion in our Tables. These half-life values for long-lived nuclides include those due to various decay modes,(alpha)-decay,(beta)-decay, electron capture decay,(beta)(beta)-decay, proton decay and spontaneous fission decay. This data review (post Brisbane) provides an update to the recommendation of the 2001 review.
NTIS
Atomic Weights; Radioactive Decay; Nuclides; Chronology; Radioactive Isotopes

20040079799 Brookhaven National Lab., Upton, NY, USA
High P(t) Measurement at RHIC
Mioduszewski, S.; 2003; In English
Report No.(s): DE2004-15006712; BNL-71750-2003-CP; No Copyright; Avail: National Technical Information Service (NTIS)

We present recent high transverse momentum measurements in Au+Au and p+p collisions at the Relativistic Heavy Ion Collider (RHIC). We define and show the nuclear modification factor for neutral pions and charged hadrons and discuss the particle species dependence. By means of the nuclear modification factor, we observe a suppression factor at high p(sub T) of 5-6 for neutral pions and 3-4 for charged hadrons in central Au+Au collisions relative to the binary-scaled yields in p+p (or peripheral) collisions. Finally we present strong evidence for the observation of jets in Au+Au collisions and the disappearance of the away-side jet in central Au+Au collisions.
NTIS
Collisions; Heavy Ions; Particle Accelerators

20040081023 Brookhaven National Lab., Upton, NY
R&D Program for Targetry and Capture at a Neutrino Factory and Muon Collider Source
Hassenein, A.; Bernadonan, A.; 2003; 14 pp.; In English
Report No.(s): DE2004-15006727; BNL-71877-2003-CP; No Copyright; Avail: Department of Energy Information Bridge
The need for intense muon beams for muon colliders and for neutrino factories based on muon storage rings leads to a concept of 1-4 MW proton beams incident on a moving target that is inside a 20-T solenoid magnet, with a mercury jet as a preferred example. Novel technical issues for such a system include disruption of the mercury jet by the proton beam and distortion of the jet on entering the solenoid, as well as more conventional issues of materials lifetime and handling of activated materials in an intense radiation environment. As part of the R&D program of the Neutrino Factory and Muon Collider Collaboration, an R&D effort related to targetry is being performed within the context of experiment E951 at Brookhaven National Laboratory, first results of which are reported here.
NTIS
Neutrinos; Muons; Targets

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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*.

20040078936 Osaka Univ., Osaka
US-Japan Cooperative Research on Biology-Inspired Precision Maneuvering of Underwater Vehicles
Kato, Naomi; Jun. 2, 2004; 4 pp.; In English
Contract(s)/Grant(s): N00014-01-1-0501
Report No.(s): AD-A423511; No Copyright; Avail: CASI; A01, Hardcopy
The objective of this project was to numerically and experimentally evaluate the underwater precision maneuverability of a cylindrical body, in particular the STOP & HOVER motions, by using fore and aft pairs of pectoral fins, similar to their usage in a fish. We examined the hydrodynamic characteristics of a mechanical pectoral fin through experimental and numerical analyses and the optimal match of the fin motions to generate the maximum hydrodynamic forces. We constructed an underwater vehicle equipped with two pairs of mechanical pectoral fins and pectoral fin controllers to examine the swimming performance of the underwater vehicle in still water and its control performance both in still water and in waves. We developed automatic control algorithms for guidance and control of the test body In 3D underwater space. Fuzzy Algorithms were utilized as necessary to compensate for shortcomings in mathematical descriptions of 3MDMPF performance. We demonstrated the high maneuverability of the cylindrical underwater vehicle equipped with 3MDMPFs following a prearranged trajectory around undersea obstacles.
DTIC
Biomimetics; Fins; Japan; Maneuvers; Precision; Underwater Vehicles

20040081086 NASA Ames Research Center, Moffett Field, CA, USA
Aeroacoustic Research Techniques: Jets to Autos
Soderman, Paul T.; February 02, 1999; 14 pp.; In English; 3rd ASME/JSME Joint Fluids Engineering Conference, 18-23 Jul. 1999, San Francisco, CA, USA
Contract(s)/Grant(s): RTOP 519-20-22
Report No.(s): FEDSM99-7240; Copyright; Avail: Other Sources
Aeroacoustic research has benefited from the development of advanced techniques for the study of fluid mechanically

generated noise New instrumentation; methodologies, information technologies, and facilities have evolved to help researchers investigate the complexities of aircraft and automobile noise. In this paper, research techniques are reviewed with emphasis on the subject closest to the author s experience: aircraft propulsion and airframe noise in simulated flight. A new technology developed for the study of aircraft airframe noise is described as a potential tool for the study of automobile noise. The important role of information technology in aeroacoustic research is discussed.
Author
Aeroacoustics; Aircraft Noise

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*.

20040081196 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Electron-H P-Wave Elastic Scattering
Bhatia, A. K.; [2004]; 1 pp.; In English; No Copyright; Avail: Other Sources; Abstract Only

In previous papers [Bhatia and Temkin, Phys. Rev. A 64, 032709-1 (2001), Phys. Rev. A 66, 064702 (2002)], electron-hydrogen and electron-He(+) S-wave scattering phase shifts were calculated using the optical potential approach. This method is now extended to the singlet and triplet electron-H P-wave scattering in the elastic region. Phase shifts are calculated using Hylleraas-type correlation functions with up to 220 terms. Results are rigorous lower bounds to the exact phase shifts and they are compared to phase shifts obtained from previous calculations.
Author
P Waves; Elastic Scattering; Wave Scattering; Quantum Mechanics

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*.

20040077311 Lawrence Livermore National Lab., Livermore, CA
Effects of Spatial Variations in Packing Fraction of Reactor Physics Parameters in Pebble-Bed Reactors
Terry, W. K.; Ougouag, A. M.; Rahnema, F.; McKinley, M. S.; Jun. 11, 2003; In English
Report No.(s): DE2003-15004427; UCRL-JC-154607; No Copyright; Avail: National Technical Information Service (NTIS)

The well-known spatial variation of packing fraction near the outer boundary of a pebble-bed reactor core is cited. The ramifications of this variation are explored with the MCNP computer code. It is found that the variation has negligible effects on the global reactor physics parameters extracted from the MCNP calculations for use in analysis by diffusion-theory codes, but for local reaction rates the effects of the variation are naturally important. Included is some preliminary work in using first-order perturbation theory for estimating the effect of the spatial variation of packing fraction on the core eigenvalue and the fission density distribution.
NTIS
Computer Programs; Reactor Physics; Pebble Bed Reactors

20040078827 Air Force Research Lab., Hanscom AFB, MA
High-Resolution State-Selected Ion-Molecule Reaction Studies Using Pulsed Field Ionization Photoelectron- Secondary Ion Coincidence Method
Qian, X. M.; Zhang, T.; Chang, C.; Wang, P.; Ng, C. Y.; Sep. 2003; 15 pp.; In English
Report No.(s): AD-A423289; AFRL-VS-HA-TR-2004-1100; No Copyright; Avail: CASI; A03, Hardcopy

We have developed an octopole-quadrupole photoionization apparatus at the Advanced Light Source for absolute integral cross-section measurements of rovibrational- state-selected ion-molecule reactions. This apparatus consists of a high-resolution photoionization ion source, a wired ion gate lens, a dual radio-frequency (rf) octopole ion guide reaction gas cell, and a quadrupole mass spectrometer for reactant and product ion detection. The unique feature of this apparatus is the

implementation of the high-resolution pulsed field ionization-photoelectron (PFI-PE)-photoion coincidence (PFI-PEPICO) technique, which has allowed the rotational-state selection of diatomic ions for ion-molecule reaction studies. The novel application of the wired ion gate lens for the rejection of false coincidence background ions is described. This application, along with the differential-ion-gate scheme, has made possible the measurements of rovibrational-state- selected absolute integral reaction cross sections for ion- molecule collisions using the PFI-PE-secondary ion coincidence (PFI-PESICO) method.
DTIC
High Resolution; Ionic Reactions; Ionization; Molecular Interactions; Photoelectrons; Photoionization

20040079758 Savannah River Ecology Lab., Aiken, SC, USA
Reactor Room Experimental SF6 Tests to Determine Probable Stack Activity Response to Radioactive Releases
Cooper, R. E.; Milham, R. C.; 1985; 20 pp.; In English
Report No.(s): DE2004-800771; DPST-85-802; No Copyright; Avail: Department of Energy Information Bridge
This study was performed to obtain information that could be useful for obtaining an early estimate of the probable total stack activity monitor response in the event of an accidental release of radioactive activity in the process room.
NTIS
Accidents; Radioactivity

20040081111 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Properties of Vector Preisach Models
Kahler, Gary R.; Patel, Umesh D.; Torre, Edward Della; February 20, 2004; 9 pp.; In English; No Copyright; Avail: CASI; A02, Hardcopy
This paper discusses rotational anisotropy and rotational accommodation of magnetic particle tape. These effects have a performance impact during the reading and writing of the recording process. We introduce the reduced vector model as the basis for the computations. Rotational magnetization models must accurately compute the anisotropic characteristics of ellipsoidally magnetizable media. An ellipticity factor is derived for these media that computes the two-dimensional magnetization trajectory for all applied fields. An orientation correction must be applied to the computed rotational magnetization. For isotropic materials, an orientation correction has been developed and presented. For anisotropic materials, an orientation correction is introduced.
Author
Anisotropy; Magnetic Tapes; Particles

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*.

20040077314 Lawrence Livermore National Lab., Livermore, CA
National Ignition Facility: The World's Largest Laser
Moses, E. I.; Oct. 13, 2003; 12 pp.; In English
Report No.(s): DE2004-15006461; UCRL-CONF-152564; No Copyright; Avail: Department of Energy Information Bridge
The National Ignition Facility (NIF), currently under construction at the 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 with room for nearly 100 experimental diagnostics. When completed, NIF will be the world's largest and most energetic laser experimental system, providing an international center to study inertial confinement fusion and the physics of matter at extreme energy densities and pressures. NIF's 192 energetic laser beams will compress fusion targets to conditions required for thermonuclear burn, liberating more energy than required to initiate the fusion reactions. This paper provides a detailed look the NIF laser systems, laser and optical performance and results from recent laser commissioning shots, and plans for commissioning diagnostics for experiments on NIF.
NTIS
Laser Beams; Laser Outputs; Ultraviolet Lasers

20040077357 Lawrence Livermore National Lab., Livermore, CA
National NIF Diagnostic Program Fiscal Year 2002 Second Quarter Report
MacGowan, B.; Apr. 01, 2002; In English
Report No.(s): DE2003-15005031; UCRL-ID-148561; No Copyright; Avail: National Technical Information Service (NTIS)

Since October 2001 the development of the facility diagnostics for NIF has been funded by the NIF Director through the National NIF Diagnostic Program (NNDP). The current emphasis of the NNDP is on diagnostics for the early NIF quad scheduled to be available for experiment commissioning in FY03. During the past six months the NNDP has set in place processes for funding diagnostics, developing requirements for diagnostics, design reviews and monthly status reporting. Those processes are described in an interim management plan for diagnostics ('National NIF Diagnostic Program Interim Plan', NIF-0081315, April 2002) and a draft Program Execution Plan ('Program Execution Plan for the National NIF Diagnostic Program', NIF-0072083, October 2001) and documents cited therein. Work has been funded at Lawrence Livermore National Laboratory (LLNL), Los Alamos National Laboratory (LANL), Naval Research Laboratory (NRL), Sandia National Laboratories (SNL), Bechtel Nevada at Los Alamos and Santa Barbara. There are no major technical risks with the early diagnostics. The main concerns relate to integration of the diagnostics into the facility, all such issues are being worked. This report is organized to show the schedule and budget status and a summary of Change Control Board actions for the past six months. The following sections then provide short descriptions of the status of each diagnostic. Where design reviews or requirements documents are cited, the documents are available on the Diagnostics file server or on request.
NTIS
X Ray Detectors; Risk; Diagnosis

20040078744 NASA Goddard Space Flight Center, Greenbelt, MD, USA
The Bermuda BioOptics Project (BBOP) Years 9-11
Maritorena, S.; Siegel, D. A.; Nelson, Norm B.; 2004; 7 pp.; In English
Contract(s)/Grant(s): NAS5-00200
Report No.(s): NASA/CR-2004-212757; No Copyright; Avail: CASI; A02, Hardcopy

The Bermuda BioOptics Project (BBOP) is a collaborative effort between the Institute for Computational Earth System Science (ICESS) at the University of California at Santa Barbara (UCSB) and the Bermuda Biological Station for Research (BBSR). This research program is designed to characterize light availability and utilization in the Sargasso Sea, and to provide an optical link by which biogeochemical observations may be used to evaluate bio-optical models for pigment concentration, primary production, and sinking particle fluxes from satellite-based ocean color sensors. The BBOP time-series was initiated in 1992, and is carried out in conjunction with the U.S. JGOFS Bermuda Atlantic Time-series Study (BATS) at the Bermuda Biological Station for Research. The BATS program itself has been observing biogeochemical processes (primary productivity, particle flux and elemental cycles) in the mesotrophic waters of the Sargasso Sea since 1988. Closely affiliated with BBOP and BATS is a separate NASA-funded study of the spatial variability of biogeochemical processes in the Sargasso Sea using high-resolution AVHRR and SeaWiFS data collected at Bermuda. The collaboration between BATS and BBOP measurements has resulted in a unique data set that addresses not only the SIMBIOS goals but also the broader issues of important factors controlling the carbon cycle.
Author
Biogeochemistry; Optical Equipment; Pigments; Earth Sciences; Carbon Cycle

20040078901 Air Force Research Lab., Detachment 15, Kihei Maui, HI
Object Characterization from Spectra Data
Luu, K. K.; Matson, Charles L.; Snodgrass, Joshua; Giffin, S. M.; Hamada, Kris; Jan. 2003; 13 pp.; In English
Contract(s)/Grant(s): F29601-00-D-0204; Proj-4868/4983
Report No.(s): AD-A423457; XC-AFRL/DET-15; No Copyright; Avail: CASI; A03, Hardcopy

In general, the task of identifying the shape, function, and status of objects from nonimaging temporally- resolved spectral data is impossible. This is due to the limited degrees of freedom in the data as compared to the degrees of freedom that define shape, function, and status. However, by modeling objects as combinations of simple shapes with simple reflective and spectral characteristics, the problem though daunting is expected to become tractable due to the reduction of degrees of freedom in object space. One anticipated result from this modeling process is that the properties of null and near-null object features can be characterized; that is, an object can be characterized as a set of observable features summed with null or near-null features that perturb the measurement only slightly or not at all. The initial development of classes presented in this

paper is a first step towards an inversion procedure to map spectral data into classes.
DTIC
Artificial Satellites; Characterization; Images; Spectra

20040079636 Swedish Defence Research Establishment, Linkoeping, Sweden
Optical Communication in Urban Areas, Focus on Non Line-of-Sight Optical Communication
Sakari, P.; Pettersson, M.; Sep. 2003; In English
Report No.(s): PB2004-104593; FOI-R-0944-SE; No Copyright; Avail: National Technical Information Service (NTIS)

Optical wireless communication could in many cases be an alternative to radio communication, due to, among others, its possibility of high bit rate and jamming resistance. For military operations in an urban environment where communication is necessary, optical communication has some disadvantages compared to radio. Normally, optical communication outdoors demands a free line-of-sight between the transmitter and receiver, which not always is possible in urban environments. The free-space optic links today are not designed for moving platforms, but only for communication between buildings. Research in this field is however in progress. Following a short introduction to optical communication in urban environments, the report states the possibilities and the limitations for optical communication lacking a free line-of-sight. The possibility to use reflections from walls or other diffusively reflection surfaces has been studied. Measurements of the attenuation when the signal reflects against different surfaces and at two different wavelengths have been performed. Calculations made from the measurement results show a limited range for such a system, which is due to the relatively low laser output power and the attenuation when the beam reflects against the surface. A distance of up to 50 meters between the reflecting surface and the receiver could be possible, on the assumption that the background noise coming from the sun and other light sources can be filtered in an efficient way.
NTIS
Optical Communication; Transmitter Receivers

20040079674 Lawrence Livermore National Lab., Livermore, CA
Methods for Mitigating Growth of Laser-Initiated Surface Damage on DKDP Optics at 351nm
Hrubesh, L. W.; Brusasco, R. B.; Grundler, W.; Norton, M. A.; Donohue, E. E.; Oct. 11, 2002; 18 pp.; In English
Report No.(s): DE2004-15002263; UCRL-JC-148497; No Copyright; Avail: Department of Energy Information Bridge

We report an experimental investigation of mitigating surface damage growth at 351nm for machine-finished DKDP optics. The objective was to determine which methods could be applied to pre-initiated or retrieved-from-service optics, in order to stop further damage growth for large aperture DKDP optics used in high-peak-power laser applications. The test results, and the evaluation thereof, are presented for several mitigation methods applied to DKDP surface damage. The mitigation methods tested were CW-CO2 laser processing, aqueous wet-etching, short-pulse laser ablation, and micro-machining. We found that micro-machining, using a single crystal diamond tool to completely remove the damage pit, produces the most consistent results to halt the growth of surface damage on DKDP. We obtained the successful mitigation of laser-initiated surface damage sites as large as 0.14mm diameter, for up to 1000 shots at 351nm and fluences in the range of 2 to 13J/sq cm,(approx) 11ns pulse length. Data obtained to-date indicates that micro-machining is the preferred method to process large-aperture optics.
NTIS
Carbon Dioxide Lasers; Laser Damage; Machining; Optical Equipment

20040079718 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Broadband Wavefront Sensing for JWST Fine Phasing
Dean, Bruce; Green, Joseph J.; 2004; 1 pp.; In English; SPIE Astronomical Telescope Conference, June 2004, Scotland, UK; No Copyright; Avail: Other Sources; Abstract Only

An application of broadband image-based wavefront sensing is considered for JWST fine phasing. The wavefront sensing error is derived as a function of filter bandpass and then applied to determine the appropriate filter specifications for observatory fine-phasing. These specifications are defined by considering an optimization in the trade space consisting of detector integration time vs. filter bandpass subject to wavefront sensing error budget constraints.
Author
Wave Fronts; Broadband; Image Analysis

20040081036 NASA Goddard Space Flight Center, Greenbelt, MD, USA

The Micro-Pulse Lidar Network (MPLNET): A Federated Network of Micro-pulse Lidars and AERONET Sunphotometers

Welton, Ellsworth J.; Campbell, James R.; Spinhirne, James D.; Berkoff, Timothy A.; Holben, Brent; Tsay, Si-Chee; [2004]; 23 pp.; In English; Original contains color illustrations; No Copyright; Avail: CASI; A03, Hardcopy

We present the formation of a new global-ground based eye-safe lidar network, the NASA Micro-Pulse Lidar Network (MPLNET). The aim of MPLNET is to acquire long- term observations of aerosol and cloud vertical profiles at unique geographic sites within the NASA Aerosol Robotic Network (AERONET). MPLNET utilizes standard instrumentation and data processing algorithms for efficient network operations and direct comparison of data between each site. The micro-pulse lidar is eye-safe, compact, and commercially available, and most easily allows growth of the network without sacrificing standardized instrumentation goals. Network growth follows a federated approach, pioneered by AERONET, wherein independent research groups may join MPLNET with their own instrument and site. MPLNET sites produce not only vertical profile data, but also column-averaged products already available from AERONET (aerosol optical depth, sky radiance, size distributions). Algorithms are presented for each MPLNET data product. Real-time Level 1 data products (next-day) include daily lidar signal images from the surface to -2Okm, and Level 1.5 aerosol extinction profiles at times co-incident with AERONET observations. Quality assured Level 2 aerosol extinction profiles are generated after screening the Level 1.5 results and removing bad data. Level 3 products include continuous day/night aerosol extinction profiles, and are produced using Level 2 calibration data. Rigorous uncertainty calculations are presented for all data products. Analysis of MPLNET data show the MPL and our analysis routines are capable of successfully retrieving aerosol profiles, with the strenuous accounting of uncertainty necessary for accurate interpretation of the results.

Author

Optical Radar; Aerosols; Photometers; Size Distribution; Calibrating

75
PLASMA PHYSICS

Includes magnetohydrodynamics and plasma fusion. For ionospheric plasmas see *46 Geophysics*. For space plasmas see *90 Astrophysics*.

20040074497 Helsinki Univ. of Technology, Espoo

Numerical Simulation of Neoclassical Currents, Parallel Viscosity, and Radial Current Balance in Tokamak Plasmas

Kiviniemi, T.; 2001; 58 pp.; In English

Report No.(s): PB2004-105758; No Copyright; Avail: CASI; A04, Hardcopy

One of the principal problems en route to a fusion reactor is that of insufficient plasma commitment, which has lead to both theoretical and experimental research into transport processes in the parameter range relevant for fusion energy production. The neoclassical theory of tokamak transport is well-established unlike the theory of turbulence driven anomalous transport in which extensive progress has been made during last few years. So far, anomalous transport has been dominant in experiments, but transport may be reduced to the neoclassical level in advanced tokamak scenarios. This thesis reports a numerical study of neoclassical uses, parallel viscosity, and neoclassical radial current balance in tokamaks.

NTIS

Numerical Analysis; Electric Current; Viscosity

20040079664 Lawrence Livermore National Lab., Livermore, CA

Recent Advances in Indirect Drive ICF Target Physics

Hammel, B. A.; Lindl, J.; Amendt, P. A.; Bernat, T. P.; Collins, G. W.; Oct. 08, 2002; In English

Report No.(s): DE2004-15002265; UCRL-JC-150309; No Copyright; Avail: National Technical Information Service (NTIS)

In preparation for ignition on the National Ignition Facility (NIF), the Lawrence Livermore National Laboratory's Inertial Confinement Fusion Program, working in collaboration with Los Alamos National Laboratory, Commissariat a Energie Atomique (CEA), and Laboratory for Laser Energetics at the University of Rochester, has performed a broad range of experiments on the Nova and Omega lasers to test the fundamentals of the NIF target designs. These studies have refined our understanding of the important target physics, and have led to many of the specifications for the NIF laser and the cryogenic ignition targets.

NTIS

Ignition; Research Facilities; Lasers

20040079725 Lawrence Livermore National Lab., Livermore, CA
Neutron Scintillators for Downscattered Neutron Imaging
Moran, M. J.; Koch, J.; Barrera, C. A.; Morse, E. C.; Aug. 25, 2003; In English
Report No.(s): DE2003-15005366; UCRL-JC-152377; No Copyright; Avail: National Technical Information Service (NTIS)

Images of neutron emission from Inertial Confinement Fusion (ICF) (D,T) targets reveal the internal structure of the target during the fusion burn. 14-MeV neutrons provide images which show the size and shape of the region where (D,T) fusion is most intense. Images based on 'downscattered' neutrons with energies from 5 to 10 MeV emphasize the distribution of deuterium and tritium fuel within the compressed target. The downscattered images are difficult to record because the lower energy neutrons are detected with less efficiency than the much more intense pulse of 14-MeV neutrons which precedes them at the detector. The success of downscattered neutron imaging will depend on the scintillation decay times and the sensitivities to lower-energy neutrons of the scintillator materials that are used in the detectors.
NTIS
Neutron Emission; Scintillation Counters; Imaging Techniques

20040081042 California Univ., Santa Cruz, CA, USA
Plasma Enhanced Growth of Carbon Nanotubes For Ultrasensitive Biosensors
Cassell, Alan M.; Meyyappan, M.; [2004]; 1 pp.; In English; Nanomix, Inc., 13 May 2004, Emeryville, CA, USA
Contract(s)/Grant(s): NAS2-03144; No Copyright; Avail: Other Sources; Abstract Only

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

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*.

20040077338 National Renewable Energy Lab., Golden, CO
Rapid, Non-Contact Method for Measurement of Si Wafer Thickness: Principles and Prelimiary Results
Sopori, B.; Auriemma, C.; Li, C.; Madjdpour, J.; Aug. 2003; In English
Report No.(s): DE2003-15004592; NREL/CP-520-34654; No Copyright; Avail: National Technical Information Service (NTIS)

The thickness of a semiconductor wafer can critically influence mechanical and/or electronic yield of the device(s) fabricated on it. For most microelectronic (surface) devices, the thickness of a wafer is important primarily for mechanical reasons--to provide control and stability of devices by minimizing stresses resulting from various device-fabrication processes. However, for minority-carrier devices, such as solar cells, the entire thickness of the wafer participates in the optical and electronic performance of the device. In either case, control of wafer thickness through careful measurement is a fundamental requirement in the commercial fabrication of electronic devices.
NTIS
Thickness; Semiconductors (Materials); Microelectronics

20040077359 Lockheed Martin Corp., Syracuse, NY, USA
Neutron Capture and Transmission Measurements and Resonance Parameter Analysis of Samarium
Leinweber, G.; Burke, J. A.; Knox, H. D.; Drindak, N. J.; Mesh, D. W.; Jul. 2001; 40 pp.; In English
Report No.(s): DE2004-821312; LM-01K066; No Copyright; Avail: Department of Energy Information Bridge

In this paper, by systematically treating the integrals involved in the piezoelectric inclusion problem, explicit results were

obtained for the piezoelectric Eshelby tensors for a spheroidal inclusion aligned along the axis of the anisotropy in a transversely isotropic piezoelectric material. This problem was first treated by Dunn and Wienecke (1996) using a Green's function approach, which closely follows Withers' approach (1989) for an ellipsoidal inclusion problem in a transversely isotropic elastic medium. The same problem was recently treated by Michelitsch and Levin (2000) also using a Green's function approach. In this paper, a different method was used to obtain the explicit results for the piezoelectric Eshelby tensors for a spheroidal inclusion. The method is a direct extension of a more unified approach, which has been recently developed by Mikata (2000), which is based on Deeg's results (1980) on a piezoelectric inclusion problem. The main advantage of this method is that it is more straightforward and simpler than Dunn and Wienecke (1996), or Michelitsch and Levin (2000), and the results are a little bit more explicit than their solutions. The key step of this paper is an analytical closed form evaluation of several integrals, which was made possible after a careful treatment of a certain bi-cubic equation.
NTIS
Neutrons; Capture Effect; Samarium

20040081038 NASA Ames Research Center, Moffett Field, CA, USA
Nanotubes May Break Through "Chip Wall"
Laufenberg, Larry; November 13, 2003; 2 pp.; In English
Contract(s)/Grant(s): UPN 704-00-00; No Copyright; Avail: CASI; A01, Hardcopy

In 1965, just four years after the first planar integrated circuit (IC) was discovered, Cordon Moore observed that the number of transistors per integrated circuit had grown exponentially. He predicted that this would continue, and the media soon began to call his prophesy "Moore's Law" For nearly forty years, Moore's Law has been validated by the technological progress achieved in the semiconductor industry. Now, however, industry experts are warning of a "Red Brick Wall" that may soon block the continued scaling predicted by by Moore's Law. The "red bricks" in the wall are those areas of technical challenge for which no known manufacturable solution exists. One such "brick" is the challenge of finding a new material and processing technology to replace the metals used today to interconnect transistors on a chip.
Derived from text
Nanotubes; Integrated Circuits; Semiconductors (Materials)

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*.

20040078808 Naval Facilities Engineering Service Center, Port Hueneme, CA
Cost And Performance Report; Application of Thermocouple Conversion to Destroy Demolition Debris from Fort Ord
Jul. 2, 2003; 35 pp.; In English; Original contains color illustrations
Report No.(s): AD-A423255; NFESC-TR-2233-ENV; No Copyright; Avail: CASI; A03, Hardcopy

A series of thermal treatment tests were conducted on military wood waste contaminated with lead-based paint for the U.S. Army Engineer Research & Development Center Construction Engineering Research Laboratory (ERDC/CERL) champaign, Illinois under a contract with the Naval Facilities Engineering Service Center (NFESC) in Port Hueneme California. The tests were designed to collect data that would facilitate the design and capital/operational cost estimates for a transportable treatment system that could process such waste on site during demolition activities at current and former military installations. The data produced from the tests facilitated the development of a design of a transportable processing system for the LBP-coated materials. The transportable processing system can process the waste for a cost of less than 1/3 the cost of land disposal of the waste designated as X008 waste (exempt household hazardous waste) and less than 1/5 the cost of land disposal if the waste originates from other than residential structures and is designated as RCRA hazardous waste.
DTIC
Cost Estimates; Costs; Debris; Thermocouples; Thermodynamic Properties; Waste Treatment

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*.

20040077335 NASA Dryden Flight Research Center, Edwards, CA, USA
From Runway to Orbit: Reflections of a NASA Engineer
Iliff, Kenneth W.; Peebles, Curtis L.; 2004; 424 pp.; In English; Original contains color and black and white illustrations
Report No.(s): NASA/SP-2004-4109; No Copyright; Avail: CASI; A18, Hardcopy

In his remarkable memoir Runway to Orbit, Dr. Kenneth W. Iliff - the recently retired Chief Scientist of the NASA Dryden Flight Research Center- tells a highly personal, yet a highly persuasive account of the last forty years of American aeronautical research. His interpretation of events commands respect, because over these years he has played pivotal roles in many of the most important American aeronautics and spaceflight endeavors. Moreover, his narrative covers much of the second half of the first 100 years of flight, a centennial anniversary being celebrated this year. aerospace knowledge. He arrived at the then NASA Flight Research Center in 1962 as a young aeronautical engineer and quickly became involved in two of the seminal projects of modern flight, the X-15 and the lifting bodies. In the process, he pioneered (with Lawrence Taylor) the application of digital computing to the reduction of flight data, arriving at a method known as parameter estimation, now applied the world over. Parameter estimation not only enabled researchers to acquire stability and control derivatives from limited flight data, but in time allowed them to obtain a wide range of aerodynamic effects. Although subsequently involved in dozens of important projects, Dr. Iliff devoted much of his time and energy to hypersonic flight, embodied in the Shuttle orbiter (or as he refers to it, the world s fastest airplane). To him, each Shuttle flight, instrumented to obtain a variety of data, represents a research treasure trove, one that he has mined for years. This book, then, represents the story of Dr. Ken Iliff s passion for flight, his work, and his long and astoundingly productive career. It can be read with profit not just by scientists and engineers, but equally by policy makers, historians, and journalists wishing to better comprehend advancements in flight during the second half of the twentieth century. Dr. Iliff's story is one of immense contributions to the nation s repository of
Author
Space Transportation System Flights; Space Flight; Policies; Lifting Bodies; Hypersonic Flight; Aerodynamics

20040081222 Helsinki Univ., Helsinki, Finland
Large Deviations of Zeroes and Fixed Points of Random Maps with Applications to Equilibrium Economics
Kuusela, Mikko; Martio, Olli, Editor; 2004; ISSN 1239-6303; 55 pp.; In English
Report No.(s): Rept-138; Copyright; Avail: Other Sources

In the first part of this study we present some background information needed. We present key results on random economies by Hildenbrand [Hill, Bhattacharya and Majumdar [BM] as well as Nummelin [Numl]. Furthermore, we present basic facts about large deviations theory. Brouwer's and Kakutani's fixed point theorems are also presented. As an example of the latter, we consider a social system of n agents. In Part 2 we concentrate on proving existence and large deviations results on equilibrium when we have an economic system with random agents. The aim is to prove the same kind of existence and upper bound results as Nummelin ([Numl], [Num2]), but without the restrictive equicontinuity assumption, see the assumption (iii) of Theorem 5.2. The strategy is to consider first the situation where the agents are i.i.d., and later to give up this restriction. The search for equilibrium prices of an economic system is similar to finding fixed points for a map. In Part 3 we widen our perspective from economic equilibrium theory to general fixed point considerations. It turns out that many of the results of the previous part are applicable to this case. Finally, we give some examples of how these theoretical results can be used. We emphasize economic applications. Especially the so called Cobb-Douglas system is studied carefully in two special cases.
Author
Economics; Deviation

81
ADMINISTRATION AND MANAGEMENT

Includes management planning and research.

20040077331 Institute of Sound and Vibration Research, Southampton, UK
Institute of Sound and Vibration Research
August 2003; 107 pp.; In English; Copyright; Avail: Other Sources

The past year has seen an enormous change in the structure of the University of Southampton. As from 1 August 2003 the University is moving from its existing organization to a new structure based on 20 new Schools . Under this new arrangement the Schools will comprise the budgetary groups and be directly responsible for the management of their financial affairs. As reported last year, the ISVR has the status of a School in this new structure and will be a member of the new Faculty of Engineering, Science and Mathematics. The other Schools in the Faculty will be those of Chemistry, Physics and Astronomy, Mathematics, Geography, Ocean and Earth Science, Civil Engineering and the Environment, Engineering Sciences, and Electronics and Computer Science. It is great pleasure to report that Professor J K Hammond, previously Director of ISVR, has been appointed as Dean of this new Faculty. The other Schools in the structure will constitute the Faculty of Medicine, Health and Life Sciences, and the Faculty of Law, A r t s and Social Sciences. The Vice Chancellor, three Deputy Vice Chancellor's, the Deans of the three Faculties, the Secretary and Registrar, and the Director of Finance, will compose the University Executive Group. This Group will take responsibility for the management and strategic direction of the University. The aim of the new structure will be to realise the Vice Chancellor s Vision for the development of the University over the next ten years. This year has also seen the first direct interaction between the Institute and the University Executive Group through the annual strategic planning process. Although much groundwork had been done during the previous year, a further major effort was dedicated to producing a strategic plan for the development of the Institute, together with financial projections based on assumptions regarding our development. Plans have been submitted for the development of the Research. Education and Enterprise that form the three categories of activity in which the new Schools in the University are expected to engage. Of course, the ISVR has a long history of successful involvement in all three and it was therefore not difficult to describe their further evolution. In terms of Research, emphasis was given to developments in human sciences, particularly with regard to the enhancement of our motion simulation facilities and our leading role in the EPSRC-funded Rail Research UK. Further development of our existing strengths in aeroacoustics were emphasised and a new Chair appointment sought in the field of jet noise/computational aeroacoustics that Rolls-Royce plc had agreed to part-fund. The interaction between the Signal Processing and Control Group and researchers in the Human Sciences Group was also foreseen as vitally important for future developments at the life sciences interface. Emphasis was also given to the development of our existing strengths in underwater acoustics and ultrasonics, especially through collaborative initiatives with other Schools, for example, of Chemistry and of Ocean and Earth Science. Finally, the dynamics of complex engineering structures was seen as a continuing area of strength in research. With regard to Education, priority was given to the launch of our new undergraduate programme leading to the degree of BSc in Audiology, together with the enhancement of the existing MSc programme through offering further Diploma programmes funded by the Workforce Development Confederation. Our Masters programmes in Sound and Vibration Studies, Applied Digital Signal Processing, and Automotive Refinement will be integrated into a single managed portfolio of Masters level programmes. The programme leading to the award of the degree of MEng in Acoustical Engineering will be sustained and enhanced through a more forceful approach to marketing. Our Enterprise activities will continue to be focused on the further development and growth of the South of England Cochlear Implant Cent (SOCEIC) and through the growth of ISVR Consulting (which has been formed from the merger of ISVR Consultancy Services and the Automotive Design Advisory Unit).
Derived from text

Aeroacoustics; Audiology; Dynamic Structural Analysis; Finance; Schools; Universities; Vibration

20040079354 NASA Ames Research Center, Moffett Field, CA, USA

Providing Effective Access to Shared Resources: A COIN Approach

Airiau, Stephane; Wolpert, David H.; [2004]; 8 pp.; In English; Copyright; Avail: CASI; A02, Hardcopy

Managers of systems of shared resources typically have many separate goals. Examples are efficient utilization of the resources among its users and ensuring no user s satisfaction in the system falls below a preset minimal level. Since such goals will usually conflict with one another, either implicitly or explicitly the manager must determine the relative importance of the goals, encapsulating that into an overall utility function rating the possible behaviors of the entire system. Here we demonstrate a distributed, robust, and adaptive way to optimize that overall function. Our approach is to interpose adaptive agents between each user and the system, where each such agent is working to maximize its own private utility function. In turn, each such agent's function should be both relatively easy for the agent to learn to optimize, and "aligned" with the overall utility function of the system manager - an overall function that is based on but in general different from the satisfaction functions of the individual users. To ensure this we enhance the Collective INtelligence (COIN) framework to incorporate user satisfaction functions in the overall utility function of the system manager and accordingly in the associated private utility functions assigned to the users agents. We present experimental evaluations of different COIN-based private

utility functions and demonstrate that those COIN-based functions outperform some natural alternatives.
Author
Systems Management; Alternatives; Resources Management

20040081050 NASA Wallops Flight Center, Wallops Island, VA, USA
A Recipe for Streamlining Mission Management
Mitchell, Andrew E.; Semancik, Susan K.; February 18, 2004; 1 pp.; In English; 55th International Astronautical Conference, 4-8 Oct. 2004, Vancouver, Canada; No Copyright; Avail: Other Sources; Abstract Only

This paper describes a project's design and implementation for streamlining mission management with knowledge capture processes across multiple organizations of a NASA directorate. Thc project's focus is on standardizing processes and reports; enabling secure information access and case of maintenance; automating and tracking appropriate workflow rules through process mapping; and infusing new technologies. This paper will describe a small team's experiences using XML technologies through an enhanced vendor suite of applications integrated on Windows-based platforms called the Wallops Integrated Scheduling and Document Management System (WISDMS). This paper describes our results using this system in a variety of endeavors, including providing range project scheduling and resource management for a Range and Mission Management Office; implementing an automated Customer Feedback system for a directorate; streamlining mission status reporting across a directorate; and initiating a document management, configuration management and portal access system for a Range Safety Office's programs. The end result is a reduction of the knowledge gap through better integration and distribution of information, improved process performance, automated metric gathering, and quicker identification of problem areas and issues. However, the real proof of the pudding comes through overcoming the user's reluctance to replace familiar, seasoned processes with new technology ingredients blended with automated procedures in an untested recipe. This paper shares some of the team's observations that led to better implementation techniques, as well as an IS0 9001 Best Practices citation. This project has provided a unique opportunity to advance NASA's competency in new technologies, as well as to strategically implement them within an organizational structure, while wetting the appetite for continued improvements in mission management.
Author
Streamlining; Project Management; Systems Engineering; NASA Programs

20040081052 NASA Kennedy Space Center, Cocoa Beach, FL, USA
7th Annual NASA/Contractors Conference on Quality and Productivity: "Total Quality Leadership"
April 1991; ISSN 1049-667X; 182 pp.; In English; Seventh Annual NASA/Contractors Conference on Quality and Productivity, 24-25 Oct. 1990, Grenelefe, FL, USA; No Copyright; Avail: CASI; A09, 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, processess, and services. The annual NASA/contractors conferences serve as catalysts for achieving success in this mission. The conference was highlighted by the announcement of the first recipients of the George M. Low Trophy: NASA's Quality and Excellence Award. My congratulations go out to all nine finalist organizations and to the two recipients of this prestigious honor: Rockwell Space Systems Division and Marotta Scientific Controls, Inc. (the first small business to achieve this honor). These organizations have demonstrated a commitment to quality that is unsurpassed in the aerospace industry. This report summarizes the presentations and is not intended to be a verbatim proceedings document. You are encouraged to contact the speakers with any requests for further information.
Author
Contract Management; Total Quality Management

20040081099 NASA Ames Research Center, Moffett Field, CA, USA
Collective Intelligence, Chapter 17
Wolpert, David H.; Computational Intelligence: The Experts Speak; [2003], pp. 245-260; In English; Copyright; Avail: Other Sources

Many systems of self-interested agents have an associated performance criterion that rates the dynamic behavior of the overall system. This chapter presents an introduction to the science of such systems. Formally, collectives are defined as any

system having the following two characteristics: First, the system must contain one or more agents each of which we view as trying to maximize an associated private utility; second, the system must have an associated world utility function that rates the possible behaviors of that overall system. In practice, collectives are often very large, distributed, and support little, if any, centralized communication and control, although those characteristics are not part of their formal definition. A naturally occurring example of a collective is a human economy. One can identify the agents and their private utilities as the human individuals in the economy and the associated personal rewards they are each trying to maximize. One could then identify the world utility as the time average of the gross domestic product. ("World utility" per se is not a construction internal to a human economy, but rather something defined from the outside.) To achieve high world utility it is necessary to avoid having the agents work at cross-purposes lest phenomena like liquidity traps or the Tragedy of the Commons (TOC) occur, in which agents' individually pursuing their private utilities lowers world utility. The obvious way to avoid such phenomena is by modifying the agents utility functions to be "aligned" with the world utility. This can be done via punitive legislation. A real-world example of an attempt to do this was the creation of antitrust regulations designed to prevent monopolistic practices.
Author
Intelligence; Procedures; Dynamic Characteristics

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*.

20040077329 NASA Goddard Space Flight Center, Greenbelt, MD, USA
NASA GSFC's Role in the US Space Program
Simpson, James E.; May 2004; 15 pp.; In English; New Jersey Civil Air Patrol Conference, 30 Apr. - 1 May, 2004, Bridgewater, NJ, USA; No Copyright; Avail: CASI; A03, Hardcopy

The paper discussss the GSFC research interests and how GSFC contributes to solve some of most basic questions Humans having been asking for thousands of years. How big is universe? How old is the universe? Will Humans and industrialization of the Earth change the climate significantly? Can Humans live in space? How does the Sun affect life on Earth? Goddard s role in Earth Science is very unique. We buy and build instruments that collect data about weather around the world. By flying those instruments on spacecraft, we have a unique vantage point to observe the weather patterns on a global scale. The best example is a satellite network called GOES (Geostationary Operational Environmental Satellite) which produces the weather pictures and videos you see on the nightly news and weather channel. Earth Science is another area of great interest to Goddard scientists and spacecraft designers. This photo of an oil fire in Iraq taken on March 2Ist of this year shows the down range effect pollution will have on entire region. Space Weather has become extremely important in the Space business. Satellites not only can become inoperable due to the occasional high level of radiation but astronauts can be exposed to dangerous levels of radiation. Space Weather is actually an issue when planning Extra Vehicular Activities (EVA). At Goddard, our operation of the Hubble Space Telescope has meant we have worked closely with several Shuttle crews over the years.
Derived from text
Aerospace Industry; Climate; Earth Sciences; Extravehicular Activity; Life Sciences; Space Programs; Space Weather

20040078800 Naval Postgraduate School, Monterey, CA
Submarine Warfare in the 20th & 21st Centuries: A Bibliography
Huygen, Michaele L.; Dec. 2003; 376 pp.; In English; Original contains color illustrations
Report No.(s): AD-A423241; No Copyright; Avail: CASI; A17, Hardcopy

There are constant motions in the sea caused by atmospheric and seabed activities volcanic disruptions marine animals ships and submarines -- all of which create what is called the ambient noise level of the oceans. Today acoustics is the basis of both submarine and antisubmarine warfare: the single most significant element upon which all undersea warfare activity depends. When the submarine was first developed its security lay beneath the surface of the ocean where it would not be seen. Today its security lies in its ability to avoid being heard.
DTIC
Bibliographies; Warfare

20040078825 Army War Coll., Carlisle Barracks, PA
Analysis of Intelligence Support to the 1991 Persian Gulf War Enduring Lessons
Bird, John J.; May 3, 2004; 29 pp.; In English
Report No.(s): AD-A423282; No Copyright; Avail: CASI; A03, Hardcopy

When examining intelligence support to military operations one cannot truly appreciate where the USA Army is today or sense where it must go in the future unless we fully understand and embrace the critical lessons of the past. The 1991 Gulf War presented a number of critical intelligence support lessons which are highly relevant to future U.S. Army operations. The intent of this paper is to analyze Gulf War intelligence collection and analysis efforts primarily at echelons division through theater in order to distill the enduring lessons learned. The paper is an unclassified executive level presentation of the rich timeless and meaningful intelligence lessons learned from the 1991 Gulf War.
DTIC
Intelligence; Persian Gulf; Warfare

20040078845 Army War Coll., Carlisle Barracks, PA
Information Technology Challenges Facing the Strategic Leaders of Homeland Security in the 21st Century
Alexander, Dan; May 3, 2004; 24 pp.; In English
Report No.(s): AD-A423331; No Copyright; Avail: CASI; A03, Hardcopy

This paper examines the Information Technology challenges that face strategic leaders of the Department of Homeland Security (DHS) as the USA transitions into the 21st Century. Author assumes that Information Technology is the enabler to providing the Department of Homeland Security a high fidelity effective and operational infrastructure and is critical to the overall success of the Global War on Terrorism. The author reviews and discusses options for maintaining an effective infrastructure of Information Technology that protects the vital interests of the U.S. homeland. Author argues that by having positive control of the five (5) challenging areas of cultural change systems integration knowledge management decision-making and telecommunications DHS can successfully maintain an efficient and effective organization that will provide a protective wall between terrorist activities and the homeland of the USA.
DTIC
Information Systems; Security

20040078876 Army War Coll., Carlisle Barracks, PA
Peacekeeping: A Selected Bibliography
May 2004; 35 pp.; In English
Report No.(s): AD-A423396; No Copyright; Avail: CASI; A03, Hardcopy

No abstract available
Bibliographies

20040078893 Reliability Analysis Center, Rome, NY
Reliability Sourcebook
Fuqua, Norman B.; May 7, 1990; 58 pp.; In English
Contract(s)/Grant(s): F30602-87-C-0228
Report No.(s): AD-A423444; RDSC-1; No Copyright; Avail: CASI; A04, Hardcopy

This publication was developed to fill the need for a single, consolidated reference to sources of reliability data and information. Many of the inquiries received by the Reliability Analysis Center (RAC) are concerned with whether a certain type of reliability datum exists and how and where it can be obtained. While various bibliographic publications do exist, there has been no convenient source document consolidating information about all types of data sources - books, periodicals, organizations, on-line databases, etc. - covering both military and industrial/commercial arenas. This publication is intended to provide a ready source for this type of information. While it would be virtually impossible to identify all sources of reliability information and data, an attempt has been made in this publication to identify those sources that are the most readily available and the most helpful to the reliability practitioner. This document is organized into four chapters. Chapter 1, Organizations, includes government, military, professional, and educational groups that support reliability and quality disciplines. Chapter 2, Publications, includes proceedings, journals, newsletters, periodicals, and books containing reliability data and information. Chapter 3, Databases, contains automated and semi-automated databases containing component and system reliability data. Chapter 4, Electronic Bulletin Boards, provides on-line resources for reliability information exchange. The data sources listed cover a broad spectrum. Some focus on DoD needs; others serve a limited segment of the industrial

community. Access to some data sources is restricted, while others are open to any and all users. Some sources are available at no cost to the user, where others charge the user for the information. Where possible these distinctions have been made in the text.
DTIC
Maintainability; Reliability

20040078928 Information International Associates, Inc., Havertown, PA
Digital Preservation and Permanent Access to Scientific Information: The State of the Practice
Hodge, Gail; Frangakis, Evelyn; Feb. 2004; 91 pp.; In English
Report No.(s): AD-A423497; CENDI-2004-3: REV. 05/04; No Copyright; Avail: CASI; A05, Hardcopy

In 1999, the International Council for Scientific and Technical Information (ICSTI) and CENDI jointly sponsored a report on Digital Electronic Archiving: The State of the Art and Practice (Carroll & Hodge 1999). ICSTI and CENDI remain interested in digital preservation as they represent large repositories, publishers, and libraries of scientific and technical information. This report is an update to that 1999 report. This report focuses on operational digital preservation systems specifically in science and technology (S&T). It considers the wide range of digital objects of interest to S&T, including e-journals, technical reports, e- records, project documents, scientific data, etc. The report also discusses archiving based on format types text, data, audio, video, etc. It is, of course, international in scope, and as much as possible crosses organizational sectors (academic, government, commercial, etc.). However, this report does not attempt to provide a comprehensive survey of systems, but, rather, to highlight selected systems/projects that can help to identify trends, remaining issues and activities that ICSTI, CENDI, and other organizations interested in the preservation and permanent access to the record of science can consider when developing their own systems and policies. More than 50 projects and systems were identified from the surveys, from experts, or from the literature. From these, 21 were selected for highlighting in this report. However, references are made to other projects throughout the report as appropriate.
DTIC
Documents; Information Systems; Preserving

20040078930 National Imagery and Mapping Agency, Bethesda, MD
Guide to Marking Documents
Oct. 4, 2001; 77 pp.; In English
Report No.(s): AD-A423499; No Copyright; Avail: CASI; A05, Hardcopy

The national security of the USA depends on many things. including the security of its information. Throughout our history. the national interest has required that certain information be maintained in confidence in order to protect our citizens, our democratic nstitutions. and our participation within the community of nations. This innovation is called national Security Information and is classified to afford its protection. This guide provides guidance on identifying and marking classified information. The guidance is based on Executive Order 12958, Classified National Security Information: and Director of Central Intelligence Direetives (DCIDs). It is intended for use by NIMA original and derivative classifiers and administrative personnel who prepare the final producL Classification markings serve several purposes. They alert holders to the presence of classified information and identify the exact information or portion that needs prntection. Markings give the reason for the initial classification decision and provide guidance for downgrading and declassification. They also warn the holders of any special access, controls. or safeguarding requirements. While we cannot anticipate every marking situation this guide provides the basic ground rules that apply to all classified information, regardless of the media used. This guide contains no classified information. The security classification markings declassification instructions, and warning notices are for illustration purposes only.
DTIC
Security

20040078935 Princeton Univ., NJ
Hydrologic Modeling of Extreme Floods Using Remote Sensing Observations
Smith, James A.; Jan. 1999; 178 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAAD19-99-1-0163
Report No.(s): AD-A423510; ARO-39129.7-E; No Copyright; Avail: CASI; A09, Hardcopy

The objectives of this research are to develop a comprehensive understanding of extreme floods and to dramatically improve the capability to model these events. Paired diagnostic and modeling studies play a central role in this project.

Hydrologic and hydrometeorological studies of extreme floods in the Great Plains, central Appalachians, The Milwaukee metropolitan area, Charlotte, NC metropolitan area and, high-gradient rainforest west of Puerto Rico have been completed. For the large flood events examined in this study, the spatial (1 km) and temporal (15 minutes) resolution of rainfall estimates provided by the WSR-88D was crucial to accurate modeling of extreme flood response. Coupled hydraulic and hydrologic modeling studies using RMA-2V and the Network Model have been carried out to characterize the dependence of flood response on floodwave attenuation and altered runoff processes associated with impervious cover and elaboration of the drainage network.
DTIC
Computer Networks; Floods; Hydrology; Hydrology Models; Mathematical Models; Remote Sensing

20040079331 NASA Kennedy Space Center, Cocoa Beach, FL, USA
Research and Technology: 2003 Annual Report of the John F Kennedy Space Center
November 2003; 211 pp.; In English; Original contains color illustrations
Report No.(s): NASA/TM-2003-211190; No Copyright; Avail: CASI; A10, Hardcopy
The John F. Kennedy Space Center (KSC) is America's Spaceport Technology Center. The KSC technology development program encompasses the efforts of the entire KSC team, consisting of Government and contractor personnel, working in partnership with academic institutions and commercial industry. KSC's assigned mission areas are space launch operations and spaceport and range technologies. KSC's technology development customers include current space transportation programs, future space transportation programs / initiatives, and enabling technical programs. The KSC Research and Technology 2003 Annual Report encompasses the efforts of contributors to the KSC advanced technology development program and KSC technology transfer activities. Dr. Dave Bartine, KSC Chief Technologist, (321) 867-7069, is responsible for publication of this report and should be contacted for any desired information regarding KSC's research and technology development activities.
Author
Research and Development; Space Transportation; Spacecraft Launching; Technology Transfer

20040079632 Swedish Defence Research Establishment, Linkoeping, Sweden
Authentication Across System Borders
Bengtsson, A.; Hunstad, A.; Westerdahl, L.; 2003; 74 pp.; In Swedish
Report No.(s): PB2004-104641; FOI-R-1025-SE; No Copyright; Avail: CASI; A04, Hardcopy
The vision of a network based defense demands that its C (sup4)1-system, FMLS, shall co-operate with external systems, e.g. civilian systems or systems from other nations. When subsystems are connected a lot of security issues arise. One is authentication, i.e. verification of identities stated by different parties across system borders. Parties to authenticate include not only humans, but also digital objects like computers, mobile software code, radio sets, etc. The main part of the report describes Web Services and developing standards for authentication within Web Services. Since this area is developing, the report is descriptive rather than assessing. One conclusion is that authentication of a human user to a Web Service is under way, but authentication between Web Services is in its infancy.
NTIS
Computer Information Security; Computer Programs

20040079756 General Accounting Office, Washington, DC
Information Security: Continued Action Needed to Improve Software Patch Management
Jun. 2004; 48 pp.; In English
Report No.(s): PB2004-105534; GAO-04-706; No Copyright; Avail: CASI; A03, Hardcopy
Flaws in software code can introduce vulnerabilities that may be exploited to cause significant damage to federal information systems. Such risks continue to grow with the increasing speed, sophistication, and volume of reported attacks, as well as the decreasing period of the time from vulnerability announcement to attempted exploits. The process of applying software patches to fix flaws, referred to as patch management, is a critical process to help secure systems from attacks. The Chairmen of the House Committee on Government Reform and its Subcommittee on Technology, Information Policy, Intergovernmental Relations and the Census requested that GAO assess the (1) reported status of 24 selected agencies in performing effective patch management practices, (2) patch management tools and services available to federal agencies, (3)

challenges to performing patch management, and (4) additional steps that can be taken to mitigate the risks created by software vulnerabilities.
NTIS
Computer Systems Programs; Procedures; Information Systems

20040081065 Lockheed Martin Space Operations, Bay Saint Louis, MS, USA
The NASA John C. Stennis Environmental Geographic Information System
Cohan, Tyrus; March 04, 2002; 21 pp.; In English; Presentation for the 2002 NASA Environmental Management and Energy Conference, 12-14 Mar. 2002, Norfolk, VA, USA
Contract(s)/Grant(s): NAS13-650
Report No.(s): SE-2002-03-00014-SSC; No Copyright; Avail: CASI; A03, Hardcopy

The Environmental Geographic Information System (EGIS) at Stennis Space Center (SSC) covers four counties in Mississippi and four parishes in Louisiana. The EGIS includes 410 data layers including vector and raster data from various public and private sources. These data layers provide information on natural and cultural features. SSC initially used the EGIS to: 1) Monitor on and off-site impacts of propulsion testing; 2) Classify land cover at SSC to predict the impacts of future programs. This viewgraph presentation provides an overview of ongoing projects and future applications for the EGIS.
CASI
Geographic Information Systems; Research Facilities; Environmental Monitoring

20040081192 NASA Ames Research Center, Moffett Field, CA, USA
SemanticOrganizer Brings Teams Together
Laufenberg, Lawrence; July 08, 2003; 2 pp.; In English; Original contains black and white illustrations
Contract(s)/Grant(s): UPN 704-00-00; No Copyright; Avail: CASI; A01, Hardcopy

SemanticOrganizer enables researchers in different locations to share, search for, and integrate data. Its customizable semantic links offer fast access to interrelated information. This knowledge management and information integration tool also supports real-time instrument data collection and collaborative image annotation.
Derived from text
Information Systems; Networks; Applications Programs (Computers)

20040081293 Computer Sciences Corp., USA
Handbook for Using IP Protocols for Space Missions
Hogie, Keith; Criscuolo, Ed; Parise, Ron; [2004]; 1 pp.; In English; Space Internet Workshop-4, 8-10 Jun. 2004, Hanover, MD, USA
Contract(s)/Grant(s): NASA Order S-43961-G; No Copyright; Avail: Other Sources; Abstract Only

This presentation will provide a summary of a handbook developed at GSFC last year that contains concepts and guidelines for using Internet protocols for space missions. It will include topics on: Lessons learned from current Space IP mission. General architectural issues related to use of IP in space. Operational scenarios for common space data transfer applications. Security issues. A general review of protocols applicable for use with IP in space. The presentation will also pose questions on what sort of information would be useful in future versions of the document.
Author
Handbooks; Technology Utilization; Architecture (Computers)

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*.

20040077204 California Univ., Los Angeles, CA, USA
Kinetic Simulation of Inhomogeneous Plasma with a Variable Sized Grid System
Schriver, David; Lecture Notes in Physics; 2003; Volume 615, pp. 93-108; In English
Contract(s)/Grant(s): NAG5-10473; NAG5-11704; NSF INT-00-10111; Copyright; Avail: Other Sources

Space plasmas are usually inhomogeneous and irregular. Particle in cell (PIC) plasma simulations, however, often consider the plasma to be homogeneous and periodic. Here non-periodic PIC simulations with inhomogeneities in the density,

temperature and background magnetic field are considered. Boundary conditions and a variable sized grid system are discussed, along with an application to a magnetospheric plasma physics problem in the auroral zone.
Author
Space Plasmas; Magnetic Fields; Boundary Conditions; Temperature Distribution

20040077267 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Progress on Space Borne Laser Risk Reduction at Goddard Space Flight Center
Heaps, William S.; Novo-Gradac, Anne-Marie; [2004]; 3 pp.; In English; 22nd International Lasar Radar Conference, 12-16 Jul. 2004, Matera, Italy; No Copyright; Avail: CASI; A01, Hardcopy

At the direction of NASA Headquarters NASA Goddard Space Flight Center (GSFC) and NASA Langley Research Center (LaRC) undertook in 2002 a program in fundamental research on laser manufacturing technologies aimed at improving the performance and lifetime of lasers sent into space for remote sensing applications. The work at GSFC has concentrated on three areas: 1) development of high power 1 micron lasers, 2) lifetime and reliability testing for 808 nm pump diodes, and 3) efficient conversion of 1 micron radiation to wavelengths needed for various remote sensing tasks. After almost 2 years of development interesting results in all three areas are beginning to emerge. Some of these results will be described along with discussion of future directions.
Author
Spaceborne Lasers; Risk; Remote Sensing; High Power Lasers; Reliability

20040077322 NASA Marshall Space Flight Center, Huntsville, AL, USA
Seeing the Invisible with the IMAGE Mission
Gallagher, D. L.; 2004; 1 pp.; In English; Royal Observatory Seminar, 5 May 2004, Brussels, Belgium; No Copyright; Avail: Other Sources; Abstract Only

The Global Positioning System, communication, power transmission, and oil pipelines are only a few of the technologies upon which we depend in research and in everyday life. Each is at risk from invisible storms in near-Earth space. The astrophysical plasmas near our planet store and deliver vast amounts of energy from the Sun in the form of high energy particles, electric currents, and heating of the upper atmosphere. This natural plasma environment is the only one routinely measured in situ over the last 40 years and until recently one of the few we haven't been able to see. Much like atmospheric weather satellites brought global context to that field many decades ago, the IMAGE Mission is now revealing a global context for space weather. The contributions being made by the IMAGE Mission to understanding space weather will be presented along with a brief overview of this dynamic environment. Special emphasis will be placed on research involving the plasmasphere, a toroidal region of relatively dense, cold plasma surrounding the Earth that plays a key role in energy and mass transport through near-Earth space.
Author
Electric Current; Heating; Upper Atmosphere; Space Plasmas; Storms; Global Positioning System; Energy Transfer; Particle Energy

20040077328 Iowa Univ., Iowa City, IA, USA
Cluster II Wideband (WBD) Plasma Wave Investigation Mission Operations and Data Analysis
Gurnett, Donald A.; 2004; 11 pp.; In English
Contract(s)/Grant(s): NAG5-9974; No Copyright; Avail: CASI; A03, Hardcopy

This Summary of Research is being submitted to NASA Goddard Space Flight Center. A summary of the significant accomplishments of the Cluster Wideband (WBD) Plasma Wave Investigation team achieved during the period of the grant, October 1,2000 through January 14, 2004, and a listing of all of the publications that resulted from work carried out under the grant is presented. Also included is a listing of the numerous public outreach activities that took place during the period of the grant in which the Cluster mission and Cluster WBD science were discussed.
Derived from text
Broadband; Cluster Mission; Plasma Waves; Data Processing

20040078796 Naval Observatory, Washington, DC
Gauge Symmetry of the N-body Problem in the Hamilton-Jacobi Approach
Efroimsky, Michael; Goldreich, Peter; Jan. 12, 2004; 25 pp.; In English
Report No.(s): AD-A423236; No Copyright; Avail: CASI; A03, Hardcopy

In most books the Delannay and Lagrange equations for the orbital elements are derived by the Hamilton-Jacobi method: one begins with the two-body Hamilton equations in spherical coordinates, performs a canonical transformation to the orbital elements, and obtains the Delannay system. A standard trick is then used to generalise the approach to the N-body case. We re-examine this step and demonstrate that it contains an implicit condition which restricts the dynamics to a 9(N-1)-dimensional submanifold of the 12(N-1)-dimensional space spanned by the elements and their time derivatives. The tacit condition is equivalent to the constraint that Lagrange imposed by "hand" to remove the excessive freedom, when he was deriving his system of equations by variation of parameters. It is the condition of the orbital elements being osculating, i.e., of the instantaneous ellipse (or hyperbola) being always tangential to the physical velocity. Imposure of any supplementary condition different from the Lagrange constraint (but compatible with the equations of motion) is legitimate and will not alter the physical trajectory or velocity (though will alter the mathematical form of the planetary equations).
DTIC
Hamilton-Jacobi Equation; Many Body Problem; Measuring Instruments; Symmetry

20040078797 Naval Observatory, Washington, DC
Gauge Freedom in the N-body Problem of Celestial Mechanics
Efroimsky, Michael; Goldreich, Peter; Jul. 7, 2003; 23 pp.; In English
Report No.(s): AD-A423238; No Copyright; Avail: CASI; A03, Hardcopy

Whenever a standard system of six planetary equations(in the Lagrange, Delaunay, or other form) is employed, the trajectory resides on a 9(N-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-parameters method) or implicitly (in the Hamilton-Jacobi approach). This constraint imposes the condition that the orbital elements osculate the trajectory, i. e., that both the instantaneous position and velocity be fit by a Keplerian ellipse (or hyperbola). Imposition of an 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.
DTIC
Celestial Mechanics; Many Body Problem; Measuring Instruments

20040079371 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Fabrication of Microshutter Arrays for James Webb Space Telescope
Li, Mary J.; Zheng, Yun; Hess, Larry; Hu, Ron; Kelly, Dan; Lynch, Barney; Oh, Lance; Ray, Chris; Smith, Wayne; Babu, Sachi, et al.; [2004]; 1 pp.; In English; No Copyright; Avail: Other Sources; Abstract Only

Two-dimensional MEMS microshutter arrays are being developed at NASA Goddard Space Flight Center for use in the near-infrared region on the Next Generation Space Telescope (NGST). The microshutter arrays are designed for the selective transmission of light with high efficiency and high contrast. The NGST environment requires cryogenic operation at 45K. Microshutter arrays are fabricated out of silicon-oxide-insulated (SOI) silicon wafers. Arrays are close-packed silicon nitride membranes with a pixel size of 100x100 microns. Individual shutters are patterned with a torsion flexure permitting shutters to open 90 degrees with a minimized mechanical stress concentration. The mechanical shutter arrays are fabricated using MEMS technologies. The processing includes a multi-layer metal deposition and patterning of shutter electrodes and magnetic pads, reactive ion etching (RE) of the front side to form shutters out of the nitride membrane, an anisotropic back-etch for wafer thinning, followed by a deep RIE (DRIE) back-etch down to the nitride shutter membrane to form frames and relieve shutters from the silicon substrate. An additional metal deposition and patterning is used to form back electrodes. Shutters are actuated using a magnetic force and latched using an electrostatic force.
Author
Microelectromechanical Systems; Etching; James Webb Space Telescope; Spaceborne Telescopes; Silicon Nitrides; Membranes; Electrostatics

20040081096 NASA Ames Research Center, Moffett Field, CA, USA
Energy Requirements of Hydrogen-utilizing Microbes: A Boundary Condition for Subsurface Life
Hoehler, Tori M.; Alperin, Marc J.; Albert, Daniel B.; Martens, Christopher S.; August 06, 2003; 1 pp.; In English; Exobiology P.I. Symposium, 25-29 Aug. 2003, Moffett Field, CA, USA
Contract(s)/Grant(s): RTOP 622-01-21-10; No Copyright; Avail: Other Sources; Abstract Only

Microbial ecosystems based on the energy supplied by water-rock chemistry carry particular significance in the context of geo- and astrobiology. With no direct dependence on solar energy, lithotrophic microbes could conceivably penetrate a planetary crust to a depth limited only by temperature or pressure constraints (several kilometers or more). The deep lithospheric habitat is thereby potentially much greater in volume than its surface counterpart, and in addition offers a stable refuge against inhospitable surface conditions related to climatic or atmospheric evolution (e.g., Mars) or even high-energy impacts (e.g., early in Earth's history). The possibilities for a deep microbial biosphere are, however, greatly constrained by life s need to obtain energy at a certain minimum rate (the maintenance energy requirement) and of a certain minimum magnitude (the energy quantum requirement). The mere existence of these requirements implies that a significant fraction of the chemical free energy available in the subsurface environment cannot be exploited by life. Similar limits may also apply to the usefulness of light energy at very low intensities or long wavelengths. Quantification of these minimum energy requirements in terrestrial microbial ecosystems will help to establish a criterion of energetic habitability that can significantly constrain the prospects for life in Earth's subsurface, or on other bodies in the solar system. Our early work has focused on quantifying the biological energy quantum requirement for methanogenic archaea, as representatives of a plausible subsurface metabolism, in anoxic sediments (where energy availability is among the most limiting factors in microbial population growth). In both field and laboratory experiments utilizing these sediments, methanogens retain a remarkably consistent free energy intake, in the face of fluctuating environmental conditions that affect energy availability. The energy yields apparently required by methanogens in these sediment systems for sustained metabolism are about half that previously thought necessary. Lowered energy requirements would imply that a correspondingly greater proportion of the planetary subsurface could represent viable habitat for microorganisms.
Author
Chemical Energy; Energy Requirements; Microorganisms; Solar Energy; Exobiology; Extraterrestrial Life; Panspermia

20040081132 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Space Technology 5: Pathfinder for Future Micro-Sat Constellations
Carlisle, Candace; Finnegan, Eric; [2004]; 2 pp.; In English; 2004 IEEE Aerospace Conference, 6-13 Mar. 2004, Big Sky, MT, USA; No Copyright; Avail: CASI; A01, Hardcopy

The Space Technology 5 (ST-5) Project, currently in the implementation phase, is part of the National Aeronautics and Space Administration (NASA) s New Millennium Program (NMP). ST-5 will consist of a constellation of three miniature satellites, each with mass less than 25 kg and size approximately 60 cm by 30 cm. ST-5 addresses technology challenges, as well as fabrication, assembly, test and operations strategies for future micro-satellite missions. ST-5 will be deployed into a highly eccentric, geo-transfer orbit (GTO). This will expose the spacecraft to a high radiation environment as well as provide a low level magnetic background. A three-month flight demonstration phase is planned to validate the technologies and demonstrate concepts for future missions. Each ST-5 spacecraft incorporates NMP competitively-selected breakthrough technologies. These include Cold Gas Micro-Thrusters for propulsion and attitude control, miniature X-band transponder for space-ground communications, Variable Emittance Coatings for dynamic thermal control, and CULPRiT ultra low power logic chip used for Reed-Solomon encoding. The ST-5 spacecraft itself is a technology that can be infused into future missions. It is a fully functional micro-spacecraft built within tight volume and mass constraints. It is built to withstand a high radiation environment, large thermal variations, and high launch loads. The spacecraft power system is low-power and low-voltage, and is designed to turn on after separation &om the launch vehicle. Some of the innovations that are included in the ST-5 design are a custom spacecraft deployment structure, magnetometer deployment boom, nutation damper, X-band antenna, miniature spinning sun sensor, solar array with triple junction solar cells, integral card cage assembly containing single card Command and Data Handling and Power System Electronics, miniature magnetometer, and lithium ion battery. ST-5 will demonstrate the ability of a micro satellite to perform research-quality science. Each ST-5 spacecraft will deploy a precision magnetometer to be used both for attitude determination and as a representative science instrument. The spacecraft has been developed with a low magnetic signature to avoid interference with the magnetometer. The spacecraft will be able to detect and respond autonomously to science events, i.e. significant changes in the magnetic field measurements. The three spacecraft will be a pathfinder for future constellation missions. They will be deployed to demonstrate an appropriate geometry for scientific measurements as a constellation. They will be operationally managed as a constellation, demonstrating automation and communication strategies that will be useful for future missions. The technologies and future mission concepts will be validated both on the ground and in space. Technologies will be validated on the ground by a combination of component level and system level testing of the flight hardware in a thermal vacuum environment. In flight, specific validation runs are planned for each of the technologies. Each validation run consists of one or more orbits with a specific validation objective. This paper will describe the ST-5 mission, and the applicability of the NMP technologies, spacecraft, and mission concepts to future

missions. It will also discuss the validation approach for the ST-5 technologies and mission concepts.
Author
Launch Vehicles; Magnetic Fields; Magnetic Signatures; Miniaturization

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ASTRONOMY

Includes observations of celestial bodies; astronomical instruments and techniques; radio, gamma-ray, x-ray, ultraviolet, and infrared astronomy; and astrometry.

20040077275 NASA Goddard Space Flight Center, Greenbelt, MD, USA
The James Webb Space Telscope
Mather, John C.; 2003; 1 pp.; In English; Harvard-Smithsonian Center for Astrophysics Meeting, 5-7 Nov. 2003, Cambridge, MA, USA; No Copyright; Avail: Other Sources; Abstract Only

The James Webb Space Telescope (JWST) will extend the discoveries of the Hubble Space Telescope by deploying a large cooled infrared telescope at the Sun-Earth Lagrange point L2. With a 6 m aperture and three instruments covering the wavelength range from 0.6 to 28 microns, it will provide sensitivities orders of magnitude better than any other facilities. It is intended to observe the light from the first galaxies and the first supernovae, the assembly of galaxies, and the formation and evolution of stars and planetary systems. In this talk I will review the scientific objectives, the hardware concepts and technology, and the predicted system performance.
Author
James Webb Space Telescope; Infrared Telescopes; Star Formation; Stellar Evolution; Supernovae

20040077333 NASA Ames Research Center, Moffett Field, CA, USA
Spitzer Infrared Spectrograph Observations of L, M, and T Dwarfs
Roellig, Thomas L.; VanCleve, Jeffrey E.; Sloan, Gregory C.; Wilson, John C.; Saumon, Didier; Leggett, Sandy K.; Marley, Mark S.; Cushing, Michael; Kirkpatrick, J. Davy; Mainzer, Amanda K., et al.; March 15, 2004; 1 pp.; In English
Contract(s)/Grant(s): WBS 21-456-06-IR
Report No.(s): SSA-137; No Copyright; Avail: Other Sources; Abstract Only

We present here the first mid-infriared spectra of brown dwarfs, together with observations of a low-mass star. Our targets are the M3.5 dwarf GJ 1001 A, the L8 dwarf DENIS-P JO255-4700, and the T1/T6 binary system epsilon Indi Ba/Bb. As expected, the mid- infrared spectral morphology of these objects changes rapidly with spectral class due to the changes in atmospheric chemistry resulting from their differing effective temperatures and atmospheric structures. By taking advantage of the unprecedented sensitivity of the Infrared Spectrograph instrument of the Spitzer Space Telescope we have detected for the first time the 7.6 micron methane band and confirmed the presence of ammonia in a T dwarf atmosphere.
Author
Infrared Instruments; Spectrographs; Dwarf Stars; Targets; Spectra; Infrared Radiation; Atmospheric Chemistry

20040078787 Naval Observatory, Washington, DC
A Comparison of Radio and Optical Astrometric Reduction Algorithms
Kaplan, G. H.; Jan. 1998; 16 pp.; In English; Original contains color illustrations
Report No.(s): AD-A423227; No Copyright; Avail: CASI; A03, Hardcopy

This paper examines the correspondence between two approaches to astrometric observational reductions: the approach based on angular observables used for optical observations, and the approach based on the interferometric delay observable used for very long baseline radio interferometry (VLBI) observations. Specifically, of interest here is the group of algorithms that have become standard in accounting for the physical effects traditionally called annual and diurnal aberration and gravitational light bending. These algorithms are important because they must be applied to all wide-angle astrometric measurements, whether ground-or space-based, and regardless of the distance of the objects observed.
DTIC
Algorithms; Astrometry

20040078788 Naval Observatory, Washington, DC
Another Look at Non-Rotating Origins
Kaplan, George H.; Jul. 22, 2003; 5 pp.; In English; Original contains color illustrations
Report No.(s): AD-A423228; No Copyright; Avail: CASI; A01, Hardcopy

Two "non-rotating origins" were defined by the IAU in 2000 for the measurement of Earth rotation: the Celestial Ephemeris Origin (CEO) in the ICRS and the Terrestrial Ephemeris Origin (TEO) in the ITRS. Universal Time (UT1) is now defined by an expression based on the angle theta between the CEO and TEO. Many previous papers, e.g., Capitaine, Guinot, & McCarthy (2000), developed the position of the CEO in terms of a quantity s, the difference between two arcs on the celestial sphere. A similar quantity s was defined for the TEO. As an alternative, a simple vector differential equation for the position of a non-rotating origin on its reference sphere is presented here. The equation can be easily numerically integrated to high precision. This scheme directly yields the unit vector of the CEO in the ICRS, or that of the TEO in the ITRS, as a function of time. This simplifies the derivation of the main transformation matrix between the ITRF and the ICRS. The directness of the development may have pedagogical and practical advantages for the vast majority of astronomers who are unfamiliar with the history of this topic.
DTIC
Earth Movements; Rotation

20040078794 Naval Observatory, Washington, DC
US Naval Observatory Ephemerides of the Largest Asteroids
Hilton, James L.; Feb. 1999; 11 pp.; In English
Report No.(s): AD-A423234; No Copyright; Avail: CASI; A03, Hardcopy

A new set of ephemerides for 15 of the largest asteroids has been produced for use in the Astronomical Almanac. The ephemerides cover the period from 1800 through 2100. The internal uncertainty in the mean longitude at epoch, 1997 December 18, ranges from 0",05 for 7 Iris through 0",22 for 65 Cybele, and the uncertainty in the mean motion varies from 0",02 per century for 4 Vesta to 0", 14 per century for 511 Davida. This compares very favorably with the internal errors for the outer planets in recent Jet Propulsion Laboratory planetary ephemerides. However, because the asteroids have relatively little mass and are subject to perturbations by other asteroids, the actual uncertainties in their mean motions are likely to be a few tenths of an arcsecond per century. As part of the improvement to the ephemerides, new masses and densities were determined for 1 Ceres, 2 Pallas, and 4 Vesta, the three largest asteroids. These masses are as follows: Ceres (4.39+0.04) x l0-10 M, Pallas (1.59+0.05) x l0-10 M, and Vesta (1.69+0.11) x 10-10 M. The mass for Ceres is smaller than most previous determinations of its mass. This smaller mass is a direct consequence of the increase in the mass determined for Pallas. The densities found for these three asteroids are 2.00 + 0.03 g cm-3 for Ceres 42 + 0.3 gm cm-3 for Pallas, and 4.3 + 0.3 g cm-3 for Vesta. The density for Ceres is somewhat greater than that found for the taxonomically similar 253 Mathilde.
DTIC
Asteroids; Ephemerides; Observatories

20040079384 Smithsonian Astrophysical Observatory, Cambridge, MA, USA
The Evolution of CTB-109
Plucinsky, Paul; Mushotzky, Richard, Technical Monitor; June 2004; 2 pp.; In English
Contract(s)/Grant(s): NAG5-9914
Report No.(s): Rept-4; No Copyright; Avail: Other Sources; Abstract Only

The subject grant is for the analysis of XMM observations of the galactic supernova remnant (SNR) CTB-109. There are three observations contained under this proposal. The first of the three observations was executed by XMM in January 2002 and the data were received by the PI in February, 2002. The second and third observations were executed in July 2002 and the data were received on 22 August 2002.
Author
Supernova Remnants; Xmm-Newton Telescope; X Ray Astronomy

20040079630 Lawrence Livermore National Lab., Livermore, CA
Anisoplanatic Performance of Horizontal-Path Speckle Imaging
Carrano, C.; Jul. 01, 2003; In English
Report No.(s): DE2003-15004424; UCRL-ID-154070; No Copyright; Avail: National Technical Information Service (NTIS)

We have previously demonstrated and reported on the use of sub-field speckle processing for the enchancement of both near and far-range surveillance imagery of people and vehicles that have been degraded by atmospheric turbulence. We have obtained near diffraction-limited imagery in many cases and have shown dramatic image quality improvement in other cases. As it is possible to perform only a limited number of experiments in a limited number of conditions, we have developed a computer simulation capability to aid in the prediction of imaging performance in a wider variation of conditions. Our simulation capability includes the ability to model extended scenes in distributed turbulence. This paper will begin to explore these issues which are important for predicting the performance of both passive and active horizontal and slant-path imaging systems.
NTIS
Imaging Techniques; Performance Prediction; Surveillance; Atmospheric Turbulence

20040079752 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Pulsars, Pulsar Winds and Plerions
Harding, Alice K.; [2004]; 1 pp.; In English; International Symposium on High Energy Gamma-Ray Astronomy, 26-30 Jul. 2004, Heidelberg, Germany; No Copyright; Avail: Other Sources; Abstract Only

Rotation-powered pulsars and the interaction with their environments are expected sources of high-energy gamma-ray emission. I will discuss the latest developments in models for pulsed emission, including the slot gap extension of the polar cap model and outer gap models, and the predicted emission at GeV and TeV energies. Millisecond pulsars appear to be especially promising sources at energies around 50- 100 GeV. There have also been a number of new plerions discovered in the X-ray band over the last few years by Chandra and XMM. I will review these observations as well as the models for high-energy emission from these sources.
Author
Pulsars; Supernova Remnants; Stellar Winds; Gamma Ray Sources (Astronomy)

20040079770 Lawrence Livermore National Lab., Livermore, CA
Progress with the Lick Adaptive Optics System
Gavel, D. T.; Olivier, S. S.; Bauman, B.; Max, C. E.; Macintosh, B.; Mar. 01, 2000; 14 pp.; In English
Report No.(s): DE2004-15006376; UCRL-JC-138807; No Copyright; Avail: Department of Energy Information Bridge

Progress and results of observations with the Lick Observatory Laser Guide Star Adaptive Optics System are presented. This system is optimized for diffraction-limited imaging in the near infrared, 1-2 micron wavelength bands. We describe our development efforts in a number of component areas including, a redesign of the optical bench layout, the commissioning of a new infrared science camera, and improvements to the software and user interface. There is also an ongoing effort to characterize the system performance with both natural and laser guide stars and to fold this data into a refined system model. Such a model can be used to help plan future observations, for example, predicting the point-spread function as a function of seeing and guide star magnitude.
NTIS
Optics; Adaptive Optics; Control; Astronomical Observatories; Near Infrared Radiation

20040079825 NASA Goddard Space Flight Center, Greenbelt, MD, USA
The Distribution of Cosmic-Ray Sources in the Galaxy, Gamma-Rays and the Gradient in the CO-to-H2 Relation
Strong, A. W.; Moskalenko, I. V.; Reimer, O.; Diehl, S.; Diehl, R.; April 2, 2004; 4 pp.; In English; Copyright; Avail: CASI; A01, Hardcopy

We present a solution to the apparent discrepancy between the radial gradient in the diffuse Galactic gamma-ray emissivity and the distribution of supernova remnants, believed to be the sources of cosmic rays. Recent determinations of the pulsar distribution have made the discrepancy even more apparent. The problem is shown to be plausibly solved by a variation in the Wco-to-N(H2) scaling factor. If this factor increases by a factor of 5-10 from the inner to the outer Galaxy, as expected from the Galactic metallicity gradient and supported by other evidence, we show that the source distribution required to match the radial gradient of gamma-rays can be reconciled with the distribution of supernova remnants as traced by current studies of pulsars. The resulting model fits the EGRET gamma-ray profiles extremely well in longitude, and reproduces the mid-latitude inner Galaxy intensities better than previous models.
Author
Cosmic Rays; Gamma Rays; Interstellar Matter; Hydrogen; Carbon Monoxide; Point Sources; Galactic Structure; Metallicity

20040081032 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Constellation X-Ray Observatory Unlocking the Mysteries of Black Holes, Dark Matter and Life Cycles of Matter in the Universe
Weaver, Kim; Wanjek, Christopher; 2004; 20 pp.; In English
Report No.(s): NP-2004-4-629-GSFC; No Copyright; Avail: CASI; A03, Hardcopy

This document provides an overview of the Contellation X-Ray Observatory and its mission. The observatory consists of four x-ray telescopes borne on a satellite constellation at the Earth-Sun L2 point.
CASI
X Ray Telescopes; Satellite Constellations; Astronomical Satellites; X Ray Astronomy

20040081134 NASA Goddard Space Flight Center, Greenbelt, MD, USA
The Slot Gap Model for Pulsar High-Energy Emission
Harding, Alice K.; Muslimov, Alexander; [2004]; 1 pp.; In English; COSPAR, 18-25 Jul. 2004, Paris, France; No Copyright; Avail: Other Sources; Abstract Only

A new picture of pulsar high-energy emission is proposed that is different from both the traditional polar cap and outer gap models, but combines elements of each. The slot gap model is based on electron acceleration along the edge of the open field region from the neutron star surface to near the light cylinder. Along the last open field line, the pair formation front rises to very high altitude forming a slot gap, where the accelerating electric field is unscreened by pairs. Electrons continue to accelerate to high altitudes in the slot gap, reaching a radiation reaction-limited energy of several TeV. The resulting radiation pattern features sharp caustics on the trailing edge of the open field region, allowing for the possibility of double-peaked pulse profiles very similar to those observed in gamma-ray pulsars. Since emission from a large range of altitudes arrives in phase, this model very naturally explains the phase alignment of radiation at all wavelengths from the Crab pulsar.
Author
Pulsars; Stellar Models; Gamma Rays; Supernova Remnants; High Energy Electrons

20040081177 NASA Goddard Space Flight Center, Greenbelt, MD, USA
The Gamma-Ray Bright BL Lac Object RX J1211+2242
Beckmann, V.; Favre, P.; Tavecchio, F.; Bussien, T.; Fliri, J.; Wolter, A.; [2004]; 10 pp.; In English
Contract(s)/Grant(s): COFIN-2001-028773-007; No Copyright; Avail: CASI; A02, Hardcopy

RX J1211+2242 is an optically faint (B approximately equal to 19.2mag) but X-ray bright (f2-10kev = 5 x l0(exp -12)erg per square centimeter per second) AGN, which has been shown to be a BL Lac object at redshift z = 0.455. The ROSAT X-ray, Calar Alto optical, and NVSS radio data suggest that the peak of the synchrotron emission of this object is at energies as high as several keV. BeppoSAX observations have been carried out simultaneously with optical observations in order to extend the coverage to higher energies. The new data indeed indicate a turn-over in the 2 - 10keV energy region. We propose that RX J1211+2242 is the counterpart of the unidentified EGRET source 3EG J1212+2304, making it a gamma-ray emitter with properties similar to, for example, Markarian 501 in its bright state, though being at a much larger distance.
Author
Bl Lacertae Objects; Gamma Ray Astronomy; X Ray Sources; Active Galactic Nuclei

20040081181 NASA Goddard Space Flight Center, Greenbelt, MD, USA
First Detection of the Hatchett-McCray Effect in the High-Mass X-ray Binary
Sonneborn, G.; Iping, R. C.; Kaper, L.; Hammerschiag-Hensberge, G.; Hutchings, J. B.; [2004]; 1 pp.; In English; AAS 203rd Meeting, 4-8 Jan. 2004, Atlanta, GA, USA
Report No.(s): AAS-84-05; No Copyright; Avail: Other Sources; Abstract Only

The orbital modulation of stellar wind UV resonance line profiles as a result of ionization of the wind by the X-ray source has been observed in the high-mass X-ray binary 4U1700-37/HD 153919 for the first time. Far-UV observations (905-1180 Angstrom, resolution 0.05 Angstroms) were made at the four quadrature points of the binary orbit with the Far Ultraviolet Spectroscopic Explorer (FUSE) in 2003 April and August. The O6.5 laf primary eclipses the X-ray source (neutron star or black hole) with a 3.41-day period. Orbital modulation of the UV resonance lines, resulting from X-ray photoionization of the dense stellar wind, the so-called Hatchett-McCray (HM) effect, was predicted for 4U1700-37/HD153919 (Hatchett 8 McCray 1977, ApJ, 211, 522) but was not seen in N V 1240, Si IV 1400, or C IV 1550 in IUE and HST spectra. The FUSE spectra show that the P V 1118-1128 and S IV 1063-1073 P-Cygni lines appear to vary as expected for the HM effect, weakest at phase 0.5 (X-ray source conjunction) and strongest at phase 0.0 (X-ray source eclipse). The phase modulation of the O VI 1032-1037

lines, however, is opposite to P V and S IV, implying that O VI may be a byproduct of the wind's ionization by the X-ray source. Such variations were not observed in N V, Si IV, and C IV because of their high optical depth. Due to their lower cosmic abundance, the P V and S IV wind lines are unsaturated, making them excellent tracers of the ionization conditions in the O star's wind.
Author
X Ray Binaries; Detection; Stellar Winds; X Ray Astronomy; Stellar Mass

20040081198 NASA Goddard Space Flight Center, Greenbelt, MD, USA
WMAP Detection of Early Reionization
Kogut, A.; [2003]; 1 pp.; In English; Internationa Union of radio Science, 6-9 Jan. 2003, Boulder, CO, USA; No Copyright; Avail: Other Sources; Abstract Only

The Wilkinson Microwave Anisotropy Probe (WMAP) has mapped the full sky in Stokes I, Q, and U parameters at frequencies 23, 33, 41, 61, and 94 GHz. We detect correlations between the temperature and polarization maps significant at more than 10 standard deviations. The correlations are inconsistent with instrument noise and are significantly larger than the upper limits established for potential systenatic errors. The correlations are present in all WMAP frequency bands with similar amplitude from 23 to 94 GHz, and are consistent with a superposition of a CMB signal with a weak foreground. The fitted CMB component is robust against different data combinations and fitting techniques. On small angular scales the WMAP data show the temperature-polarization correlation expected from adiabatic density perturbations. The data for $\ell > 20$ agree well with the signal predicted solely from the temperature power spectra, with no additional free parameters. The existence of correlations on super-horizon scales provides significant support for inflationary cosmologies. We detect excess power on large angular scales compared to predictions based on the temperature power spectra alone. The excess power is well described by reionization at redshift $11 < z < 30$ at 95\% confidence. A model-independent fit to reionization optical depth yields results consistent with the best-fit ΛCDM model, with best fit value $\tau = 0.17 \pm 0.04$ at 68\% confidence, including systematic and foreground uncertainties. This value is larger than expected given the detection of a Gunn-Peterson trough in the absorption spectra of distant quasars, and implies that the universe has a complex ionization history. I will discuss the WMAP data and its implications for reionization in the early universe.
Author
Microwave Anisotropy Probe; Detection; Ionization; Universe

20040081201 Smithsonian Astrophysical Observatory, Cambridge, MA, USA
Membership and Coronal Activity in the NGC 2232 and Cr 140 Open Clusters
Oliversen, Ronald J., Technical Monitor; Patten, Brian M.; June 2004; 13 pp.; In English; Original contains black and white illustrations
Contract(s)/Grant(s): NAG5-9131; No Copyright; Avail: CASI; A03, Hardcopy

Making use of eight archival ROSAT HRI images in the regions of the NGC 2232 and Cr 140, this project's primary focus is to identify X-ray sources and to extract net source counts for these sources in these two open clusters. These X-ray data would be combined with ground-based photometry and spectroscopy in order to identify G, K, and early-M type cluster members. Such membership data are important because, at present, no members later than spectral type approx. F5 are currently known for either cluster. With ages estimated to be approx. 25 Myr and at distances of just approx. 350 pc, the combined late-type membership of the NGC 2232 and Cr 140 clusters would yield an almost unique sample of solar-type stars in the post-T Tauri/pre-main sequence phase of evolution. These stars could be used to assess the level and dispersion of coronal activity levels, as a part of a probe of the importance of magnetic braking and the level of magnetic dynamo activity, for solar-type stars just before they reach the zero-age main sequence.
Author
Open Clusters; X Ray Astronomy; Stellar Coronas

20040081205 NASA Goddard Space Flight Center, Greenbelt, MD, USA
The Discovery of an Evolving Dust Scattered X-ray Halo Around GRB 031203
Vaughan, S.; Willingale, R.; OBrien, P. T.; Osborne, J. P.; Reeves, J. N.; Levan, A. J.; Watson, M. G.; Tedds, J. A.; Watson, D.; Santos-Lleo, M., et al.; [2003]; 13 pp.; In English
Contract(s)/Grant(s): CEC-HPRN-CT-2002-00294; No Copyright; Avail: CASI; A03, Hardcopy

We report the first detection of a time-dependent, dust-scattered X-ray halo around a gamma-ray burst. GRB3 031203 was observed by XMM-Newton starting six hours after the burst. The halo appeared as concentric ring-like structures centered on

the GRB location. The radii of these structures increased with time as t(sup 1/2), consistent with small-angle X-ray scattering caused by a large column of dust along the line of sight to a cosmologically distant GRB. The rings are due to dust concentrated in two distinct slabs in the Galaxy located at distances of 880 and 1390 pc, consistent with known Galactic features. The halo brightness implies an initial soft X-ray pulse consistent with the observed GRB.
Author
Galactic Halos; Gamma Ray Bursts; Detection; Galactic Structure; Cosmic Dust

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ASTROPHYSICS

Includes cosmology; celestial mechanics; space plasmas; and interstellar and interplanetary gases and dust.

20040068134 NASA Ames Research Center, Moffett Field, CA, USA
On the Measurement of Elemental Abundance Ratios in Inner Galaxy H II Regions
Simpson, Janet P.; Rubin, Robert H.; Colgan, Sean W. J.; Erickson, Edwin F.; Haas, Michael R.; January 2004; 44 pp.; In English
Contract(s)/Grant(s): NCC2-1134; NCC2-1367; NCC2-9021; Copyright; Avail: CASI; A03, Hardcopy

Although abundance gradients in the Milky Way Galaxy certainly exist, details remain uncertain, particularly in the inner Galaxy, where stars and H II regions in the Galactic plane are obscured optically. In this paper we revisit two previously studied, inner Galaxy H II regions: G333.6-0.2 and W43. We observed three new positions in G333.6-0.2 with the Kuiper Airborne Observatory and reobserved the central position with the Infrared Space Observatory's Long Wavelength Spectrometer in far-infrared lines of S++, N++, N+, and O++. We also added the N+ lines at 122 and 205 microns to the suite of lines measured in W43 by Simpson et al.. The measured electron densities range from approx. 40 to over 4000 per cu cm in a single HII region, indicating that abundance analyses must consider density variations, since the critical densities of the observed lines range from 40 to 9000 per cu cm. We propose a method to handle density variations and make new estimates of the S/H and N/H abundance ratios. We find that our sulfur abundance estimates for G333.6-0.2 and W43 agree with the S/H abundance ratios expected for the gradient previously reported by Simpson et al., with the S/H values revised to be smaller owing to changes in collisional excitation cross sections. The estimated N/H, S/H, and N/S ratios are the most reliable because of their small corrections for unseen ionization states (< or approx. 10%). The estimated N/S ratios for the two sources are smaller than what would be calculated from the N/H and S/H ratios in our previous paper. If all low excitation H II regions had similar changes to their N/S ratios as a result of adding measurements of N+ to previous measurements of N++, there would be no or only a very small gradient in N/S. This is interesting because nitrogen is considered to be a secondary element and sulfur is a primary element in galactic chemical evolution calculations. We compute models of the two H II regions to estimate corrections for the other unseen ionization states. We find, with large uncertainties, that oxygen does not, have a high abundance, with the result that the N/O ratio is as high (approx. 0.35) as previously reported. The reasons for the uncertainty in the ionization corrections for oxygen are both the non-uniqueness of the H II region models and the sensitivity of these models to different input atomic data and stellar atmosphere models. We discuss these predictions and conclude that only a few of the latest models adequately reproduce H II region observations, including the well-known, relatively-large observed Ne++/O++ ratios in low- and moderate-excitation H II regions.
Author
Galaxies; H Ii Regions; Interstellar Matter; Abundance; Infrared Astronomy

20040077261 Illinois Univ., IL, USA
Hard X-ray Emission from White Dwarfs
Chu, You-Hua; Gruendl, Robert; June 16, 2004; 1 pp.; In English
Contract(s)/Grant(s): NAG5-13076; No Copyright; Avail: Other Sources; Abstract Only

Hot white dwarfs may exhibit photospheric emission at X-ray wavelengths, but their X- ray emission should be soft, mutch less than 0.5 keV. Hard X-ray emission, at approx. 1 keV, is not expected from white dwarfs, unless they are in binary systems and the hard X-ray emission is produced by a late-type companion's coronal activity or by accretion of a companion's material onto the surface of the white dwarf. We proposed to use the ROSAT archive to search for hard X-ray emission from white dwarfs in order to determine whether hard X-ray emission may provide a sensitive diagnostic for the existence of a binary companion.
Author
X Rays; Emission; White Dwarf Stars

20040077350 Lawrence Livermore National Lab., Livermore, CA

Toward an Energy Transfer and Interacting Scale Analysis of MHD Turbulence with Implications for Space and Astrophysical Plasmas

Zhou, Y.; Schilling, O.; Ghosh, S.; Apr. 11, 2001; In English

Report No.(s): DE2003-15005326; UCRL-JC-140765; No Copyright; Avail: National Technical Information Service (NTIS)

MHD turbulence has numerous applications in space and astrophysical plasmas. In this paper, the eddy-damped quasi-normal Markovian (EDQNM) model is used to perform a preliminary study of the nonlinear transfer process in three-dimensional MHD turbulence. Both two- and three-dimensional contour plots of the triadic transfer functions are presented for the case of assumed energy spectra corresponding to Kolmogorov inertial subrange scaling.

NTIS

Computational Fluid Dynamics; Magnetohydrodynamic Turbulence; Energy Transfer

20040077372 NASA Ames Research Center, Moffett Field, CA, USA

Dusty Disks, Diffuse Clouds, and Dim Suns: Galactic Science with the Infrared Spectrograph on the Spitzer Space Telescope

Roellig, T. L.; Watson, D. M.; Uchida, K. I.; Forrest, W. J.; VanCleve, J. E.; Herter, T. L.; Sloan, G. C.; Furlan, E.; Wilson, J. C.; Bernard-Salas, J., et al.; March 15, 2004; 1 pp.; In English; 204th Meeting of the American Astronomical Society, 30-May - 3 Jun. 2004, Denver, CO, USA

Contract(s)/Grant(s): NAS2-1407; WBS 21-456-06-1R; No Copyright; Avail: Other Sources; Abstract Only

The Infrared Spectrograph (IRS) on the Spitzer Space Telescope has now been in routine science operations since Dec. 14,2003. The IRS Science Team has used a portion of their guaranteed time to pursue three major science themes in galactic astronomy: the evolution of protostellar disks and debris disks; the composition and evolution of diffuse matter and clouds in the interstellar medium; and the composition and structure of brown dwarfs and low-mass main-sequence stars. We report here on the results from the first five months of IRS observations in these programs. Full IRS Spectra have already been obtained for large samples of YSO/protoplanetary disks in the Taurus and TW Hya associations, and or debris disks around main-sequence stars, in which many aspects of the evolution of planetary systems can be addressed for the first time. As anticipated, the mid-infrared IRS observations of brown dwarfs have yielded important new information about their atmospheres, including the identification of NH3 and measurements of new methane features. This work is based on observations made with the Spitzer Space Telescope, which is operated by the Jet Propulsion Laboratory, California Institute of Technology under NASA contract 1407. Support for this work was provided by NASA's Office of Space Science.

Author

Dust; Clouds; Disks; Galactic Evolution; Infrared Radiation

20040078923 Naval Observatory, Flaggstaff, AZ

The Three-Dimensional Power Spectrum Of Galaxies from the Sloan Digital Sky Survey

Tegmark, Max; Blanton, Michael R.; Strauss, Michael A.; Hennessy, Greg; Munn, Jeffrey A.; May 10, 2004; 40 pp.; In English; Original contains color illustrations

Report No.(s): AD-A423485; No Copyright; Avail: CASI; A03, Hardcopy

We measure the large-scale real-space power spectrum P(k) by using a sample of 205,443 galaxies from the Sloan Digital Sky Survey, covering 2417 effective square degrees with mean redshift z = 0.1. We employ a matrix-based method using pseudo-Karhunen-Loeve eigenmodes, producing uncorrelated minimum-variance measurements in 22 k-bands of both the clustering power and its anisotropy due to redshift- space distortions with narrow and well-behaved window functions in the range 0.02 h/Mpc < k < 0.3 h /Mpc. We pay particular attention to modeling, quantifying, and correcting for potential systematic errors, nonlinear redshift distortions, and the artificial red-tilt caused by luminosity- dependent bias. Our results are robust to omitting angular and radial density fluctuations and are consistent between different parts of the sky. Our final result is a measurement of the real-space matter power spectrum P(k) up to an unknown overall multiplicative bias factor. Our calculations suggest that this bias factor is independent of scale to better than a few percent for k < 0.1 h/Mpc, thereby making out results useful for precision measurements of cosmological parameters in conjunction with data from other experiments such as the Wilkinson Microwave Anisotropy Probe satellite. The power spectrum is not well-characterized by a single power law but unambiguously shows curvature. As a simple characterization of the data, our measurements are well fitted by a flat scale- invariant adiabatic cosmological model with h Omega (sub m) = 0.213 +/- 0. 023 and sigma (sub 8) = 0.89 +/- 0.02 for L(sub *) galaxies, when fixing the baryon fraction Omega (sub b)/Omega (sub m) - 0.17 and the Hubble

parameter h = 0.72; cosmological interpretation is given in a companion paper.
DTIC
Galaxies; Power Spectra; Sky Surveys (Astronomy)

20040078954 Naval Observatory, Flaggstaff, AZ
Dynamical Mass Constraints on Low-Mass Pre-Main- Sequence Stellar Evolutionary Tracks: An Eclipsing Binary in Orion with a 1.0 M(solar) Primary and a 0.7 M(solar) Secondary
Stassun, Keivan G.; Mathieu, Robert D.; Vaz, Luiz Paulo; Stroud, Nicholas; Vrba, Frederick J.; Apr. 2004; 30 pp.; In English
Contract(s)/Grant(s): AST-0098417
Report No.(s): AD-A423559; No Copyright; Avail: CASI; A03, Hardcopy

We report the discovery of a double-lined, spectroscopic, eclipsing binary in the Orion star-forming region. We analyze the system spectroscopically and photometrically to empirically determine precise, distance- independent masses, radii, effective temperatures, and luminosities for both components. The measured masses for the primary and secondary, accurate to approx. 1%, are 1.01 and 0. 73 M(solar), respectively; thus, the primary is a definitive pre-main-sequence solar analog, and the secondary is the lowest-mass star yet discovered among pre-main-sequence eclispsing binary systems. We use these fundamental measurements to test the predictions of per-main-sequence stellar evolutionary tracks. None of the models we examined correctly predict the masses of the two components simultaneously, and we implicate differences between the theoretical and empirical effective temperature scales for this failing. All of the models predict the observed slope of the mass-radius relationship reasonably well, though the observations tend to favor models with low convection efficiencies. Indeed considering our newly determined mass measurements together with other dynamical mass measurements of pre-main-sequence stars in the literature, as ell as measurements of Li abundances in these stars, we show that the data strongly favor evolutionary models with inefficient convection in the stellar interior, even though such models cannot reproduce the properties of the present-day Sun.
DTIC
Binary Stars; Eclipses; Eclipsing Binary Stars; Mass; Pre-Main Sequence Stars; Stars; Stellar Evolution

20040079819 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Spectral Index and Quasi-Periodic Oscillation Frequency Correlation in Black Hole (BH) Sources: Observational Evidence of Two Phases and Phase Transition in BHs
Titarchuk, Lev; Fiorito, Ralph; 2004; 37 pp.; In English; No Copyright; Avail: CASI; A03, Hardcopy

Recent studies have shown that strong correlations are observed between the low frequencies (1-10 Hz) of quasiperiodic oscillations (QPOs) and the spectral power law index of several Black Hole (BH) candidate sources, in low hard states, steep power-law (soft) states and in transition between these states. The observations indicate that the X-ray spectrum of such state (phases) show the presence of a power-law component and are sometimes related to simultaneous radio emission indicated the probable presence of a jet. Strong QPOs (less than 20% rms) are present in the power density spectrum in the spectral range where the power-law component is dominant (i.e. 60-90%). This evidence contradicts the dominant long standing interpretation of QPOs as a signature of the thermal accretion disk. We present the data from the literature and our own data to illustrate the dominance of power-law index-QPO frequency correlations. We provide a model, that identifies and explains the origin of the QPOs and how they are imprinted on the properties of power-law flux component. We argue the existence of a bounded compact coronal region which is a natural consequence of the adjustment of Keplerian disk flow to the innermost sub-Keplerian boundary conditions near the central object and that ultimately leads to the formation of a transition layer (TL) between the adjustment radius and the innermost boundary. The model predicts two phases or states dictated by the photon upscattering produced in the TL: (1) hard state, in which the TL is optically thin and very hot (kT approx. greater than 50 keV) producing photon upscattering via thermal Componization; the photon spectrum index Gamma appprox.1.5 for this state is dictated by gravitational energy release and Compton cooling in an optically thin shock near the adjustment radius; (2) a soft state which is optically thick and relatively cold (approx. less than 5 keV); the index for this state, Gamma approx. 2.8 is determined by soft-photon upscattering and photon trapping in converging flow into BH. In the TL model for corona the QPO frequency vnu(sub high) is related to the gravitational (close to Keplerian) frequency nu(sub K) at the outer (adjustment) radius and nu(sub low) is related to the TL s normal mode (magnetoacoustic) oscillation frequency nu(sub MA). The observed correlations between index and low and high QPO frequencies are readily explained in terms of this model. We also suggest a new method for evaluation of the BH mass using the index-frequency correlation.
Author
Oscillations; Frequencies; Black Holes (Astronomy)

20040081046 NASA Ames Research Center, Moffett Field, CA, USA
An Effective Initial Mass Function for Galactic Disks
Hollenbach, David; [2004]; 1 pp.; In English; IMF at 50, 16-20 May 2004, Savteano, Italy
Contract(s)/Grant(s): WBS 21-456-06-14; No Copyright; Avail: Other Sources; Abstract Only

We derive a semi-empirical effective galactic initial mass function (IMF), which represents the IMF averaged over the age of the galactic disk, from observational constraints. We assume that the star formation rate in a galaxy can be expressed as the product of the IMF,psi(m), which is a smooth function of mass m (in units of solar mass), and a time and space dependent rate zeta(sub *1). The mass dependence of the proposed IMF is determined by four parameters: the low-mass slope gamma, the high-mass slope -Gamma, the characteristic mass m(sub ch) at which the IMF turns over, and the upper limit on the mass, m(sub u).
Derived from text
Galactic Mass; Disk Galaxies; Stellar Mass

20040081130 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Cosmic Ray Propagation Models
Moskalenko, I. V.; [2004]; 1 pp.; In English; Frontier Science 2004 "Physics and Astrophysics in Space", 14-19 Jun. 2004, Rome, Italy; No Copyright; Avail: Other Sources; Abstract Only

Astrophysics of cosmic rays and gamma rays depends very much on the quality of the data, which become increasingly accurate each year and therefore more constraining. While direct measurements of cosmic rays are possible in only one location on the outskirts of the Milky Way, the Galactic diffuse gamma-ray emission provides insights into the spectra of cosmic rays in distant locations, therefore complementing the local cosmic-ray studies. This connection, however, requires extensive modeling and is yet to be explored in detail. The GUST mission, which is scheduled for launch in 2007 and is capable of measuring gamma-rays in the range 20 MeV - 300 GeV, will change the status quo dramatically. Galactic diffuse gamma-ray emission gathered by GUST will require adequate theoretical models. The efforts will be rewarded by the wealth of information on cosmic ray spectra and fluxes in remote locations. In its turn, a detailed cosmic ray propagation model will provide a reliable basis for other studies such as search for dark matter signals in cosmic rays and diffuse gamma rays, spectrum and origin of the extragalactic gamma-ray emission, theories of nucleosynthesis and evolution of elements etc. In this talk, I will discuss what we can learn studying the cosmic ray propagation and diffuse gamma-ray emission.
Author
Cosmic Rays; Gamma Rays; Dark Matter

20040081131 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Propagation of Cosmic Rays
Moskalenko, I. V.; [2004]; 1 pp.; In English; No Copyright; Avail: Other Sources; Abstract Only

Astrophysics of cosmic rays and gamma rays depends very much on the quality of the data, which become increasingly accurate each year and therefore more constraining. While direct measurements of cosmic rays are possible in only one location on the outskirts of the Milky Way, the Galactic diffuse gamma-ray emission provides insights into the spectra of cosmic rays in distant locations, therefore complementing the local cosmic-ray studies. This connection, however, requires extensive modeling and is yet to be explored in detail. The GLAST mission, which is scheduled for launch in 2007 and is capable of measuring gamma-rays in the range 20 MeV - 300 GeV, will change the status quo dramatically. The detailed spectra and skymaps of the Galactic diffuse gamma-ray emission gathered by GLAST will require adequate theoretical models. The efforts will be rewarded by the wealth of information on cosmic ray spectra and fluxes in remote locations. In its turn, a detailed cosmic ray propagation model will provide a reliable basis for other studies such as search for dark matter signals in cosmic rays and diffuse gamma rays, spectrum and origin of the extragalactic gamma-ray'emission, theories of nucleosynthesis and evolution of elements etc. In this talk, I will discuss what we can learn studying the cosmic ray propagation and diffuse gamma-ray emission.
Author
Astrophysics; Cosmic Rays; Milky Way Galaxy

20040081133 NASA Goddard Space Flight Center, Greenbelt, MD, USA
The NASA Beyond Einstein Program
White, Nicholas E.; [2004]; 1 pp.; In English; 5th International LISA Symposium; No Copyright; Avail: Other Sources; Abstract Only

The Laser Interferometer Space Antenna (LISA) mission is part of NASA s Beyond Einstein program. This program seeks to answer the questions What Powered the Big Bang?, What happens at the edge of a Black Hole?, and What is Dark Energy?. LISA IS the first mission to be launched in this new program. This paper will give an overview of the Beyond Einstein program, its current status and where LISA fits in.
Author
Black Holes (Astronomy); Dark Energy; Big Bang Cosmology

20040081172 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Rossi X-ray Timing Explorer
Swank, J.; [2004]; 1 pp.; In English; The Electromagnetic Spectrum of Neutron Stars, 7-18 Jun. 2004, Marmaris, Turkey; No Copyright; Avail: Other Sources; Abstract Only

The prime objectives of the Rossi X-ray Timing Explorer (RXTE) are the study of astrophysical compact objects: black holes (galactic and extragalactic), many types of neutron stars, and accreting white dwarfs. RXTE's capability for rapid timing is unique among all past and present X-ray observatories. It has enabled qualitatively new discoveries about dynamical timescale phenomena related to neutron stars and black holes. These phenomena probe basic physics in the most extreme environments of gravity, density, and magnetic fields. The observations to date are a public archive for studying questions not addressed in the initial studies. Proposed future observations emphasize the discovery of additional millisecond pulsars and finding the answers to questions about low mass X-ray binaries and black holes.
Author
Black Holes (Astronomy); Neutron Stars; X Ray Timing Explorer; White Dwarf Stars; Astrophysics; Dynamic Characteristics

20040081180 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Population Studies of Radio and Gamma-Ray Pulsars
Harding, Alice K; Gonthier, Peter; Coltisor, Stefan; 2004; 1 pp.; In English; Workshop on the Multiwavelength Approach to Unidentified Gamma Ray Sources, 1-4 Jun. 2004, Hong Kong, China; No Copyright; Avail: Other Sources; Abstract Only

Rotation-powered pulsars are one of the most promising candidates for at least some of the 40-50 EGRET unidentified gamma-ray sources that lie near the Galactic plane. Since the end of the EGRO mission, the more sensitive Parkes Multibeam radio survey has detected mere than two dozen new radio pulsars in or near unidentified EGRET sources, many of which are young and energetic. These results raise an important question about the nature of radio quiescence in gamma-ray pulsars: is the non-detection of radio emission a matter of beaming or of sensitivity? The answer is very dependent on the geometry of the radio and gamma-ray beams. We present results of a population synthesis of pulsars in the Galaxy, including for the first time the full geometry of the radio and gamma-ray beams. We use a recent empirically derived model of the radio emission and luminosity, and a gamma-ray emission geometry and luminosity derived theoretically from pair cascades in the polar slot gap. The simulation includes characteristics of eight radio surveys of the Princeton catalog plus the Parkes MB survey. Our results indicate that EGRET was capable of detecting several dozen pulsars as point sources, with the ratio of radio-loud to radio-quiet gamma-ray pulsars increasing significantly to about ten to one when the Parkes Survey is included. Polar cap models thus predict that many of the unidentified EGRET sources could be radio-loud gamma- ray pulsars, previously undetected as radio pulsars due to distance, large dispersion and lack of sensitivity. If true, this would make gamma-ray telescopes a potentially more sensitive tool for detecting distant young neutron stars in the Galactic plane.
Author
Radio Emission; Gamma Rays; Pulsars; Detection

20040081209 NASA Goddard Space Flight Center, Greenbelt, MD, USA
NGC 4388- Spectral Studies of the First Seyfert 2 Seen by INTEGRAL
Beckman, V.; Gehrels, N.; Favre, P.; Courvoisier, T. J.-L.; Walter, R.; Malzac, J.; Petrucci, P.-O.; 2004; 8 pp.; In English; 5th INTERAL Workshop, 16-20 Feb. 2004, Munich, Germany; No Copyright; Avail: CASI; A02, Hardcopy

We present first INTEGRAL and XMM-Newton ob- servations of a Seyfert galaxy, the type 2 AGN NGC 4388. Several INTEGRAL observations performed in 2003 allow us to study the spectrum in the 20 - 300 keV range. In addition two XMM-Newton observations give detailed insight into the 0.2 - 10 keV emission. Comparison with previous observations by BeppoSAX, SIGMA and CGROIOSSE show that the overall spectrum for soft X-rays up to the gamma-rays can be described by a highly absorbed and variable non-thermal component in addition to constant non-absorbed thermal emission of low abundance (2 - 5%Za), plus a constant Fe K alpha line. The hard X-ray component is well described by a simple power law with a mean photon index of 1 = 1.7. During the INTEGRAL observations the flux at 100 keV increased by a factor of 1.5.

The analysis of XMM-Newton data implies that the emission below 3 keV is decoupled from the AGN and probably due to extended emission as seen in Chandra observations. The constant iron line emission is apparently also decoupled from the direct emission of the central engine and likely to be generated in the obscuring material, e.g. in the molecular torus or even further away.
Author
Seyfert Galaxies; X Ray Spectra

20040081270 NASA Goddard Space Flight Center, Greenbelt, MD, USA
RXTE All-Sky Slew Survey. Catalog of X-Ray Sources at B Greater Than 10 deg
Revnivtsev, M.; Sazonov, S.; Jahoda, K.; Gilfanov, M.; [2004]; 19 pp.; In English
Report No.(s): astro-ph/0402414; Copyright; Avail: CASI; A03, Hardcopy

We report results of a serendipitous hard X-ray (3-20 keV), nearly all-sky (absolute value of b greater than l0 deg.) survey based on RXTE/PCA observations performed during satellite reorientations in 1996-2002. The survey is 80% (90%) complete to a 4(sigma) limiting flux of approx. = 1.8 (2.5) x 10(exp -l1) erg/s sq cm in the 3-20 keV band. The achieved sensitivity in the 3-8 keV and 8-20 keV subbands is similar to and an order of magnitude higher than that of the previously record HEAO-1 A1 and HEAO-1 A4 all-sky surveys, respectively. A combined 7 x 10(exp 3) sq. deg area of the sky is sampled to flux levels below l0(exp -11) erg/ s sq cm (3-20 keV). In total 294 sources are detected and localized to better than 1 deg. 236 (80%) of these can be confidently associated with a known astrophysical object; another 22 likely result from the superposition of 2 or 3 closely located known sources. 35 detected sources remain unidentified, although for 12 of these we report a likely soft X-ray counterpart from the ROSAT all-sky survey bright source catalog. Of the reliably identified sources, 63 have local origin (Milky Way, LMC or SMC), 64 are clusters of galaxies and 100 are active galactic nuclei (AGN). The fact that the unidentified X-ray sources have hard spectra suggests that the majority of them are AGN, including highly obscured ones (N(sub H) greater than l0(exp 23)/sq cm). For the first time we present a log N-log S diagram for extragalactic sources above 4 x l0(exp -12) erg/ s sq cm at 8-20 keV. Key words. cosmo1ogy:observations - diffuse radiation - X-rays general
Author
X Ray Sources; Active Galactic Nuclei; Catalogs (Publications)

20040081292 NASA Goddard Space Flight Center, Greenbelt, MD, USA
The Swift MIDEX Mission
Gehrels, Neil; [2004]; 1 pp.; In English; Beyond Einstein Meeting, 11-14 May 2004, Stanford, CA, USA; No Copyright; Avail: Other Sources; Abstract Only

Swift is a NASA MIDEX mission that is in development for launch in 2004. It is a multiwavelength observatory for transient astronomy. The goals of the mission are to determine the origin of gamma-ray bursts and their afterglows and use bursts to probe the early Universe. The mission will also perform a hard x-ray survey at the 1 milliCrab level and will continuously monitor the sky for transients. A wide- field gamma-ray camera will detect more than a hundred GRBs per year to 3 times fainter than BATSE. Sensitive narrow-field X-ray and Uv/optical telescopes will be pointed at the burst location in 20 to 70 sec by an autonomously controlled "swift" spacecraft. For each burst, arcsec positions will be determined and optical/W/X-ray/gamma-ray spectrophotometry performed. The instrumentation is a combination of existing flight-spare hardware and design from XMM and Spectrum-X/JET-X contributed by collaborators in the UX and Italy and development of a coded-aperture camera with a large-area (-0.5 square meter) CdZnTe detector array. The ground station in Malindi is contributed by the Italian Space Agency. The instruments have now completed their fabrication phase and are currently being integrated on the observatory for final testing. up and outreach programs to engage the astronomical community and public in Swift.
Author
Gamma Ray Observatory; Gamma Ray Bursts; X Rays; Cameras

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LUNAR AND PLANETARY SCIENCE AND EXPLORATION

Includes planetology; selenology; meteorites; comets; and manned and unmanned planetary and lunar flights. For spacecraft design or space stations see *18 Spacecraft Design, Testing and Performance*.

20040077202 NASA Ames Research Center, Moffett Field, CA, USA
Mixed-Initiative Constraint-Based Activity Planning for Mars Exploration Rovers
Bresina, John; Jonsson, Ari K.; Morris, Paul H.; Rajan, Kanna; 2004; 9 pp.; In English; 4th International Workshop on Planning and Scheduling for Space, 23-25 Jun. 2004, Darmstadt, Germany; No Copyright; Avail: CASI; A02, Hardcopy

In January, 2004, two NASA rovers, named Spirit and Opportunity, successfully landed on Mars, starting an unprecedented exploration of the Martian surface. Power and thermal concerns constrained the duration of this mission, leading to an aggressive plan for commanding both rovers every day. As part of the process for generating these command loads, the MAPGEN tool provides engineers and scientists an intelligent activity planning tool that allows them to more effectively generate complex plans that maximize the science return each day. The key to'the effectiveness of the MAPGEN tool is an underlying artificial intelligence plan and constraint reasoning engine. In this paper we outline the design and functionality of the MAEPGEN tool and focus on some of the key capabilities it offers to the MER mission engineers.
Author
Roving Vehicles; Mars Exploration; Mars Surface; Loads (Forces)

20040079347 NASA Ames Research Center, Moffett Field, CA, USA
Large Well-Exposed Alluvial Fans in Deep Late-Noachian Craters
Moore, J. M.; Howard, A. D.; 2004; 2 pp.; In English; Lunar and Planetary Science Conference, 12-20 Mar. 2004, Houston, TX, USA; Original contains black and white illustrations
Contract(s)/Grant(s): RTOP 965-90-01; No Copyright; Avail: CASI; A01, Hardcopy

Large, fresh-appearing alluvial fans (typically greater than 10 km long) have been identified during a systematic search of 100 m/pixel low-sun daylight THEMIS IR imaging in deep late-Noachian or early-Hesperian craters. Our study of these fans was augmented with MOLA-derived topography and high-resolution MOC and THEMIS VIS images where available. The influence of alluvial fan deposition on the topography of crater floors has been recognized in previous topographic studies. Recent Mars Odyssey-era studies have also identified and described in detail a fluvial delta or fan of approximately the same age as the alluvial fans of this study. Our results, at the time of this writing, indicate that these fans are only found in less than 5% of all craters greater than or equal to 70 kilometers in diameter within a large study region. In every case the fan-containing craters were restricted to a latitude belt between 20 degrees S and 30 degrees S. All of which had significant topographic relief and appeared morphologically younger than typical mid-Noachian craters in the size range. However, large fans were not found in the most pristine (and presumably youngest) craters in this size range. Most Martian fans have morphologies consistent with terrestrial debris-flow-dominated fans.
Derived from text
Alluvium; Fans (Landforms); Mars Craters; Topography; Mars Surface

20040079382 NASA Wallops Flight Center, Wallops Island, VA, USA
Laboratory Analysis of Polymer Thin Films for Planetary Balloons and Gossamer Structures
Sterling, Jerry; Fairbrother, Debora A.; 2004; 7 pp.; In English; 5th AIAA Gossamer Spacecraft Forum, 19-22 Apr. 2004, Palm Springs, CA, USA; No Copyright; Avail: CASI; A02, Hardcopy

Commercially available polymer thin fdms with thickness of 15 microns or less were evaluated for potential application as the gas envelope material of balloons and other inflated vehicles. Films on this thickness scale are of interest for Earth and Mars ballooning as well as many gossamer space structures. Due to the uniqueness of these missions relative to typical uses of these materials, application-specific materials properties measurements were made. We evaluated numerous polymer chemistries, plus a few variations within one chemistry. The data show that there are often trade-offs among the different materials, such as with polyesters and polyimides having greater stiffness (modulus) but lower tear propagation resistance than polyethylene. Sections of polyethylene films can be joined by heat sealing, while adhesives and their accompanying mass penalty must be used with polyesters and polyimides. When the analysis temperature is reduced to 190 K, polyethylenes display dramatically increased stiffness and yield point, while the increase for other materials is more modest. The data also show that manufacturing processes can significantly affect film properties. To emphasize the need for application-specific properties assessment, we discuss two recent applications using these materials.
Author
Large Space Structures; Balloons; Spacecraft Structures; Polyimides; Thin Films

20040079716 NASA Goddard Space Flight Center, Greenbelt, MD, USA
The Terrestrial Planet Finder and Darwin Missions
Danchi, William C.; 2004; 1 pp.; In English; No Copyright; Avail: Other Sources; Abstract Only

Both in the USA and in Europe, teams of scientists and engineers are exploring the feasibility of the Terrestrial Planet Finder (TPF) and Darwin missions, which are designed to search for Earth-like planets in the habitable zone of nearby stars. In the US, the TPF Science Working Group is studying four options - small (4m by 6 m primary mirror) and large (4m by

10 m primary mirror) coronagraphs for planet detection at visible wavelengths, and structurally connected and free-flyer interferometers at thermal infrared wavelengths. The US TPF-SWG is charged with selecting an option for NASA by the end of 2006. In Europe the Darwin Terrestrial Exo-planet Advisory Team (TE- SAT) is exploring the free-flyer interferometer option only at this time. I will discuss the vurtures and difficulties of detecting and characterizing extra-solar planets in both wavelength regions as well as some of the technical challenges and progress in the past year.
Derived from text
Terrestrial Planets; Infrared Spectra; Interferometers; Coronagraphs

20040079765 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Analytical Protocols for Analysis of Organic Molecules in Mars Analog Materials
Mahaffy, Paul R.; Brinkerhoff, W.; Buch, A.; Demick, J.; Glavin, D. P.; 2004; 1 pp.; In English; Astrobiology Science Conference, 28 Mar. - 1 Apr. 2004, Moffet Field, CA, USA; No Copyright; Avail: Other Sources; Abstract Only

A range of analytical techniques and protocols that might be applied b in situ investigations of martian fines, ices, and rock samples are evaluated by analysis of organic molecules m Mars analogues. These simulants 6om terrestrial (i.e. tephra from Hawaii) or extraterrestrial (meteoritic) samples are examined by pyrolysis gas chromatograph mass spectrometry (GCMS), organic extraction followed by chemical derivatization GCMS, and laser desorption mass spectrometry (LDMS). The combination of techniques imparts analysis breadth since each technique provides a unique analysis capability for Certain classes of organic molecules.
Author
Molecules; Organic Chemistry; Mars Surface; Analogs; Numerical Analysis

20040079815 NASA Goddard Space Flight Center, Greenbelt, MD, USA
A New View of Mars
Smith, David E.; 2004; 1 pp.; In English; Catholic University Seminar, 21 Jan. 2004, Washington, DC, USA; No Copyright; Avail: Other Sources; Abstract Only

During the last 8 years the US has successfully sent 2 major spacecraft to Mars 1z?der= planet. The Mars Global Surveyor spacecraft (IGS), which started operating at Mars in Sept 1977 and Mars Odyssey spacecraft that started operating in Jan 2002, are both operational and collecting data, including 1.5 meter pixel imagery, them spectrometry, magnetometry, altimeter/ radiometry, gamma ray and neutron counts. imaging spectrometry, and gravity. The two orbiters are conceptually similar to Earth orbiting spacecraft in that their primary purpose is to observe, monitor, and measure a variety of parameters about the planet and report any changes that might be occurring on the surfaces and in the atmosphere. As a result we now have detailed physical descriptions of the shape, topography, magnetism. surface roughness, thermal inertia, atmospheric pressure and temperature, the distribution of hydrogen in the top meter of the crust, models for the planetary interior based upon data, and an image set that portrays much of the history of the past 3 billion years. understand how the planet came to be this way.
Author
Atmospheric Temperature; Atmospheric Pressure; Mars (Planet); Magnetic Properties; Magnetic Measurement

20040081037 NASA Ames Research Center, Moffett Field, CA, USA
Biology and The Future of Mars
McKay, Christopher P.; [2004]; 1 pp.; In English; Astrobiology Conference, 28 Mar. 1 Apr. 2004, Moffett Foeld, CA, USA Contract(s)/Grant(s): UPN 344-33-00-18; No Copyright; Avail: Other Sources; Abstract Only

It is possible that at some time in the future we might recreate a habitable climate on Mars returning it to the life-bearing state it may have enjoyed early in its history. Our studies of Mars are still in a preliminary state but everything we have learned suggests that it may he possible to restore Mars to a habitable climate. Long part of the intersection of science and fiction (eg. Clarke, 1995), serious studies of planetary ecosynthesis on Mars began after the results of the Viking mission indicated that all the compounds needed for life were present on the surface of Mars is some accessible form (Averner and MacElroy, 1976; McKay et al., 1991; Fogg, 1995). Recent work has focused on the use of climate models to compute the timescales to warm Mars (McKay et al., 1991 ; McKay and Marinova, 2001). Planetary ecosynthesis on Mars has implications for the objectives and conduct of robotic and human exploration. In particular the question of forward contamination must be considered in a new way if we wish to control the introduction of life to Mars in advance of planetary ecosynthesis.
Author
Mars Environment; Mars Surface; Climate Models; Contamination

20040081082 Washington Univ., Saint Louis, MO, USA
Origin and Evolution of the Solar System: Microanalytical Studies of Meteorites and Interplanetary Dust
Floss, Christine; Crozaz, Ghialaine; Stadermann, Frank; Walker, Robert; Zinner, Ernst; [2004]; 4 pp.; In English
Contract(s)/Grant(s): NAG5-13467; No Copyright; Avail: CASI; A01, Hardcopy

Below we summarize the results of the research carried out under the above-mentioned grant, which was funded from May 1, 2003 through April 30, 2004. A list of publications resulting from this work is to be found at the end of this document.
Author (revised)
Meteoritic Composition; Interplanetary Dust; Microanalysis

20040081090 NASA Ames Research Center, Moffett Field, CA, USA
Enantiomeric and Isotopic Analysis of Organic Compounds in Carbonaceous Meteorites
Cooper, George; 2004; 1 pp.; In English; Presentation at Exobiology PI Symposium, 25-29 Aug. 2003, Moffett Field, CA, USA; No Copyright; Avail: Other Sources; Abstract Only

Carbonaceous meteorites are relatively enriched in soluble organic compounds. The Murchison and Murray meteorites contain numerous compounds of interest in the study of early solar system organic chemistry and organic compounds of potential importance for the origin of life. These include: amino acids, amides, carboxylic acids, and polyols. This talk will focus on the enantiomeric and isotopic analysis of individual meteoritic compounds - primarily polyol acids. The analyses will determine if, in addition to certain amino acids from Murchison, another potentially important class of prebiotic compounds also contains enantiomeric excesses, i.e., excesses that could have contributed to the current homochirality of life. Preliminary enantiomeric and isotopic (C- 13) measurements of Murchison glyceric acid show that it is indeed extraterrestrial. C-13 and D isotope analysis of meteoritic sugar alcohols (glycerol, threitol, ribitol, etc.) has shown that they are also indigenous to the meteorite.
Author
Organic Compounds; Organic Chemistry; Isotopes; Glycerols

20040081107 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Jupiter's Atmospheric Temperatures: From Voyager IRIS to Cassini CIRS
Simon-Miller, Amy A.; Conrath, Barney J.; Gierasch, Peter J.; Orton, Glenn S.; Achterberg, Richard K.; Flasar, F. Michael; Fisher, Brendan; [2004]; 56 pp.; In English; Original contains black and white illustrations; No Copyright; Avail: CASI; A04, Hardcopy

Retrievals run on Cassini Composite Infrared Spectrometer data obtained during the distant Jupiter flyby have been used to generate global temperature maps of the planet in the troposphere and stratosphere. Similar retrievals were performed on Voyager 1 IRIS data and have provided the first detailed IRIS map of the stratosphere. In both data sets, high latitude troposphere temperatures are presented for the first time, and the meridional gradients indicate the presence of circumpolar jets. Thermal winds were calculated for each data set and show strong vertical shears in the zonal winds at low latitudes. The temperatures retrieved from the two spacecraft were also compared with yearly ground-based data obtained over the intervening two decades. Tropospheric temperatures reveal gradual changes at low latitudes, with little obvious seasonal or short-term variation (Orton et al. 1994). Stratospheric temperatures show much more complicated behavior over short timescales, consistent with quasi-quadrennial oscillations at low latitudes, as suggested in prior analyses of shorter intervals of ground- based data (Orton et al. 1991, Friedson 1999). A scaling analysis indicates that meridional motions, mechanically forced by wave or eddy convergence, play an important role in modulating the temperatures and winds in the upper troposphere and stratosphere on seasonal and shorter time scales. At latitudes away from the equator, the mechanical forcing can be derived simply from a temporal record of temperature and its vertical derivative. Ground-based observations with improved vertical resolution and/or long-term monitoring from spacecraft are required for this purpose.
Author
Jupiter (Planet); Cassini Mission; Atmospheric Temperature; Voyager Project; Jupiter Atmosphere; Infrared Interferometers; Iris Satellites

20040081121 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Libration Point Navigation Concepts Supporting Exploration Vision
Carpenter, J. Russell; Folta, David C.; Moreau, Michael C.; Gramling, Cheryl J.; [2004]; 3 pp.; In English; AIAA Guidance, Navigation and Control Conference, 16-19 Aug. 2004, Providence, RI, USA; No Copyright; Avail: CASI; A01, Hardcopy

Farquhar described several libration point navigation concepts that would appear to support NASA s current exploration

vision. One concept is a Lunar Relay Satellite operating in the vicinity of Earth-Moon L2, providing Earth-to-lunar far-side and long- range surface-to-surface navigation and communications capability. Reference [1] lists several advantages of such a system in comparison to a lunar orbiting relay satellite constellation. Among these are one or two vs. many satellites for coverage, simplified acquisition and tracking due to very low relative motion, much longer contact times, and simpler antenna pointing. An obvious additional advantage of such a system is that uninterrupted links to Earth avoid performing critical maneuvers "in the blind." Another concept described is the use of Earth-Moon L1 for lunar orbit rendezvous, rather than low lunar orbit as was done for Apollo. This rendezvous technique would avoid large plane change and high fuel cost associated with high latitude landing sites and long stay times. Earth-Moon L1 also offers unconstrained launch windows from the lunar surface. Farquhar claims this technique requires only slightly higher fuel cost than low lunar orbit rendezvous for short-stay equatorial landings. Farquhar also describes an Interplanetary Transportation System that would use libration points as terminals for an interplanetary shuttle. This approach would offer increased operational flexibility in terms of launch windows, rendezvous, aborts, etc. in comparison to elliptical orbit transfers. More recently, other works including Folta[3] and Howell[4] have shown that patching together unstable trajectories departing Earth-Moon libration points with stable trajectories approaching planetary libration points may also offer lower overall fuel costs than elliptical orbit transfers. Another concept Farquhar described was a Deep Space Relay at Earth-Moon IA and/or L5 that would serve as a high data rate optical navigation and communications relay satellite. The advantages in comparison to a geosynchronous relay are minimal Earth occultation, distance from large noise sources on Earth, easier pointing due to smaller relative velocity, and a large baseline for interferometry if both L4 and L5 are used.
Author
Libration; Lunar Satellites; Surface Navigation; Optical Communication; Elliptical Orbits; Lunar Surface

20040081122 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Atmospheric Rotational Effects on Mars Based on the NASA Ames General Circulation Model: Angular Momentum Approach
Sanchez, Braulio V.; Haberle, Robert M.; Schaeffer, James; [2004]; 34 pp.; In English; No Copyright; Avail: CASI; A03, Hardcopy

The objective of the investigation is to determine the motion of the rotational axis of Mars as a result of mass variations in the atmosphere and condensation and sublimation of CO2 ice on the polar caps. A planet experiences this type of motion if it has an atmosphere, which is changing its mass distribution with respect to the solid body of the planet and/or it is asymmetrically changing the amount of ice at the polar caps. The physical principle involved is the conservation of angular momentum, one can get a feeling for it by sitting on a well oiled swivel chair holding a rotating wheel on a horizontal direction and then changing the rotation axis of the wheel to a vertical direction. The person holding the wheel and the chair would begin to rotate in opposite direction to the rotation of the wheel. The motions of Mars atmosphere and the ice caps variations are obtained from a mathematical model developed at the NASA Ames Research Center. The model produces outputs for a time span of one Martian year, which is equivalent to 687 Earth days. The results indicate that Mars axis of rotation moves in a spiral with respect to a reference point on the surface of the planet. It can move as far away as 35.3 cm from the initial location as a result of both mass variations in the atmosphere and asymmetric ice variations at the polar caps. Furthermore the pole performs close to two revolutions around the reference point during a Martian year. This motion is a combination of two motions, one produced by the atmospheric mass variations and another due to the variations in the ice caps. The motion due to the atmospheric variations is a spiral performing about two and a half revolutions around the reference point during which the pole can move as far as 40.9 cm. The motion due to variations in the ice caps is a spiral performing almost three revolutions during which the pole can move as far as 32.8 cm.
Author
Atmospheric Effects; Rotation; Mars Atmosphere; Mathematical Models; Carbon Dioxide; Angular Momentum

20040081175 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Representations of Invariant Manifolds for Applications in Three-Body Systems
Howell, K.; Beckman, M.; Patterson, C.; Folta, D.; [2004]; 18 pp.; In English; 14th AAS/AIAA Space Flight Mechanics Meeting, 8-12 Feb. 2004, Maui, HI, USA; Original contains black and white illustrations
Contract(s)/Grant(s): NCC5-358; NCC5-727
Report No.(s): AAS-04-287; No Copyright; Avail: CASI; A03, Hardcopy

The Lunar L1 and L2 libration points have been proposed as gateways granting inexpensive access to interplanetary space. To date, only individual solutions to the transfer between three-body systems have been found. The methodology to solve the problem for arbitrary three-body systems and entire families of orbits is currently being studied. This paper presents

an initial approach to solve the general problem for single and multiple impulse transfers. Two different methods of representing and storing the invariant manifold data are presented. Some particular solutions are presented for two types of transfer problems, though the emphasis is on developing the methodology for solving the general problem.
Author
Manifolds (Mathematics); Libration; Impulses

20040081212 NASA Goddard Space Flight Center, Greenbelt, MD, USA
The Gas Chromatograph Mass Spectrometer for the Huygens Probe
Niemann, H. B.; Atreya, S. K.; Bauer, S. J.; Biemann, K.; Carignan, G. R.; Donahue, T. M.; Gautier, D.; Hunten, D. M.; Israel, G.; Lunine, J. I., et al.; [2004]; 1 pp.; In English; Huygens Titan Conference, 13-17 Apr. 2004, Noordwijk, Netherlands; No Copyright; Avail: Other Sources; Abstract Only

Titan is unique in the solar system, the only moon that has a dense atmosphere. The major constituents of the atmosphere, nitrogen and methane, are continuously broken apart by a combination of solar UV, impinging electrons from Saturn s magnetosphere, and a steady flux of cosmic rays. The resulting molecular fragments recombine and form a variety of new species, many of which were detected for the first time by Voyager1 . The ubiquitous, surface- hiding aerosol blanket manifests the existence of still more complex compounds. In addition to hydrocarbons and nitriles, the atmosphere is known to contain CO, CO2 and externally delivered H2O. The Gas Chromatograph Mass Spectrometer (GCMS) on the Huygens Probe will measure the chemical composition of the atmosphere of Titan from 170 Km altitude (approximately 1hPa) to the surface (approximately 1500hPa) and determine the isotope ratios of the major constituents. The GCMS will also analyze gas samples from the Aerosol Collector Pyrolyser (ACP) and may be able to obtain compositional information of several surface materials. The GCMS consists of a quadrupole mass spectrometer (QP) with a secondary electron multiplier ion detector, a three-column gas chromatograph (GC) and an elaborate gas sampling system. The gas sampling system will provide atmospheric samples to the QP for nearly continuous analysis during the Probe descent and batch samples at several altitudes for GC analysis. It also contains a chemical scrubber for noble gas analysis and an enrichment cell for trace constituent enhancement. In addition to the sampling of the atmosphere periodic gas samples, derived from the pyrolysis of aerosols, will be transferred from the ACP to the GCMS for direct QP and full GCMS analysis. The QP can analyze molecular masses from 2 to 141Dalton. The nominal detection threshold is at a mixing ratio of 10E-8. Data rate is 885 bits/sec. The mass of the instrument is 17.3 kg and the energy required for operation during the descent is 110 Watt-hours.
Author
Gas Chromatography; Huygens Probe; Mass Spectrometers; Titan

20040081227 NASA Ames Research Center, Moffett Field, CA, USA
The Habitability of Mars: Lessons from Ophiolites on Earth
Schulte, Michell; September 23, 2003; 1 pp.; In English; AGU Conference, December 2003, San Francisco, CA, USA
Contract(s)/Grant(s): RTOP 279-00-03-55; No Copyright; Avail: Other Sources; Abstract Only

Ophiolite sequences, sections of lower oceanic crust and upper mantle that have been thrust onto continental craton, are located in northern and central California. These rock suites provide easily accessible outcrops that likely parallel the rock types on Mars. We have begun investigating and characterizing these sites in order to understand better the processes that may be responsible for the water chemistry, mineralogy and biology on Mars. The ophiolites found in northern and central California include the Trinity, Josephine, Coast Range and Point Sal, and all are approximately 160 million years old. These ophiolite bodies are actively serpentinizing. Fluids from serpentinizing springs are generally alkaline, with high pH and H2 contents, indicating that the mafic rock compositions control the fluid chemistry through water-rock reactions during relatively low-grade hydrothermal processes. The general reaction for serpentinization of olivine is given by: olivine + H2O = serpentine + brucite + magnetite + H2. We have analyzed the mineralogical composition of a number of rock samples collected from the Coast Range Ophiolite near Clear Lake, CA by electron microprobe. The remnant primary mineralogy is fairly uniform in composition, with an olivine composition of Fo(sub 90) and with pyroxene compositions of En(sub 90), for orthopyroxene and En(sub 49)Wo(sub 48)Fs(sub 03) for the clinopyroxene. There are several generations of alteration products, comprised mostly of serpentines that are magnesium rich, with magnetite, brucite and carbonates observed as accessory minerals. The oxidation of iron in the ferrous component of olivine and pyroxene results in the generation of H2, as indicated by the presence of magnetite. The formation of carbonates can be taken to indicate the presence of CO2 in the altering fluids. The H2 generated through water-rock reactions in these systems may provide an energy source for chemolithoautotrophic ecosystems, while the CO2 serves as a carbon source. The identification of several species of Archaea from these rocks, including an alkalophile,

indicates that these geochemical environments do serve as habitats. We suggest that serpentinizing springs in mafic to ultramafic terranes may be the most likely areas on Mars to be habitable.
Author
Habitability; Mars Surface; Mineralogy; Planetary Geology; Geochemistry; Earth Surface

20040081232 QSS Group, Inc., Moffett Field, CA, USA
Building Hybrid Rover Models for NASA: Lessons Learned
Willeke, Thomas; Dearden, Richard; [2004]; 6 pp.; In English; Original contains black and white illustrations
Contract(s)/Grant(s): CSRO-3006-108; No Copyright; Avail: CASI; A02, Hardcopy

Particle filters have recently become popular for diagnosis and monitoring of hybrid systems. In this paper we describe our experiences using particle filters on a real diagnosis problem, the NASA Ames Research Center's K-9 rover. As well as the challenge of modelling the dynamics of the system, there are two major issues in applying a particle filter to such a model. The first is the asynchronous nature of the system-observations from different subsystems arrive at different rates, and occasionally out of order, leading to large amounts of uncertainty in the state of the system. The second issue is data interpretation. The particle filter produces a probability distribution over the state of the system, from which summary statistics that can be used for control or higher-level diagnosis must be extracted. We describe our approaches to both these problems, as well as other modelling issues that arose in this domain.
Author
Mars Roving Vehicles; NASA Space Programs; Algorithms; Hybrid Structures; Dynamic Models

20040081255 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Initiating the 2002 Mars Science Laboratory (MSL) Focused Technology Program
Caffrey, Robert T.; Udomkesmalee, Gabriel; Hayati, Samad A.; 2004; 15 pp.; In English; 2004 IEEE Aerospace Conference, 6-13 Mar. 2004, Big Sky, MT, USA; No Copyright; Avail: CASI; A03, Hardcopy

The Mars Science Laboratory (MSL) Project is an aggressive mission launching in 2009 to deliver a new generation of rover safely to the surface of Mars and conduct comprehensive in situ investigations using a new generation of instruments. This system will be designed to land with precision and be capable of operating over a large percentage on the surface of Mars. It will have capabilities that will support NASA's scientific goals into the next decade of exphation. The MSL Technology program is developing a wide-range of technologies needed for this Mission and potentially other space missions. The MSL Technology Program reports to both the MSL Project and the Mars Technology Program (MTP). The dual reporting process creates a challenging management situation, but ensures the new technology meets both the specific MSL requirements and the broader Mars Program requirements. MTP is a NASA-wide technology development program managed by the Jet Propulsion Laboratory (JPL) and is divided into a Focused Program and a Base Program. The Focused Technology Program addresses technologies that are specific and critical to near-term missions, while the Base Technology Program addresses those technologies that are applicable to multiple missions and which can be characterized as longer term, higher risk, and high payoff technologies. The MSL Technology Program is under the Focused Program and is tightly coupled to MSL's mission milestones and deliverables. The technology budget is separate from the flight Project budget, but the technology s requirements and the development process are tightly coordinated with the Project. The Technology Program combines proven management techniques of flight projects with commercial and academic technology management strategies, to create a technology management program that meets the near-term requirements of MSL and the long-term requirements of MTP. This paper examines the initiation of 2002 MSL Technology program. Some of the areas discussed in this paper include technology definition, task selection, technology management, and technology assessment.
Author
Mars Surface; Space Missions; Technology Assessment; NASA Space Programs; Space Laboratories

20040081271 NASA Goddard Space Flight Center, Greenbelt, MD, USA
A New Way to Measure Cirrus Ice Water Content by Using Ice Raman Scatter with Raman Lidar
Wang, Zhien; Whiteman, David N.; Demoz, Belay; Veselovskii, Igor; [2004]; 12 pp.; In English
Contract(s)/Grant(s): DE-FG02-03ER-63536; No Copyright; Avail: CASI; A03, Hardcopy

High and cold cirrus clouds mainly contain irregular ice crystals, such as, columns, hexagonal plates, bullet rosettes, and dendrites, and have different impacts on the climate system than low-level clouds, such as stratus, stratocumulus, and cumulus. The radiative effects of cirrus clouds on the current and future climate depend strongly on cirrus cloud microphysical properties including ice water content (IWC) and ice crystal sizes, which are mostly an unknown aspect of cinus clouds.

Because of the natural complexity of cirrus clouds and their high locations, it is a challenging task to get them accurately by both remote sensing and in situ sampling. This study presents a new method to remotely sense cirrus microphysical properties by using ice Raman scatter with a Raman lidar. The intensity of Raman scattering is fundamentally proportional to the number of molecules involved. Therefore, ice Raman scattering signal provides a more direct way to measure IWC than other remote sensing methods. Case studies show that this method has the potential to provide essential information of cirrus microphysical properties to study cloud physical processes in cirrus clouds.
Author
Cirrus Clouds; Cloud Physics; Remote Sensing; Ice

20040081289 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Retrievals of Jovian Tropospheric Phosphine from Cassini/CIRS
Irwin, P. G. J.; Parrish, P.; Fouchet, T.; Calcutt, S. B.; Taylor, F. W.; Simon-Miller, A. A.; Nixon, C. A.; [2004]; 39 pp.; In English; Copyright; Avail: CASI; A03, Hardcopy

On December 30th 2000, the Cassini-Huygens spacecraft reached the perijove milestone on its continuing journey to the Saturnian system. During an extended six-month encounter, the Composite Infrared Spectrometer (CIRS) returned spectra of the Jovian atmosphere, rings and satellites from 10-1400 cm(exp -1) (1000-7 microns) at a programmable spectral resolution of 0.5 to 15 cm(exp -1). The improved spectral resolution of CIRS over previous IR instrument-missions to Jupiter, the extended spectral range, and higher signal-to-noise performance provide significant advantages over previous data sets. CIRS global observations of the mid-infrared spectrum of Jupiter at medium resolution (2.5 cm(exp -1)) have been analysed both with a radiance differencing scheme and an optimal estimation retrieval model to retrieve the spatial variation of phosphine and ammonia fractional scale height in the troposphere between 60 deg S and 60 deg N at a spatial resolution of 6 deg. The ammonia fractional scale height appears to be high over the Equatorial Zone (EZ) but low over the North Equatorial Belt (NEB) and South Equatorial Belt (SEB) indicating rapid uplift or strong vertical mixing in the EZ. The abundance of phosphine shows a similar strong latitudinal variation which generally matches that of the ammonia fractional scale height. However while the ammonia fractional scale height distribution is to a first order symmetric in latitude, the phosphine distribution shows a North/South asymmetry at mid latitudes with higher amounts detected at 40 deg N than 40 deg S. In addition the data show that while the ammonia fractional scale height at this spatial resolution appears to be low over the Great Red Spot (GRS), indicating reduced vertical mixing above the approx. 500 mb level, the abundance of phosphine at deeper levels may be enhanced at the northern edge of the GRS indicating upwelling.
Author
Jupiter Atmosphere; Cassini Mission; Phosphines; Atmospheric Composition

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SOLAR PHYSICS

Includes solar activity, solar flares, solar radiation and sunspots. For related information see *93 Space Radiation*.

20040081203 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Search for 1-10 Hz Modulations in Coronal Emission with SECIS During the August 11, 1999 Eclipse
Rudawy, P.; Phillips, Ken J. H.; Gallagher, P. T.; Williams, D. R.; Rompolt, B.; Keenan, F. P.; [2003]; 1 pp.; In English; No Copyright; Avail: Other Sources; Abstract Only

Results of the search of the periodic changes of the 530.3 nm line intensity emitted by selected structures of the solar corona in the frequency range 1-10 Hz are presented. A set of 12728 images of the section of the solar corona extending from near the north pole to the south-west were taken simultaneously in the 530.3 nm ('green') line and white-light with the Solar Eclipse Coronal Imaging System (SECIS) during the 143-seconds-long totality of the 1999 August 11 solar eclipse observed in Shabla, Bulgaria. The time resolution of the collected data is better than 0.05-s and the pixel size is approximately 4 arcsecs. Using classical Fourier spectral analysis tools, we investigated temporal changes of the local 530.3 nm coronal line brightness in the frequency range 1-10 Hz of thousands of points within the field of view. The various photometric and instrumental effects have been extensively considered. We did not find any indisputable, statistically significant evidence of periodicities in any of the investigated points (at significance level alpha = 0.05 or better).
Author
Solar Corona; Frequency Distribution; Brightness Distribution; Temporal Distribution

93
SPACE RADIATION

Includes cosmic radiation; and inner and outer Earth radiation belts. For biological effects of radiation on plants and animals see *51 Life Sciences*; on human beings see 52 Aerospace Medicine. For theory see *73 Nuclear Physics*.

20040077273 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Detectors for the JWST Near-Infrared Spectrometer
Rauscher, B. J.; Strada, P.; Regan, M. W.; Figer, D. F.; Jakobsen, P.; Moseley, H. S.; Boeker, T.; 2004; 1 pp.; In English; American Astronomical Society Conference, 3-9 Jan. 2004, Atlanta, GA, USA; Copyright; Avail: Other Sources; Abstract Only

The Near-Infrared Spectrometer (NIRSpec) places the most stringent demands upon its detectors of all James Webb Space Telescope (JWST) instruments. We present the scientific rationale for challenging requirements including noise <or=6 e-rms per exposure. In concert, we discuss laboratory test results that are informing the design of NIRSpec's detector system and operational concept.
Author
James Webb Space Telescope; Infrared Spectroscopy; Spectrometers

20040079780 NASA Goddard Space Flight Center, Greenbelt, MD, USA
BESS: Present Results and the BESS-Polar Program
Ormes, Jonathan; [2004]; 1 pp.; In English; 12th Annual APS Meeting, 1-4 May 2004, Denver, CO, USA; No Copyright; Avail: Other Sources; Abstract Only

In nine flights between 1993 and 2002, the Balloon Borne Experiment with a Superconducting Spectrometer (BESS) has measured the spectrum of cosmic-ray antiprotons between 0.18 and 4.20 GeV, and the spectra of protons and helium to several hundred GeV/nucleon. BESS has also placed stringent upper limits on the existence of antihelium and antideuterons. Above about 1 GeV, models for antiprotons as secondary products of the interactions of primary cosmic rays agree with the BESS spectrum. Below 1 GeV, BESS data suggest the presence of an additional source of antiprotons. To extend BESS measurements to lower energies and to search for antinuclei, an evolutionary instrument, BESS-Polar, is under construction with a new, ultra-thin, superconducting spectrometer optimized for long-duration balloon flights. The initial flight is planned &om Antarctica in Winter 2004-2005. BESS Collaboration: High Energy Accelerator Research Organization (KEK), Japan; NASA Goddard Space Flight Center, USA; Kobe University, Japan; The University of Tokyo, Japan; Institute of Space and Astronautical Science/JAXA, Japan; University of Maryland, College Park, USA.
Author
Balloon Flight; Antiprotons; Superconductivity; Spectrometers; Primary Cosmic Rays

20040081103 NASA, Washington, DC, USA
Space Radiation Hazards and Countermeasures: 1990-2004
July 2004; 202 pp.; In English; No Copyright; Avail: CASI; A10, Hardcopy

Contents include the folowing: radiation environments, tools and techniques for measuring radiation dosage, effects of radiation on humans and animal models, methods for strengthening biological resistance to radiation, and radiation shielding. Derived from text
Radiation Hazards; Radiation Effects; Extraterrestrial Radiation

20040081217 NASA Goddard Space Flight Center, Greenbelt, MD, USA
A New Determination of the Extragalactic Diffuse X-Ray Background from EGRET Data
Strong, Andrew W.; Moskalenko, Igor V.; Reimer, Olaf; [2004]; 15 pp.; In English
Contract(s)/Grant(s): B<BF-QV0002; Copyright; Avail: CASI; A03, Hardcopy

We use the GALPROP model for cosmic-ray propagation to obtain a new estimate of the Galactic component of gamma rays, and show that away from the Galactic plane it gives an accurate prediction of the observed EGRET intensities in the energy range 30 MeV - 50 GeV. On this basis we re-evaluate the extragalactic gamma-ray background. We find that for some energies previous work underestimated the Galactic contribution at high latitudes and hence overestimated the background.

Our new background spectrum shows a positive curvature similar to that expected for models of the extragalactic emission based on the blazar population.
Author
Diffusion; Cosmic Rays; Diffuse Radiation; Gamma Rays; X Rays

20040081218 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Detection of Nitrogen and Neon in the X-ray Spectrum of GP Com with XMM/Newton
Strohmayer, Tod E.; [2004]; 15 pp.; In English; No Copyright; Avail: CASI; A03, Hardcopy

We report on X-ray spectroscopic observations with XMM/Newton of the ultra-compact, double white dwarf binary, GP Com. With the Reflection Grating Spectrometers (RGS) we detect the L(alpha) and L(beta) lines of hydrogen-like nitrogen (N VII) and neon (Ne X), as well as the helium-like triplets (N VI and Ne IX) of these same elements. All the emission lines are unresolved. These are the first detections of X-ray emission lines from a double-degenerate, AM CVn system. We detect the resonance (r) and intercombination (i) lines of the N VI triplet, but not the forbidden (f) line. The implied line ratios for N VI, R = f/i less than 0.3, and G = (f + i) / r approx. = 1, combined with the strong resonance line are consistent with a dense, collision-dominated plasma. Both the RGS and EPIC/MOS spectra are well fit by emission horn an optically thin thermal plasma with an emission measure (EM) is a member of (kT/6.5 keV)(sup 0.8) (model cevmkl in XSPEC). Helium, nitrogen, oxygen and neon are required to adequately model the spectrum, however, the inclusion of sulphur and iron further improves the fit, suggesting these elements may also be present at low abundance. We confirm in the X-rays the under-abundance of both carbon and oxygen relative to nitrogen, first deduced from optical spectroscopy by Marsh et al. The average X-ray luminosity of approx. = 3 x 10(exp 30) ergs/s implies a mass accretion rate dot-m approx. = 9 x 10(exp -13) solar mass/yr. The implied temperature and density of the emitting plasma, combined with the presence of narrow emission lines and the low dot-m value, are consistent with production of the X-ray emission in an optically thin boundary layer just above the surface of the white dwarf.
Author
Nitrogen; Detection; Neon; X Ray Spectra

20040081220 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Fine-Tuning the Accretion Disk Clock in Hercules X-1
Still, M.; Boyd, P.; [2004]; 9 pp.; In English; No Copyright; Avail: CASI; A02, Hardcopy

RXTE ASM count rates from the X-ray pulsar Her X-1 began falling consistently during the late months of 2003. The source is undergoing another state transition similar to the anomalous low state of 1999. This new event has triggered observations from both space and ground-based observatories. In order to aid data interpretation and telescope scheduling, and to facilitate the phase-connection of cycles before and after the state transition, we have re-calculated the precession ephemeris using cycles over the last 3.5 years. We report that the source has displayed a different precession period since the last anomalous event. Additional archival data from CGRO suggests that each low state is accompanied by a change in precession period and that the subsequent period is correlated with accretion flux. Consequently our analysis reveals long-term accretion disk behaviour which is predicted by theoretical models of radiation-driven warping.
Author
X Rays; Pulsars; Clocks

20040081223 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Diffuse Galactic Continuum Gamma Rays. A Model Compatible with EGRET Data and Cosmic-ray Measurements
Strong, Andrew W.; Moskalenko, Igor V.; Reimer, Olaf; [2004]; 34 pp.; In English; Copyright; Avail: CASI; A03, Hardcopy

We present a study of the compatibility of some current models of the diffuse Galactic continuum gamma-rays with EGRET data. A set of regions sampling the whole sky is chosen to provide a comprehensive range of tests. The range of EGRET data used is extended to 100 GeV. The models are computed with our GALPROP cosmic-ray propagation and gamma-ray production code. We confirm that the "conventional model" based on the locally observed electron and nucleon spectra is inadequate, for all sky regions. A conventional model plus hard sources in the inner Galaxy is also inadequate, since this cannot explain the GeV excess away from the Galactic plane. Models with a hard electron injection spectrum are inconsistent with the local spectrum even considering the expected fluctuations; they are also inconsistent with the EGRET data above 10 GeV. We present a new model which fits the spectrum in all sky regions adequately. Secondary antiproton data were used to fix the Galactic average proton spectrum, while the electron spectrum is adjusted using the spectrum of diffuse emission it- self. The derived electron and proton spectra are compatible with those measured locally

considering fluctuations due to energy losses, propagation, or possibly de- tails of Galactic structure. This model requires a much less dramatic variation in the electron spectrum than models with a hard electron injection spectrum, and moreover it fits the y-ray spectrum better and to the highest EGRET energies. It gives a good representation of the latitude distribution of the y-ray emission from the plane to the poles, and of the longitude distribution. We show that secondary positrons and electrons make an essential contribution to Galactic diffuse y-ray emission.
Author
Galaxies; Gamma Rays; Astronomical Models

20040081266 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Spatially Complete Global Spectral Surface Albedos: Value-Added Datasets Derived from Terra MODIS Land Products
Moody, Eric G.; King, Michael D.; Platnick, Steven; Schaaf, Crystal B.; Gao, Feng; IEEE Transactions on Geoscience and Remote Sensing; April 2004; 3 pp.; In English; Copyright; Avail: CASI; A01, Hardcopy

Land surface albedo is an important parameter in describing the radiative properties of the earth s surface as it represents the amount of incoming solar radiation that is reflected from the surface. The amount and type of vegetation of the surface dramatically alters the amount of radiation that is reflected; for example, croplands that contain leafy vegetation will reflect radiation very differently than blacktop associated with urban areas. In addition, since vegetation goes through a growth, or phenological, cycle, the amount of radiation that is reflected changes over the course of a year. As a result, albedo is both temporally and spatially dependant upon global location as there is a distribution of vegetated surface types and growing conditions. Land surface albedo is critical for a wide variety of earth system research projects including but not restricted to remote sensing of atmospheric aerosol and cloud properties from space, ground-based analysis of aerosol optical properties from surface-based sun/sky radiometers, biophysically-based land surface modeling of the exchange of energy, water, momentum, and carbon for various land use categories, and surface energy balance studies. These projects require proper representation of the surface albedo s spatial, spectral, and temporal variations, however, these representations are often lacking in datasets prior to the latest generation of land surface albedo products.
Derived from text
Albedo; Radiometers; Solar Radiation; Spatial Distribution

20040081287 NASA Goddard Space Flight Center, Greenbelt, MD, USA
The Space Radiation Environment and Its Implication for Designing Reliable Electronic Systems: A NASA Perspective
LaBel, Kenneth A.; [2004]; 32 pp.; In English; European Workshop on Radiation Hardened Electronics, 30 Mar. 2004, Villard de Lans, France; Original contains color illustrations; No Copyright; Avail: CASI; A03, Hardcopy

The contents include the following: The space radiation environment. The effects on electronics. The environment in action NASA approaches to commercial electronics: flight projects; and proactive research. Living with a star space environment testbed status. Final thoughts: atomic interactions; direct ionization; interaction with nucleus.
CASI
Extraterrestrial Radiation; Ionization; Electronic Equipment

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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.

20040077370 NASA Ames Research Center, Moffett Field, CA, USA
Mechanisms for Antagonistic Regulation of AMPA and NMDA-D1 Receptor Complexes at Postsynaptic Sites
Schumann, Johann; Scheler, Gabriele; 2004; 2 pp.; In English; No Copyright; Avail: CASI; A01, Hardcopy

From the analysis of these pathways we conclude that postsynaptic processes that regulate synaptic transmission undergo significant cross-talk with respect to glutamatergic and neuromodulatory (dopamine) signals. The main hypothesis is that of a compensatory regulation, a competitive switch between the induction of increased AMPA conductance by CaMKII-dependent phosphorylation and reduced expression of PP2A, and increased D1 receptor sensitivity and expression by increased PKA, PP2A and decreased PP-1/calcineurin expression. Both types of plasticity are induced by NMDA receptor activation and increased internal calcium, they require different internal conditions to become expressed. Specifically we

propose that AMPA regulation and D1 regulation are inversely coupled;The net result may be a bifurcation of synaptic state into predominantly AMPA or NMDA-D1 synapses. This could have functional consequences: stable connections for AMPA and conditional gating for NMDA-D1 synapses.
Derived from text
Phosphorylation; Plastic Properties; Dopamine; Calcium

20040081116 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Continuous Magnetic Refrigerators for Cooling in the 0.05 to 10 K Range: Progress and Future Development
Shirron, Peter; DiPirro, Michael; Canavan, Edgar; Tuttle, James; King, Todd; Numazawa, Takenori; October 08, 2003; 1 pp.; In English; Japanese Cryogenics Conference, 3-5 Dec. 2003, Tokyo, Japan; No Copyright; Avail: Other Sources; Abstract Only

Low temperature refrigeration is an increasingly vital technology for NASA s Space Science program since most detectors being developed for x-ray, IR and sub-millimeter missions must be cooled to below 100 mK in order to meet the requirements for energy and spatial resolution. For space applications, magnetic refrigeration has an inherent advantage over alternative techniques because it does not depend on gravity. Adiabatic demagnetization refrigerators, or ADRs, are relatively simple, solid state devices. The basic elements are a magnetocaloric refrigerant (usually an encapsulated paramagnetic salt) located in the bore of a superconducting magne$, and a heat switch linking the salt to a heat sink. The alignment of magnetic spins with the magnetic field causes the refrigerant to warm as the magnetic field increases and cool as the field decreases. Thus the simple process of magnetizing the refrigerant to high field with the heat switch closed, then demagnetizing it with the heat switch open allows one to obtain temperatures well below 100 mK using a heat sink as warm as 4.2 K. The refrigerant can maintain a low temperature for a length of time depending on the applied and parasitic heat loads, its mass, and the initial magnetic field strength. Typically ADRs are designed for 12-24 hours of hold time, after which they must be warmed up and recycled. The drawback to single-shot ADRs is that the cooling power per unit mass is relatively low. Refrigerants that are suitable for low temperature operation necessarily have low magnetic ion density, and therefore low entropy density. Since ADRs store entropy, systems with even modest cooling powers (a few microwatts) at temperatures below 100 mK tend to be massive, averaging 10-15 kg.
Author
Refrigerators; Magnetic Cooling; Adiabatic Demagnetization Cooling; Superconductivity; Refrigerants; Magnetic Fields

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