



**National Aeronautics and
Space Administration
Langley Research Center**

**Scientific and Technical
Information Program Office**

Scientific and Technical Aerospace Reports

STAIR

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NASA STI Program ... in Profile

Since its founding, NASA has been dedicated to the advancement of aeronautics and space science. The NASA scientific and technical information (STI) program plays a key part in helping NASA maintain this important role.

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- **TECHNICAL MEMORANDUM.** Scientific and technical findings that are preliminary or of specialized interest, e.g., quick release reports, working papers, and bibliographies that contain minimal annotation. Does not contain extensive analysis.
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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 worldwide aerospace-related scientific and technical information (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 and 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 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
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- Other U.S. Government agency and foreign patents and patent applications
- Domestic and foreign dissertations and theses

The NASA STI Program

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

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

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

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

NASA STI Availability Information

NASA Center for AeroSpace Information (CASI)

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

NASA STI is also available to the public through Federal information organizations. NASA CASI disseminates publicly available NASA STI to the National Technical Information Service (NTIS) and to the Federal Depository Library Program (FDLP) through the Government Printing Office (GPO). In addition, NASA patents are available online from the U.S. Patent and Trademark Office.

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

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

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

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[**Personal Author Index**](#)

SCIENTIFIC AND TECHNICAL AEROSPACE REPORTS

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01 AERONAUTICS (GENERAL)

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

20070010493 NASA Langley Research Center, Hampton, VA, USA

A Parametric Geometry Computational Fluid Dynamics (CFD) Study Utilizing Design of Experiments (DOE)

Rhew, Ray D.; Parker, Peter A.; February 13, 2007; 13 pp.; In English; U.S. Air Force T&E Days, 13-15 Feb. 2007, Destin, FL, USA; Original contains color illustrations

Contract(s)/Grant(s): WBS 698671.02.07.02

Report No.(s): AIAA Paper 2007-1615; No Copyright; Avail.: CASI: [A03](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20070010493>

Design of Experiments (DOE) techniques were applied to the Launch Abort System (LAS) of the NASA Crew Exploration Vehicle (CEV) parametric geometry Computational Fluid Dynamics (CFD) study to efficiently identify and rank the primary contributors to the integrated drag over the vehicles ascent trajectory. Typical approaches to these types of activities involve developing all possible combinations of geometries changing one variable at a time, analyzing them with CFD, and predicting the main effects on an aerodynamic parameter, which in this application is integrated drag. The original plan for the LAS study team was to generate and analyze more than 1000 geometry configurations to study 7 geometric parameters. By utilizing DOE techniques the number of geometries was strategically reduced to 84. In addition, critical information on interaction effects among the geometric factors were identified that would not have been possible with the traditional technique. Therefore, the study was performed in less time and provided more information on the geometric main effects and interactions impacting drag generated by the LAS. This paper discusses the methods utilized to develop the experimental design, execution, and data analysis.

Author

Computational Fluid Dynamics; Experiment Design; Design Analysis; Ascent Trajectories; Launching

20070010610 Lawrence Livermore National Lab., Livermore, CA USA

Computational Study of Tandem Dual Wheel Aerodynamics and the Effect of Fenders and Fairings on Spray Dispersion

Paschkewitz, J. S.; Jan. 17, 2006; 19 pp.; In English

Report No.(s): DE2006-895084; UCRL-TR-21805; No Copyright; Avail.: National Technical Information Service (NTIS)

With the goal of understanding how to mitigate the safety hazard of splash and spray around heavy vehicles, a computational study of the aerodynamics and spray dispersion about a simplified trailer wheel assembly has been completed. A tandem dual slick (TDS) wheel model that neglects complex geometric features such as brakes, wheel bolts and wheel cutouts but with the same dimensions as an actual trailer wheel assembly was used. A detailed simulation of the wheels alone demonstrated that the flow field is both unsteady and complex, containing a number of vortical structures that interact strongly with spray. Preliminary simulations with fenders and fairings demonstrated that these devices prevent the ballistic transport of drops larger than approximately 0.1 mm, but the fine mist speculated to be responsible for visibility reduction is unaffected. This work suggests that to use computational fluid dynamics (CFD) to design and evaluate spray mitigation strategies the jet or sheet breakup processes can be modeled using an array of injectors of small (≈ 0.01 mm) water droplets; however the choice of size distribution, injection locations, directions and velocities is largely unknown and requires further study. Possible containment strategies would include using flow structures to 'focus' particles into regions away from passing cars or surface treatments to capture small drops.

NTIS

Aerodynamics; Automobiles; Fairings; Sprayers; Spraying; Wheels; Computational Fluid Dynamics

20070010611 Lawrence Livermore National Lab., Livermore, CA USA

Simulation of Spray Dispersion in a Simplified Heavy Vehicle Wake

Paschkewitz, J. S.; Jan. 17, 2006; 20 pp.; In English

Report No.(s): DE2006-895085; UCRL-TR-218207; No Copyright; Avail.: Department of Energy Information Bridge

Simulations of spray dispersion in a simplified tractor-trailer wake have been completed with the goal of obtaining a better understanding of how to mitigate this safety hazard. The Generic Conventional Model (GCM) for the tractor-trailer was used. The impact of aerodynamic drag reduction devices, specifically trailer-mounted base flaps, on the transport of spray in the vehicle wake was considered using the GCM. This analysis demonstrated that base flaps including a bottom plate may actually worsen motorist visibility because of the interaction of fine spray with large vortex flows in the wake. This work suggests that to use computational fluid dynamics (CFD) to design and evaluate spray mitigation strategies the jet or sheet breakup processes can be modeled using an array of injectors of small (≈ 0.1 mm) water droplets; however the choice of size distribution, injection locations, directions and velocities is largely unknown and requires further study. Possible containment strategies would include using flow structures to 'focus' particles into regions away from passing cars or surface treatments to capture small drops.

NTIS

Aerodynamics; Computerized Simulation; Sprayers; Spraying; Trailers; Wakes; Computational Fluid Dynamics

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.

20070009666 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

Integrated Conceptual Design of Joined-Wing SensorCraft Using Response Surface Models

Dittmar, Josh E; Nov 2006; 166 pp.; In English; Original contains color illustrations

Report No.(s): AD-A461449; AFIT/GAE/ENY/07-D02; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA461449>

A multidisciplinary conceptual design and analysis of Boeing's joined-wing SensorCraft has been conducted. This analysis was completed using geometrical optimization, aerodynamic analyses, and response surface methodology on a composite structural model. Phoenix Integration's Model Center was used to integrate the sizing and analysis codes found in Raymer's text, 'Aircraft Design: A Conceptual Approach' as well as those from the NASA derived conceptual design tool AirCraft Synthesis (ACSYNT), and a modified Boeing Finite Element Model (FEM). This research demonstrated the utility of integrated low-order models for fast and inexpensive conceptual modeling of unconventional aircraft designs.

DTIC

Wings

20070010028 Notre Dame Univ., IN, USA

Use of Plasma Actuators as a Moving-Wake Generator

Corke, Thomas C.; Thomas, Flint O.; Klapetzky Michael J.; January 2007; 176 pp.; In English; Original contains color and black and white illustrations

Contract(s)/Grant(s): NCC3-935; WBS 561581.02.08.03.21.02

Report No.(s): NASA/CR-2007-214676; E-15812; No Copyright; Avail.: CASI: A09, Hardcopy

ONLINE: <http://hdl.handle.net/2060/20070010028>

The work documented in this report tests the concept of using plasma actuators as a simple and easy way to generate a simulated moving-wake and the disturbances associated with it in turbines. This wake is caused by the blades of the upstream stages of the turbine. Two types of devices, one constructed of arrays of NACA 0018 airfoils, and the one constructed of flat plates were studied. The airfoils or plates were equipped with surface mounted dielectric barrier discharge (DBD) plasma actuators, which were used to generate flow disturbances resembling moving-wakes. CTA hot-wire anemometry and flow visualization using a smoke-wire were used to investigate the wake independence at various spacings and downstream locations. The flat plates were found to produce better results than the airfoils in creating large velocity fluctuations in the free-stream flow. Different dielectric materials, plasma actuator locations, leading edge contours, angles of attack and plate

spacings were investigated, some with positive results. The magnitudes of the velocity fluctuations were found to be comparable to existing mechanical moving-wake generators, thus proving the feasibility of using plasma actuators as a moving-wake generator.

Author

Turbines; Wakes; Flow Visualization; Plasmas (Physics); Angle of Attack; Actuators; Airfoils; Leading Edges

20070010029 Notre Dame Univ., IN, USA

Documentation and Control of Flow Separation on a Low Pressure Turbine Linear Cascade of Pak-B Blades Using Plasma Actuators

Corke, Thomas c.; Thomas, FLint, O.; Huang, Junhui; January 2007; 182 pp.; In English; Original contains color and black and white illustrations

Contract(s)/Grant(s): NCC3-935; WBS 561581.03.21.02

Report No.(s): NASA/CR-2007-214677; E-15813; No Copyright; Avail.: CASI: A09, Hardcopy

ONLINE: <http://hdl.handle.net/2060/20070010029>

This work involved the documentation and control of flow separation that occurs over low pressure turbine (LPT) blades at low Reynolds numbers. A specially constructed linear cascade was utilized to study the flow field over a generic LPT cascade consisting of Pratt & Whitney 'Pak-B' shaped blades. Flow visualization, surface pressure measurements, LDV measurements, and hot-wire anemometry were conducted to examine the flow fields with and without separation control. Experimental conditions were chosen to give a range of chord Reynolds numbers (based on axial chord and inlet velocity) from 10,000 to 100,000, and a range of freestream turbulence intensities from $u'/U(\infty) = 0.08$ to 2.85 percent. The blade pressure distributions were measured and used to identify the region of separation that depends on Reynolds number and the turbulence intensity. Separation control was performed using dielectric barrier discharge (DBD) plasma actuators. Both steady and unsteady actuation were implemented and found to work well. The comparison between the steady and unsteady actuators showed that the unsteady actuators worked better than the steady ones. For the steady actuators, it was found that the separated region is significantly reduced. For the unsteady actuators, where the signal was pulsed, the separation was eliminated. The total pressure losses (a low Reynolds number) was reduced by approximately a factor of two. It was also found that lowest plasma duty cycle (10 percent in this work) was as effective as the highest plasma duty cycle (50 percent in this work). The mechanisms of the steady and unsteady plasma actuators were studied. It was suggested by the experimental results that the mechanism for the steady actuators is turbulence tripping, while the mechanism for the unsteady actuators is to generate a train of spanwise structures that promote mixing.

Author

Turbulence; Turbine Blades; Separated Flow; Boundary Layer Separation; Flow Distribution; Pressure Distribution; Actuators

20070010624 NASA Ames Research Center, Moffett Field, CA USA

Complete Configuration Aero-Structural Optimization Using a Coupled Sensitivity Analysis Method

Martins, Joaquim R; Alonso, Juan J; Martins, R. A.; Reuther, James J; Jan 2002; 16 pp.; In English; 9th AIAA/ISSMO Symposium on Multidisciplinary Analysis and Optimization, 4-6 Sep. 2002, Atlanta, GA, USA; Original contains color illustrations

Contract(s)/Grant(s): F49620-01-1-0291

Report No.(s): AD-A455479; AIAA 2002-5402; Copyright; Avail.: CASI: A03, Hardcopy

This paper focuses on the demonstration of a new integrated aero-structural design method for aerospace vehicles. The approach combines an aero-structural analysis solver, a coupled aero-structural adjoint solver, a geometry-based analysis and design integration strategy, and an efficient gradient-based optimization algorithm. The aero-structural solver ensures highly accurate solutions by using high-fidelity models for both disciplines as well as a high-fidelity coupling procedure. The Euler equations are solved for the aerodynamics and a detailed finite element model is used for the primary structure. The coupled aero-structural adjoint solution is used to calculate the needed sensitivities of aerodynamic and structural cost functions with respect to both aerodynamic shape and structural variables. The geometric outer mold line (OML) serves not only as an interface between the two disciplines for both the state and costate systems, but also as an interface between the numerical optimization algorithm and the high-fidelity analyses. Another set of design variables parameterizes a structure of fixed topology. Kreisselmeier Steinhauser functions are used to reduce the number of structural constraints in the problem. Sample results comparing a fully coupled aero-structural design with a more traditional sequential optimization are presented.

Author

Aerodynamics; Aerospace Vehicles; Sensitivity Analysis; Aerodynamic Configurations

20070010671 NASA Ames Research Center, Moffett Field, CA USA

High-Fidelity Aero-Structural Design Optimization of a Supersonic Business Jet

Martins, Joaquim R. R. A.; Alonso, Juan J; Reuther, James J; January 2002; 15 pp.; In English; 43rd AIAA/ASME/ASCE/AHS/ASC Structures, Structural Dynamics, and Materials Conference, 22-25 Apr. 2002, Denver, CO, USA; Original contains color illustrations

Contract(s)/Grant(s): F49620-01-1-0291

Report No.(s): AD-A455480; AIAA 2002-1483; Copyright; Avail.: CASI: [A03](#), Hardcopy

This paper focuses on the demonstration of an integrated aero-structural method for the design of aerospace vehicles. Both aerodynamics and structures are represented using high-fidelity models such as the Euler equations for the aerodynamics and a detailed finite element model for the primary structure. The aerodynamic outer mold line (OML) and a structure of fixed topology are parameterized using a large number of design variables. The aero-structural sensitivities of aerodynamic and structural cost functions with respect to both aerodynamic shape and structural variables are computed using an accurate and efficient coupled-adjoint procedure. K-S functions are used to reduce the number of structural constraints in the problem. Sample optimization results of the aerodynamic shape and structure of a natural laminar flow supersonic business jet are presented together with an assessment of the accuracy of the sensitivity information obtained using this procedure.

Author

Aerodynamic Configurations; Commerce; Design Optimization; Optimization; Structural Design; Supersonic Aircraft; Supersonic Jet Flow

20070010849 Ohio Univ., Athens, OH USA

Flight Control of Hypersonic Scramjet Vehicles Using a Differential Algebraic Approach (Postprint)

Adami, Tony A; Zhu, J J; Bolender, Michael A; Doman, David B; Oppenheimer, Michael W; Aug 2006; 23 pp.; In English Report No.(s): AD-A462412; No Copyright; Avail.: CASI: [A03](#), Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA462412>

Trajectory Linearization Control is applied to the longitudinal hypersonic scramjet vehicle model under development at the Air Force Research Laboratory. The algorithm is based on Differential Algebraic Spectral Theory which features a time-varying eigenvalue concept and avoids the use of so-called frozen-time eigenvalues which can lead to unreliable results when applied to time-varying dynamics systems. A trajectory linearization control was first designed for a non-linear, affine, rigid-body model using an allocation strategy based on trim-condition look-up tables formulated by trimming the model at multiple operating points while varying velocity and altitude. This data was then fitted to a polynomial function, and the lookup tables were replaced by analytical expressions for the effector settings. The TLC design was then verified on the first-principles based, longitudinal, rigid-body hypersonic vehicle model developed at AFRL using both look-up table and curve fit strategies, and simulation testing results are presented. The current design will be further extended to allow adaptive control of time-varying flexible modes using time-varying bandwidth notch filters and a trajectory linearization observer.

DTIC

Algebra; Flight Control; Hypersonic Aircraft; Hypersonic Vehicles; Linearization; Supersonic Combustion Ramjet Engines; Trajectory Control

20070011096 ZONA Technology, Inc., Scottsdale, AZ USA

Proper Orthogonal Decomposition (POD)/Response Surface Methodology (RSM) Methodology for Low Reynolds Number Aerodynamics on Micro Aerial Vehicle (MAV)

Liu, Danny; Tang, Lei; Jul 2006; 49 pp.; In English

Contract(s)/Grant(s): FA8650-05-M-3548; Proj-A0

Report No.(s): AD-A462551; No Copyright; Avail.: CASI: [A03](#), Hardcopy

This report was developed under a SBIR contract. The phase I project results in two major accomplishments that will facilitate the follow-on MAV design/analysis procedures. These are: a new computational (CFD) approach in the treatment of the low Reynolds number (low-Re) aerodynamics for airfoils and a proper orthogonal decomposition (POD) technique that is essential in providing a rapid CFD solution retrieval/reconstruction procedure for evaluations of forces, and moments for 3D MAV wings. Our low-Re aerodynamic method is based on Wilcox's transition/turbulence model concept in conjunction with a simple computational procedure using CFL3D for RANS simulation. Our method is found to yield correct locations of transition point, separation bubble and transition lengths for several low-Re airfoils including SD7003, Eppler387, La203a, and L VNIO9A. Other turbulence models were also exploited in that Spalart-Allmaras model was found to be superior in yielding the closest solutions with test data. Quasi-3D RANS simulation was performed using our simple low-Re aerodynamic model to investigate the vortex stretching effect of the laminar separation bubble. Finally, a POD technique is applied to a

University of Florida MAV wing planform to demonstrate its reduced-order modeling capability.

DTIC

Aerodynamic Characteristics; Aerodynamics; Decomposition; Low Reynolds Number; Orthogonality; Reynolds Number

20070011146 Michigan Univ., Ann Arbor, MI USA

Trajectory Control for Very Flexible Aircraft

Shearer, Christopher M; Carlos, Cesnik E; Oct 30, 2006; 47 pp.; In English

Report No.(s): AD-A462761; CI07-032; No Copyright; Avail.: CASI: [A03](#), Hardcopy

This paper focuses on trajectory control of the 6-DOF body fixed reference frame located on a very flexible aircraft. The 6-DOF equations of motion of a reference point on the aircraft are coupled with the aeroelastic equations that govern the geometrically nonlinear structural response of the vehicle. A low-order strain-based nonlinear structural analysis coupled with unsteady finite state potential flow aerodynamics form the basis for the aeroelastic model. The nonlinear beam finite element structural model assumes constant strain over an element in extension, twist, and in/out of plane bending. The geometrically nonlinear structural formulation, the finite state aerodynamic model, and the nonlinear rigid body equations together provide a low-order complete nonlinear aircraft analysis tool. Due to the inherent flexibility of the aircraft modeling, the low order structural frequencies are of the same order as the rigid body modes. This creates a coupling which cannot be separated by previous control schemes. The flexibility must be accounted for directly in the controller development. To accomplish this a heuristic approach based upon pilot behavior is developed. This approach separates the problem into two parts: a fast inner-loop and a slower outer-loop. Dominant kinematic nonlinearities are handled in the outer-loop while the inner-loop is further separated into a lateral and longitudinal motion. Control of the inner-loop lateral motion is accomplished using a standard Linear Quadratic Regulator. For the longitudinal motion Dynamic Inversion is utilized. Differences between the desired and actual trajectories are handled in the nonlinear outer-loop using traditional proportional-integral-derivative design guidelines. The closed loop time integration is accomplished using an implicit modified Newmark method. Numerical simulations are presented highlighting the strengths and weaknesses of the method.

DTIC

Aeroelasticity; Aircraft; Flexible Wings; Trajectories; Trajectory Control

20070011159 Knowledge Based Systems, Inc., College Station, TX USA

Smooth Function Modeling for On-Line Trajectory Reshaping Application (Preprint)

Verma, Ajay; Vadakkevedu, Kalyan; Oppenheimer, Michael W; Doman, David B; Jul 2006; 19 pp.; In English

Contract(s)/Grant(s): FA8650-05-C-3505; Proj-A05G

Report No.(s): AD-A462780; No Copyright; Avail.: CASI: [A03](#), Hardcopy

This report was developed under a SBIR contract. Online vehicle trajectory reshaping is desired for a class of autonomous air vehicles such as RLVs in order to avoid catastrophic failure when subjected to performance restricting damages and failures. An Adaptive Trajectory Reshaping and Control (ATRC) system is envisioned that responds to altered vehicle conditions by continuously retargeting and reshaping the reference RLV trajectory satisfying the feasibility constraints. On-line trajectory reshaping to determine a feasible reference trajectory is computationally a difficult problem for real time applications. ATRC is exploring the principles of vehicle dynamics inversion for online generation of feasible reference trajectory. Two essential components for generating reference trajectory for air-vehicles using 'inverse dynamics' methodology are aerodynamic model of the vehicle that is representative of the current state of the vehicle, and a framework for modeling the vehicle trajectory. Physics based modeling software such as Missile DATCOM allows fast computation of aerodynamic coefficients for given flight points and the results can be stored in tabular form. However, for efficient real-time trajectory reshaping application, it is desirable to represent aerodynamic coefficients in smooth functional forms that are governed by a few parameters. Similarly, trajectories must also be represented by smooth functions. In this paper we present modeling of smooth functions using a set of basis functions that are suitable for aerodynamic modeling and trajectory reshaping of the air vehicles. A desirable feature for function modeling is the easy imposition of boundary as well as mid point constraints in the function using a small number of parameters without limiting the scope of the function. In this paper we present a design method for generating orthonormal polynomial basis functions in one and two dimensions with constraints.

DTIC

Aerodynamics; On-Line Systems; Trajectories

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.

20070009641 Illinois Univ. at Urbana-Champaign, Savoy, IL, USA

Display Integration of Air Traffic Control Information: 3D Displays and Proximity Compatibility

Wickens, C. D.; Jan. 1995; 15 pp.; In English

Contract(s)/Grant(s): DTFA01-91-C-00045

Report No.(s): PB2007-105621; ARL-95-2; No Copyright; Avail.: National Technical Information Service (NTIS)

This report describes a series of six experiments that were carried out, primarily to examine the effectiveness of 3D perspective displays in supporting various facets of an air traffic controller's task in the TRACON area, including basic perceptual judgments, traffic flow management, conflict detection, evaluating pilot routing requests, terrain separation and weather separation. Overall the results suggest few differences between conventional planar, and perspective display formats, but where such differences do exist, they favor the conventional 2D (planar) format; and more so with air traffic controller subjects than with pilots trained in ATC skills. The program also addresses differences in the format with which data link information should be conveyed to controllers.

NTIS

Air Traffic Control; Compatibility; Display Devices

20070009659 Air Force Research Lab., Wright-Patterson AFB, OH USA

Real-time Information Extraction for Homeland Defense

Satterthwaite, Charles P; Corman, David E; Herm, Thomas S; Jun 2002; 12 pp.; In English; Original contains color illustrations

Report No.(s): AD-A461384; No Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA461384>

The National interest in Homeland Defense was the farthest thing from most American's minds prior to the horrific attacks of the Pentagon and the World Trade Center. The worst nightmares of many Department of Defense leaders and technologists had been realized. Our Country was hit, and hit hard. No longer could we take for granted our borders, our way of life, or our freedom. For a short while, no cost was too high to re-secure these basic privileges of American life. But the practicality of manning and equipping airports, seaports, power plants, water supply, borders, and many other American Infrastructure entities demanded a more comprehensive and cost effective way of defending our homeland. One practical investment is in the Nation's network of airborne warning ground based radar systems that are deployed throughout the USA and Canada to monitor any air traffic entering either of these countries. This system of networked radars was designed with the philosophy that threats would originate outside the borders of the USA and Canada. The system worked so well, that when thoughts of expanded capability presented themselves, they were abandoned in favor of more (apparent) pressing issues. This paper addresses this system of systems, and how with some insertion of technology, it can absorb its share of the National Homeland Defense.

DTIC

Air Traffic; Command and Control; Decision Support Systems; Extraction; Real Time Operation

20070010755 NASA Glenn Research Center, Cleveland, OH, USA

An Airborne Communications Roadmap for the U.S. Federal Air Marshal Service: Overview and Status

Martzaklis, Konstantinos S.; [2007]; 6 pp.; In English; 4th International Aviation Security Technology Symposium, 27 Nov. - 1 Dec. 2006, Washington, DC, USA; Original contains color illustrations

Contract(s)/Grant(s): WBS 659877.02.03.05.46.01; No Copyright; Avail.: CASI: A02, Hardcopy

ONLINE: <http://hdl.handle.net/2060/20070010755>

Following the events of September 11, 2001, the responsibilities, operations and numbers of the U.S. Federal Air Marshal Service (FAMS) were greatly expanded. With this expansion, new critical research and technology needs were identified, including the need for air to ground telecommunications capabilities. To address this need, the FAMS has created a working group to develop, deploy and enhance aviation communications with respect to security and law enforcement. This paper presents the working group's progress to date in generating a FAMS air-ground communications roadmap identifying expected

communications services, technology maturity, and technology gaps over a timeline. The paper includes a communications preliminary requirements summary and system performance characteristics needed to meet identified operational needs. The system engineering process utilized is presented beginning with the identification of users, their operational needs and relevant constraints. The operational needs are translated to desired airborne communications services. System technical performance requirements associated with the identified services are summarized. In addition, notional communications architectures addressing the requirements are presented. Finally, future plans to identify and assess potential candidate systems and their associated technical architectures, gaps and barriers to implementation are discussed. The paper addresses the current, near term (within 5 years) and far term (10 years) timeframes for such an airborne communications system.

Author

Aircraft Communication; Security; Airborne Equipment; Systems Engineering

20070010762 Lockheed Martin Corp., Hampton, VA, USA

Cockpit Displays for Enhancing Terminal-Area Situational Awareness and Runway Safety

Hyer, Paul V.; Otero, Sharon; Jones, Denise R., Technical Monitor; February 2007; 27 pp.; In English

Contract(s)/Grant(s): NAS1-00135B; WBS 609866.02.07.07.02

Report No.(s): NASA/CR-2007-214545; No Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: <http://hdl.handle.net/2060/20070010762>

HUD and PFD displays have been developed to enhance situational awareness and improve runway safety. These displays were designed to seamlessly transition through all phases of flight providing guidance and information to the pilot. This report describes the background of the Langley Research Center (LaRC) HUD and PFD work, the steps required to integrate the displays with those of other LaRC programs, the display characteristics of the several operational modes and the transitional logic governing the transition between displays.

Author

Runways; Cockpits; Situational Awareness; Aircraft Safety

20070010862 Naval Postgraduate School, Monterey, CA USA

Flight Regime Recognition Analysis for the Army UH-60A IMDS Usage

Dere, Ahmet M; Dec 2006; 127 pp.; In English; Original contains color illustrations

Report No.(s): AD-A462429; No Copyright; Avail.: CASI: A07, Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA462429>

Usage Monitoring requires accurate regime recognition. For each regime, there is a usage assigned for each component. For example, the damage accumulated at a component is higher if the aircraft is undergoing a high G maneuver than in level flight. The objective of this research is to establish regime recognition models using classification algorithms. The data used in the analysis are the parametric data collected by the onboard system and the actual data, consisting of the correct regime collected from the flight cards. This study uses Rpart (with a tree output) and C5.0 (with a ruleset output) to establish two different models. Before model fitting, the data was divided into smaller datasets that represent regime families by subsetting using important flight parameters. Nonnormal tolerance intervals are constructed on the uninteresting values; then these values in the interval are set to zero to be muted (e.g. excluded). These processes help reduce the effect of noise on classification. The final models had correct classification rates over 95%. The number of bad misclassifications were minimized (e.g. the number of bad misclassifications of a level flight regime as a hover regime was minimized), but the models were not as powerful in classifying the low-speed regimes as in classifying high-speed regimes.

DTIC

Helicopters; Maintenance; Systems Integration; UH-60A Helicopter

20070010911 Link Simulation and Training, Mesz, AZ USA

A Comparison of the Temporal Characteristics of LCS, LCoS, Laser, and CRT Projectors

Geri, George A; Morgan, William D; Dec 2006; 14 pp.; In English

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

Report No.(s): AD-A462549; No Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA462549>

We have measured the temporal response of a commercial liquid crystal on silicon (LCoS) projector, and have compared it to that of commercial liquid crystal display (LCD) and cathode ray tube (CRT) projectors, as well as to a prototype laser projector. The faster temporal response of LCoS displays, as compared to more conventional LCDs, has not been considered

a major factor in their commercial use, and so individual pixels are not turned on and off in these devices as quickly as the technology allows. Based on informal discussions with LCoS manufacturers and users, it appears that changes can be made in the LCoS display electronics to reduce pixel response times in order to sufficiently reduce smearing in moving simulator images.

DTIC

Cathode Ray Tubes; Flight Simulation; Lasers; Liquid Crystals; Projectors; Silicon

20070011124 Naval Postgraduate School, Monterey, CA USA

Cost Analysis of Civilian-Sailor Substitution Plan for Ashore Aircraft Intermediate Maintenance Departments

Scott, Matthew M; Dec 2006; 113 pp.; In English; Original contains color illustrations

Report No.(s): AD-A462731; No Copyright; Avail.: CASI: [A06](#), Hardcopy

This thesis provides a cost analysis of the plan to civilianize 4355 enlisted billets at ten shore-based Aircraft Intermediate Maintenance Departments (AIMDs). Total cost was determined for each UIC, billet, and rating. Active duty costs were compared to Government Service (GS)/Wage Grade (WG) workers and comparisons were calculated across currently funded billets. Specific savings for each AIMD, rating, total projected savings, and an Excel decision support tool are provided to aid the sponsor with decisions about which ratings, groups of ratings, or while UICs to Civ-Sub. A summary of potential sea shore rotation impacts is also included. The analysis revealed a potential personnel cost savings of 14.27%. When administrative and contractual costs are considered, along with the standard deviations inherent in this type of analysis, the overall cost effectiveness of Civ-Sub is negligible. Other effects must be considered, including active duty manpower reductions on host Naval Air Stations, significant shore duty billet reductions, costs above and beyond personnel, and retention. Potential retention effects could eventually affect manning levels at sea and ultimately damage afloat AIMD readiness. The cost savings ashore (assuming there are) from implementing Civ-Sub will not compensate for the inability to maintain aircraft and aircraft components while deployed.

DTIC

Cost Analysis; Maintenance; Substitutes

20070011126 Naval Postgraduate School, Monterey, CA USA

Application of Neural Networks to Predict UH-60L Electrical Generator Condition using (IMD-HUMS) Data

Tourvalis, Evangelos; Dec 2006; 99 pp.; In English; Original contains color illustrations

Report No.(s): AD-A462734; No Copyright; Avail.: CASI: [A05](#), Hardcopy

In 2003, the US Army began using the Integrated Mechanical Diagnostics Health and Usage Management System (IMD-HUMS), an integrated airborne and ground-based system developed by Goodrich Corporation, to support maintenance of the UH-60L. IMD-HUMS is responsible for collecting, processing, analyzing, and storing an enormous amount of vibratory and flight regime data obtained from sensors located throughout the aircraft. The purpose of this research is to predict failures of the UH-60L's electrical generators, applying Artificial Neural Networks (ANN) on the IMD-HUMS-produced data. Artificial NNs are data based vice rule based, thereby possessing the potential capability to operate where analytical solutions are inadequate. They are reputed to be robust and highly tolerant of noisy data. Software tools such as Clementine 10.0, S-Plus 7.0, and Excel are used to establish these predictions. This research has verified that ANNs have a position in machinery condition monitoring and diagnostics. However, the limited nature of these results indicates that ANNs will not solve all machinery condition monitoring and diagnostics problems by themselves. They certainly will not completely replace conventional rule-based expert systems. Ultimately, it is anticipated that a symbiotic combination of these two technologies will provide the optimal solution to the machinery condition monitoring and diagnostics problem.

DTIC

Computer Techniques; Maintenance; Neural Nets

20070011240 Arizona State Univ., Tempe, AZ USA

Visual Spatial Disorientation: Re-Visiting the Black Hole Illusion

Gibb, Randall W; Jan 24, 2007; 31 pp.; In English

Report No.(s): AD-A462899; CI07-0009; No Copyright; Avail.: CASI: [A03](#), Hardcopy

Visual spatial disorientation (SD) is cited often as a contributor to aviation accidents. The black hole illusion (BHI), a specific type of featureless terrain illusion, is a leading type of visual SD experienced by pilots. A BHI environment refers not to the landing runway but the environment surrounding the runway and the lack of ecological cues for a pilot to proceed visually. The problem is that pilots, despite the lack of visual cues, confidently proceed with a visual approach. The featureless

landing environment may induce a pilot into feeling steep (above the correct glide path) and over-estimate their perceived angle of descent (PAD) to the runway. Consequently, a pilot may initiate an unnecessary and aggressive descent resulting in an approach angle far too shallow (below the correct glide path to landing) to guarantee obstacle clearance. This review addresses two questions. One, why do pilots over-estimate their PAD? And two, if visual SD is such a well-researched and documented phenomenon, why does visual SD still continue to contribute to aviation accidents today? Based on previous research, eight reasons are hypothesized as why a pilot over-estimates PAD. Also, a historical review of the BHI is presented as well as a discussion of past research and accident investigations that demonstrate inconsistencies regarding the state of the BHI.

DTIC

Aircraft Accidents; Black Holes (Astronomy); Disorientation; Illusions; Physiology; Terrain

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.

20070009639 General Accounting Office, Washington, DC USA

Unmanned Aircraft Systems: DOD Needs to More Effectively Promote Interoperability and Improve Performance Assessments

Dec. 2005; 39 pp.; In English

Report No.(s): PB2007-105650; GAO-06-49; No Copyright; Avail.: CASI: [A03](#), Hardcopy

Unmanned aircraft systems (UAS) consist of an unmanned aircraft; sensor, communications, or weapons, carried on board the aircraft, collectively referred to as payloads; and ground controls. UAS have been used successfully in recent operations, and are in increasingly high demand by U.S. forces. To meet the demand, the Department of Defense (DOD) is increasing its investment in and reliance on UAS, and often deploying them while still in development. GAO has previously found that DODs approach to developing and fielding UAS risked interoperability problems which could undermine joint operations. GAO was asked to review (1) UAS performance in recent joint operations and (2) the soundness of DODs approach to evaluating joint UAS operational performance.

NTIS

Defense Program; Interoperability; Payloads; Pilotless Aircraft

20070009689 National Oceanic and Atmospheric Administration, Oak Ridge, TN, USA

NOAA ARL Mobile Flux Platform Instrumentation Integration on University of Alabama Sky Arrow Environmental Aircraft

Hall, P. G.; Dumas, E. J.; Senn, D. L.; Oct. 2006; 52 pp.; In English

Report No.(s): PB2007-103353; NOAA/TM/ARL-257; No Copyright; Avail.: National Technical Information Service (NTIS)

The University of Alabama and the NOAA Air Resources Laboratory (ARL) entered into a cooperative agreement to conduct atmospheric research using a Sky Arrow 650 Environmental Research Aircraft. In 2004 the Sky Arrow Aircraft was instrumented with the Mobile Flux Platform (MFP) instrument suite developed by NOAA/ARL. The University of Alabama manages the aircraft program, and the instrumentation was integrated by NOAA/ARL. Both groups are involved in data analysis, research, and instrumentation. The instrument suite includes a wind measurement system, environmental instrumentation and a data collection system. This technical memorandum gives the reader a description of each system installed in the aircraft and how they are integrated into the data collection system.

NTIS

Air Pollution; Atmospheric Circulation; Pollution Monitoring; Research Aircraft; Alabama; NOAA Satellites

20070010628 NASA Glenn Research Center, Cleveland, OH, USA

Future Fuel Scenarios and Their Potential Impact to Aviation

Hendricks, Robert C.; Lowery, Nathan; Daggett, David L.; Anast, Peter; [2007]; 18 pp.; In English; Original contains color illustrations; Copyright; Avail.: CASI: [A03](#), Hardcopy

In recent years fuel prices have been growing at a rapid pace. Current conservative projections predict that this is only

a function of the natural volatility of oil prices, similar to the oil price spikes experienced in the 1970s. However, there is growing concern among analysts that the current price increases may not only be permanent, but that prices may continue to increase into the future before settling down at a much higher level than today. At high enough fuel prices, the aircraft industry would become very sensitive to fuel price. In this paper, the likelihood of fuel price increase is considered in three different price increase scenarios: 'low,' 'medium,' and 'high.' The impact of these scenarios on the aviation industry and alternatives are also addressed.

Author

Aircraft Industry; Cost Estimates; Aircraft Fuels

20070010808 Lumir Research Inst., Grayslake, IL USA

Distributed Mission Operations Within-Simulator Training Effectiveness Baseline Study. Volume 3. Real-Time and Blind Expert Subjective Assessments of Learning

Schreiber, Brian T; Gehr, Sara E; Bennett, Jr , Winston; Jul 2006; 32 pp.; In English

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

Report No.(s): AD-A462346; No Copyright; Avail.: CASI: [A03](#), Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA462346>

The current work documented in this report is the subject matter expert (SME) rating data from a large study examining the within-simulator learning benefits of Distributed Mission Operations (DMO) training as described in AFRL-HE-AZ-TR-2006-0015 Vol I, Distributed Mission Operations Within-Simulator Training Effectiveness Baseline Study: Summary Report. That study examined 76 participating F-16 four-ship teams in week-long DMO training exercises and compared beginning-of-week to end-of-week performance on mirror-image air combat scenarios. As a major assessment component to the overall study, the current work reports data we collected from SME ratings of pilot performance. Two SME rating methods were employed -- real-time ratings (i.e., done during mission execution) and SME ratings captured later using a scientific 'blind' protocol. Comparing SME ratings of performance on the mirror-image scenarios revealed highly significant performance increases as a function of DMO training. SME real-time and blind ratings were both found to be significantly higher for end-of-week scenarios. The fact that the real-time and blind rater results corroborated one another provides strong support that performance greatly improved as a function of DMO training. Lastly, though the real-time ratings are not as scientific as the blind ratings, the fact that the blind ratings revealed very similar results to the real-time ratings greatly increases our confidence for continuing to use real-time ratings to assess performance. Compared to implementing an ongoing blind rating system, this justification to use real-time ratings creates a significant logistical, time, and financial savings for future research.

DTIC

Education; Ratings; Real Time Operation; Training Simulators

20070010814 Lumir Research Inst., Grayslake, IL USA

Distributed Mission Operations Within-Simulator Training Effectiveness Baseline Study. Volume 4. Participant Utility and Effectiveness Opinions and Ratings

Schreiber, Brian T; Rowe, Leah; Bennett, Jr , Winston; Jul 2006; 66 pp.; In English

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

Report No.(s): AD-A462355; No Copyright; Avail.: CASI: [A04](#), Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA462355>

The work in this report focuses on the user acceptance of the Air Force Research Laboratory, Human Effectiveness Directorate, Warfighter Readiness Research Division (AFRL/HEA) Distributed Mission Operations (DMO) training research site which contains four high-fidelity F-16 simulators, an Airborne Warning and Control System (AWACS) simulator, a threat generation system, and a full complement of brief/debrief technologies. The 327 F-16 pilots and the 49 AWACS users based their opinions on experiences obtained during consistent local area network five-day training research syllabi containing over 40 total 4vX scenarios, primarily air-to-air with some air-to-ground. Examining the user ratings for opinions about the DMO environment revealed that across all 58 rated statements, both F-16 and AWACS participants generally like the environment. 'I would recommend this training experience to other pilots/controllers' was rated by all but one of 49 controllers and all but 16 of 327 pilots with the highest rating possible of 'Strongly Agree.' Performing a content analysis on their open-ended responses to what they felt was most beneficial about the environment, F-16 pilots most frequently wrote comments relating to 'realistic qualities,' while AWACS operators most frequently wrote positive comments regarding the 'scenarios.' The second most written comment for both the F-16 and AWACS operators related to positive skill acquisition. Finally, when asked to rate to what extent the Mesa DMO system provides the 45 different F-16 critical air-to-air experiences (defined by the Mission

Essential Competency process), the pilots rated that 38 experiences (84%) could be obtained 'to a moderate extent' or higher, more than all seven other environments surveyed.

DTIC

Distributed Interactive Simulation; Education; Pilots; Ratings; Training Simulators

20070010815 Lumir Research Inst., Grayslake, IL USA

Distributed Mission Operations Within-Simulator Training Effectiveness Baseline Study. Volume 5. Using the Pathfinder Methodology to Assess Pilot Knowledge Structure Changes

Schreiber, Brian T; DiSalvo, Pam; Stock, William A; Bennett, Jr, Winston; Jul 2006; 30 pp.; In English

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

Report No.(s): AD-A462356; No Copyright; Avail.: CASI: [A03](#), Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA462356>

To provide an indirect assessment of learning for the overall Distributed Mission Operations (DMO) Within Simulator Training Effectiveness Baseline Study as described in Volume I, Summary Report, of AFRL-HE-AZ-TR-2006-0015, the current work examined pilots who participated in a Pathfinder data collection methodology both before and after five days of DMO training. The Pathfinder methodology is a qualitative/quantitative method that can be used to assess if the pilots' underlying knowledge structures (i.e., their understanding) of air combat may have changed significantly as a function of DMO training. A total of 144 F-16 pilots rated the relatedness of 105 pairs of air combat concepts. Analyzing the before/after DMO training Pathfinder results by flight qualification or Viper flight position revealed remarkably similar results across all matrices. The most remarkable attribute of these networks is their stability; the pilots, regardless of demographic classification or before/after DMO training, view the relationships between the air combat concepts in very similar ways. We postulate that the stability of the networks most likely indicates that the 15 chosen concepts are at a high level of abstraction and reflect the shared knowledge in the general F-16 pilot population. As such, the concepts are likely not sensitive enough (i.e., detailed enough) to reflect differences in understanding resulting from five days of DMO training.

DTIC

Education; Performance Tests; Pilots; Training Simulators

20070010816 Naval Postgraduate School, Monterey, CA USA

Experimental Investigation of Pitch Control Enhancement to the Flapping Wing Micro Air Vehicle

Kian, Chin C; Dec 2006; 135 pp.; In English; Original contains color illustrations

Report No.(s): AD-A462357; No Copyright; Avail.: CASI: [A07](#), Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA462357>

The mechanical pitching characteristic of the NPS flapping-wing Micro Air Vehicle (MAV) developed by Professor Kevin D. Jones are studied experimentally through the use of constant temperature anemometry and force balance techniques. The MAV without the main fixed-wing is placed in a laminar flow field within a low speed wind tunnel with the wake after the flapping wings characterized with a constant temperature anemometer and thrust generation measured by a load cell at various neutral angles, flapping frequencies and free stream velocities. The experiments seek to determine the effects on the MAV propulsion when the neutral angle of attack of the flapping wings is varied. Flow visualization is also performed to better enhance understanding of the flow field across the pitched flapping wings.

DTIC

Anemometers; Augmentation; Flapping; Flow Distribution; Free Flow; Propulsion; Propulsion System Configurations; Propulsion System Performance; Reynolds Number; Wings

20070010857 Naval Postgraduate School, Monterey, CA USA

Applicability of Unmanned Aerial Systems to Homeland Defense Missions

DeVane, John C; Dec 2006; 101 pp.; In English; Original contains color illustrations

Report No.(s): AD-A462422; No Copyright; Avail.: CASI: [A06](#), Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA462422>

Battlefield success of Unmanned Aerial Systems (UAS) prompted Department of Defense and Department of Homeland Security leaders to examine their possible applicability to homeland defense missions within the National Strategy for Homeland Security. The National Strategy for Homeland Security incorporates all levels of government to include law enforcement agencies and the military, the predominant owner and operator of UASs. The military, however, is restricted in its domestic role by the Posse Comitatus Act, and is therefore limited in its domestic employment of UASs. In order to

determine the applicability of UASs to homeland defense missions, it is necessary to examine the capabilities of available UASs, to match them with mission requirements, and determine the legality of where they can be used and who can operate them. A policy that places combat UAS capability with Title 10 military forces and homeland defense mission capability with Title 32 and law enforcement agencies will fulfill the goals stated in the national strategy and function within the current legal framework.

DTIC

Air Defense; Drone Vehicles; Intelligence; Law (Jurisprudence); Pilotless Aircraft; Reconnaissance; Surveillance

20070010884 Library of Congress, Washington, DC USA

Military Airlift: C-17 Aircraft Program

Bolkcom, Christopher; Jan 25, 2007; 23 pp.; In English; Original contains color illustrations

Report No.(s): AD-A462474; CRS/DC-RL30685; No Copyright; Avail.: CASI: [A03](#), Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA462474>

The C-17 Globemaster III is a long-range cargo/transport aircraft operated by the U.S. Air Force since 1993. Congress approved development of the aircraft in the late 1970s, when it was recognized that the Air Force did not have enough airlift capability. In 1981, the McDonnell Douglas C-17 emerged as winner of a competition with Boeing and Lockheed to develop a next-generation aircraft to replace C-130s and C-141s.

DTIC

C-17 Aircraft; Transport Aircraft

20070010918 Naval Postgraduate School, Monterey, CA USA

Incorporating Target Mensuration System for Target Motion Estimation Along a Road Using Asynchronous Filter

Yap, Kwee C; Dec 2006; 59 pp.; In English; Original contains color illustrations

Report No.(s): AD-A462568; No Copyright; Avail.: CASI: [A04](#), Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA462568>

In support of TNT experiments, the NPS UAV laboratory has developed a Vision-Based Target Tracking (VBTT) system for a Small Unmanned Aerial Vehicle (SUAV). This system provides an autonomous target tracking capability, while simultaneously estimating the target's velocity and position. The accuracy of the existing system can be improved by providing external corrections to the target position estimation from the geo-rectification system (GIS). This thesis addresses the implementation of an asynchronous correction scheme into the target position estimation filter. The current autonomous position estimation algorithm provides 20-30 meters accuracy. The external correction system (Perspective View Nascent Technologies (PVNT)) is expected to provide target position accuracy of 1-2 m. However, a delay of up to 10 seconds is expected. Therefore, in order to improve the accuracy of current estimation of target motion, a new asynchronous correction technique that incorporates the more accurate PVNT data is proposed. To further improve the target motion estimation, it was also proposed to incorporate a known road model into the filter and compare its performance with the original filter.

DTIC

Drone Vehicles; Roads; Synchronism; Targets

20070010936 Naval Postgraduate School, Monterey, CA USA

Tethered Operation of Autonomous Aerial Vehicles to Provide Extended Field of View for Autonomous Ground Vehicles

Phang, Nyit S; Dec 2006; 63 pp.; In English; Original contains color illustrations

Report No.(s): AD-A462612; No Copyright; Avail.: CASI: [A04](#), Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA462612>

This thesis was part of the ongoing research conducted at the Naval Postgraduate School to achieve greater collaboration between heterogeneous autonomous vehicles. The research addresses optimal control issues in the collaboration between an Unmanned Aerial Vehicle (UAV) and Autonomous Ground Vehicles (AGV). The scenario revolves around using the camera onboard the UAV to extend the effective field of view of the AGV. For military operations, this could be helpful in improving security for convoys and riverine patrols. There were three main problems addressed in this thesis. The first problem dealt with the design of a UAV control law that takes into consideration the relative speed differences between the UAV and the AGV. The UAV was assumed to have a greater speed compared to the AGV in this thesis. The second was the keystone field of view projection effect of the UAV's onboard camera onto the earth. The image captured by the camera was distorted due to the view angle of the camera from a high elevation. The third problem addressed was control of the location of the UAV to ensure the

reliability of the communication network between the UAV and the AGV. The communication was assumed to be a linear function of the relative positions of the UAV and the AGV.

DTIC

Aircraft; Autonomy; Field of View; Pilotless Aircraft; Tethering

20070011110 Clemson Univ., SC USA

Output Feedback Tracking Control of an Underactuated Quad-Rotor UAV

Lee, DongBin; Burg, Timothy; Xian, Bin; Dawson, Darren; Sep 25, 2006; 42 pp.; In English; Original contains color illustrations

Report No.(s): AD-A462603; CU/CRB/2/28/06/ 2; No Copyright; Avail.: CASI: [A03](#), Hardcopy

This paper proposes a new controller for an underactuated quad-rotor family of small-scale unmanned aerial vehicles (UAVs) using output feedback (OFB). Specifically, an observer is designed to estimate the velocities and an output feedback controller is designed for a nonlinear UAV system in which only position and angles are measurable. The design is performed via a Lyapunov type analysis. A semi-global uniformly ultimate bounded (SGUUB) tracking result is achieved. Simulation results are shown to demonstrate the proposed approach.

DTIC

Drone Vehicles; Feedback; Feedback Control; Pilotless Aircraft; Rotors

20070011115 Naval Postgraduate School, Monterey, CA USA

Development and Implementation of New Control Law for Vision Based Target Tracking System Onboard Small Unmanned Aerial Vehicles

Chong, Tay B; Dec 2006; 109 pp.; In English; Original contains color illustrations

Report No.(s): AD-A462713; No Copyright; Avail.: CASI: [A06](#), Hardcopy

A new control law is being developed and implemented for the Vision Based Target Tracking (VBTT) system onboard a small unmanned aerial vehicle (SUAV). The new control law allows for coordinated SUAV guidance and vision-based target tracking of stationary and moving targets in the presence of atmospheric disturbances and measurements noise. The new control law is tested for its performance and stability in both the theoretical 6DOF simulation and the Hardware-in-the-Loop (HIL) simulation. Principal results show that realistic measures of performance of the control law are continuous and exhibit predictable degradation of performance with increase of target speed. The results are encouraging and comparable among theoretical predictions, actual hardware simulation results, and initial flight testing. The control law development, implementation, and trial processes and procedures are also examined and categorically documented in this thesis as future reference on the subject development, as well as for better knowledge retention, continuation and proliferation of the VBTT system.

DTIC

Control Theory; Pilotless Aircraft; Radar Tracking; Remotely Piloted Vehicles; Target Acquisition; Targets; Tracking (Position)

20070011150 RAND Corp., Santa Monica, CA USA

Aircraft Modifications: Assessing the Current State of Air Force Aircraft Modifications and the Implications for Future Military Capability

Hill, Owen J; Jan 25, 2007; 157 pp.; In English

Report No.(s): AD-A462766; CI07-0020; No Copyright; Avail.: CASI: [A08](#), Hardcopy

The purpose of this dissertation is to expand the analysis of aircraft modifications to include an aggregate perspective of all recent modifications. The objective is to formulate good policy in order to help direct the future of modernization within the Air Force. Specifically, it will use a dataset constructed during this thesis describing all aircraft modifications from the years 1996 through 2005 to examine the impact of aging on modifications costs, the efficiency of procurement and installation planning, the implementation of safety modifications, and some expectations for the future of aircraft modifications. This summary will state the four research questions addressed in this dissertation as well as a brief explanation of the methods and conclusions related to each question. What are the historical trends that have preceded the present environment for aircraft modifications in the Air Force? Changing circumstances are a common occurrence for the USA military. For the Air Force in particular, things are changing in such a way that demands a response from the organizational structure. These changes include: new aircraft, a new standard of evolutionary acquisition, and aging aircraft. Each of these changes indicates that the

Air Force modification policy will be increasingly important in the future.

DTIC

Aircraft; Procurement

20070011205 Army Aeromedical Research Lab., Fort Rucker, AL USA

Comparison of Hearing in Noise Test (HINT) Scores Using Three Different Transducers

Ribera, John; Feb 2007; 16 pp.; In English

Contract(s)/Grant(s): DAAD19-02-D-0001; Proj-878

Report No.(s): AD-A462841; USAARL-2007-08; No Copyright; Avail.: CASI: [A03](#), Hardcopy

Army aircrew in hostile listening environments rely on hearing for crew coordination--a critical component of rotary-wing aviation. New technologies may require aviators to have the ability to not only hear in noise but also to localize warning and other signals. The Hearing in Noise Test (HINT) evaluates functional hearing in noise but has only been normalized using supra-aural headphones. Method: Sixty normal hearing students from Utah State University were equally partitioned into three groups. Each group was administered the HINT in four test conditions with one of three transducers: (a) THD-39 supra-aural, (b) ER-3A foam insert, or (c) the Communications Earplug (CEP). Results: Data analysis revealed no significant differences between scores obtained using the three transducers in any of the three noise conditions. There was a difference between the THD-39P results and those obtained from the other two insert earphones in the quiet condition that was likely due to a calibration issue. Conclusion: Insert-type earphones should be considered for administration of the HINT once a correction factor has been established.

DTIC

Earphones; Flight Crews; Hearing; Transducers

07

AIRCRAFT PROPULSION AND POWER

Includes primary propulsion systems and related systems and components, e.g., gas turbine engines, compressors, and fuel systems; and onboard auxiliary power plants for aircraft. For related information see also 20 Spacecraft Propulsion and Power; 28 Propellants and Fuels; and 44 Energy Production and Conversion.

20070010527 United Technologies Corp., East Hartford, CT, USA

Split Ring Retainer for Turbine Outer Air Seal

Trinks, S. W.; Lemieux, S. G.; Reinhardt, G. E.; 28 Mar 05; 8 pp.; In English

Contract(s)/Grant(s): N00019-02-C-3003

Patent Info.: Filed Filed 28 Mar 05; US-Patent-Appl-SN-11-091-204

Report No.(s): PB2007-101464; No Copyright; Avail.: CASI: [A02](#), Hardcopy

A retainer for securing the outer air seal assembly of a turbine rotor stage in a locked position. The outer air seal is suspended from the turbine casing over the rotor stage and is locked to the casing by annular segmented locking keys. A series of circumferentially spaced seats are located upon the front face of the locking key segments with the outer surfaces of the seats describing a circle approximating a first diameter. A split ring retainer is slidably carried in a radially disposed groove and is arranged to secure the key segments in a locked position. A series of lugs extend inwardly from the inside wall of the ring. The lugs are circumferentially spaced about the ring with the inner surface of the lugs approximating a circle having a second diameter that is less than that of the first diameter approximated by the seats. The lugs are spaced so that each lug can be seated upon a seat to flex the ring outwardly in a radial direction and thus secure the key segment in a locking position.

NTIS

Rotors; Seals (Stoppers); Turbines

20070010528 United Technologies Corp., East Hartford, CT, USA

Blade Outer Seal Assembly

Thompson, R. J.; Tholen, S. M.; 28 Mar 05; 7 pp.; In English

Contract(s)/Grant(s): N00019-02-C-30003

Patent Info.: Filed Filed 28 Mar 05; US-Patent-Appl-SN-11-091-172

Report No.(s): PB2007-101465; No Copyright; Avail.: CASI: [A02](#), Hardcopy

An outer seal assembly of a turbine rotor stage is secured within a circumferential groove of the turbine casing in such a manner as to both fix the outer seal assembly in its installed position and also provide for sealing around its outer periphery

so as to thereby prevent the leakage of cooling air therearound. A plurality of arcuate elements having an angle-shaped cross sectional profile are provided to interface between radially extending arms of the outer seal assembly and the inner surface of the casing, with a locking mechanism then being applied to secure the two structures in their installed positions. Each of the arcuate elements includes a radially extending panel, a plurality of forwardly extending hooks that are disposed within a groove in the casing, and a second forwardly extending flange that engages the rear surface of the outer seal assembly arm. As the outer seal assembly arm is urged rearwardly during operation, the arcuate element is caused to rotate about a fulcrum in the circumferential groove such that a radially outer edge of the radially extending panel is urged against a casing inner surface so as to thereby enhance the sealing relationship therebetween.

NTIS

Rotors; Seals (Stoppers); Turbine Blades

20070010587 NASA Glenn Research Center, Cleveland, OH, USA

Experimental Results of Performance Tests on a Four-Port Wave Rotor

Wilson, John; Welch, Gerard E.; Paxson, Daniel E.; February 2007; 23 pp.; In English; 45th Aerospace Sciences Meeting and Exhibit, 8-11 Jan. 2007, Reno, NV, USA; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 561581.02.07.03.02.01

Report No.(s): NASA/TM-2007-214488; E-15779; ARL-TR-4044; Copyright; Avail.: CASI: [A03](#), Hardcopy

A series of tests has been performed on a four-port wave rotor suitable for use as a topping stage on a gas turbine engine, to measure the overall pressure ratio obtainable as a function of temperature ratio, inlet mass flow, loop flow ratio, and rotor speed. The wave rotor employed an open high pressure loop that is the high pressure inlet flow was not the air exhausted from the high pressure outlet, but was obtained from a separate heated source, although the mass flow rates of the two flows were balanced. This permitted the choice of a range of loop-flow ratios (i.e., ratio of high pressure flow to low pressure flow), as well as the possibility of examining the effect of mass flow imbalance. Imbalance could occur as a result of leakage or deliberate bleeding for cooling air. Measurements of the pressure drop in the high pressure loop were also obtained. A pressure ratio of 1.17 was obtained at a temperature ratio of 2.0, with an inlet mass flow of 0.6 lb/s. Earlier tests had given a pressure ratio of less than 1.12. The improvement was due to improved sealing between the high pressure and low pressure loops, and a modification to the movable end-wall which is provided to allow for rotor expansion.

Author

Mass Flow Rate; Gas Turbine Engines; Performance Tests; Temperature Ratio; Rotor Speed; Pressure Ratio; Inlet Flow

20070010763 NASA Glenn Research Center, Cleveland, OH, USA

Introduction to Advanced Engine Control Concepts

Sanjay, Garg; January 31, 2007; 36 pp.; In English; Fundamentals of Aircraft Engine Control Design Course, 12-16 Feb. 2007, Oklahoma City, OK, USA; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 732759.03.01.02.17; No Copyright; Avail.: CASI: [A03](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20070010763>

With the increased emphasis on aircraft safety, enhanced performance and affordability, and the need to reduce the environmental impact of aircraft, there are many new challenges being faced by the designers of aircraft propulsion systems. The Controls and Dynamics Branch at NASA (National Aeronautics and Space Administration) Glenn Research Center (GRC) in Cleveland, Ohio, is leading and participating in various projects in partnership with other organizations within GRC and across NASA, the U.S. aerospace industry, and academia to develop advanced controls and health management technologies that will help meet these challenges through the concept of Intelligent Propulsion Systems. The key enabling technologies for an Intelligent Propulsion System are the increased efficiencies of components through active control, advanced diagnostics and prognostics integrated with intelligent engine control to enhance operational reliability and component life, and distributed control with smart sensors and actuators in an adaptive fault tolerant architecture. This presentation describes the current activities of the Controls and Dynamics Branch in the areas of active component control and propulsion system intelligent control, and presents some recent analytical and experimental results in these areas.

Author

Engine Control; Propulsion System Configurations; Active Control; Reliability Engineering; Distributed Parameter Systems; Actuators; Controllability; Diagnosis

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.

20070009837 NASA Ames Research Center, Moffett Field, CA, USA

Development of Handling Qualities Criteria for Rotorcraft with Externally Slung Loads

Hoh, Roger H.; Heffley, Robert K.; Mitchell, David G.; October 2006; 173 pp.; In English; Original contains color and black and white illustrations

Contract(s)/Grant(s): NAS2-14360

Report No.(s): NASA/CR-2006-213488; U.S. Army RDECOM No. AFDD/TR-06-003; A-060008; No Copyright; Avail.:

CASI: A08, Hardcopy

ONLINE: <http://hdl.handle.net/2060/20070009837>

Piloted simulations were performed on the NASA-Ames Vertical Motion Simulator (VMS) to explore handling qualities issues for large cargo helicopters, particularly focusing on external slung load operations. The purpose of this work was based upon the need to include handling qualities criteria for cargo helicopters in an upgrade to the U.S. Army's rotorcraft handling qualities specification, Aeronautical Design Standard-33 (ADS-33E-PRF). From the VMS results, handling qualities criteria were developed for cargo helicopters carrying external slung loads in the degraded visual environment (DVE). If satisfied, these criteria provide assurance that the handling quality rating (HQR) will be 4 or better for operations in the DVE, and with a load mass ratio of 0.33 or less. For lighter loads, flying qualities were found to be less dependent on the load geometry and therefore the significance of the criteria is less. For heavier loads, meeting the criteria ensures the best possible handling qualities, albeit Level 2 for load mass ratios greater than 0.33.

Author

Helicopters; Flight Characteristics; Loads (Forces); Vertical Motion Simulators; Controllability

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 astronomical facilities see 14 *Ground Support Systems and Facilities (Space)*.

20070009692 Dames and Moore, Washington, DC USA

Fort Jackson, South Carolina, Terrain Analysis

Apr 1979; 45 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DACA87-78-C-0276

Report No.(s): AD-A461625; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The major purpose of the program is to assist military planners in future stationing decision. To achieve this purpose, planners must obtain an appreciation of the on-post terrain that includes among other things, knowledge of the suitability for conducting field training exercises involving maneuverability of troops and military vehicles. The degree of maneuverability that can be achieved is a function of several terrain factors including slope, surface configuration, soils, vegetative cover, and surface drainage, all of which are treated in the studies. Planners concerned with troop stationing also need certain off-post information such as statistics on housing, schools, hospitals, and public utilities in urban areas near installations, as well as pertinent data on airfields and ports in the vicinity. These items are also treated in the studies. Because the program under which this study was prepared is intended to serve troop stationing requirements, the support provided by the program to environmental requirements is only incidental. Some of the information contained in the studies may be useful as environmental baseline data, but the studies are by no means complete environmental inventories of the kind required in support of environmental impact assessments.

DTIC

Terrain; Terrain Analysis

20070009694 Dames and Moore, Washington, DC USA

Fort Knox, Kentucky, Terrain Analysis

Mar 1979; 61 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DACA87-78-C-0276

Report No.(s): AD-A461626; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The major purpose of the program is to assist military planners in future stationing decisions. To achieve this purpose, planners must obtain an appreciation of the on-post terrain that includes among other things, knowledge of the suitability for conducting field training exercises involving maneuverability of troops and military vehicles. The degree of maneuverability that can be achieved is a function of several terrain factors including slope, surface configuration, soils, vegetative cover, and surface drainage, all of which are treated in the studies. Planners concerned with troop stationing also need certain off-post information such as statistics on housing, schools, hospitals, and public utilities in urban areas near installations, as well as pertinent data on airfields and ports in the vicinity. These items are also treated in the studies. Because the program under which this study was prepared is intended to serve troop stationing requirements, the support provided by the program to environmental requirements is only incidental. Some of the information contained in the studies may be useful as environmental baseline data, but the studies are by no means complete environmental inventories of the kind required in support of environmental impact assessments.

DTIC

Terrain; Terrain Analysis

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*.

20070010693 Institute of Space Medico-Engineering, Beijing, China, Institute of Space Medico-Engineering, Beijing, China **Space Medicine and Medical Engineering (Hangtian Yixue Yu Yixue Gongcheng), Volume 19, No. 6, December 2006** Chen, S. G.; Dec. 15, 2006; 100 pp.; In Chinese

Report No.(s): PB2007-105584; Copyright; Avail.: National Technical Information Service (NTIS)

;Partial Contents: Effects of Psoralen on Improving Chemotherapeutics Drug' s Concentration of H1i0 Cells(In English); Recurrence Quantification Analysis of Blood Pressure Signal in Rats after Simulated Weightlessness; Effects of Simulated Weightlessness on Activity of ERK Induced by BMP-2 in ROS17/2. 8 Cells; Sympathetic Responses in Caloric Stimulation: Role in the Cardiovascular Control of Anesthetized Rats; Induced Cardiomyogenic Differentiation of Bone Marrow Mesenchymal Stem Cells in Vitro; Evaluation of Joint Motion Based on Perceived Discomfort; Selection of Salad Vegetables in Controlled Ecological Life Support System; Numerical Simulation of CO₂ Removal with Carbon Molecular Sieve for Use in Portable Life Support; An Automatic Image Co-registration Algorithm Based on Signal Correlation Function and Artificial Neural Network; Experimental Study on Dependence of Diffusion Tensor-derived Parameters upon Diffusion Time.

NTIS

Aerospace Medicine; Weightlessness Simulation; In Vitro Methods and Tests; Cardiovascular System

20070010890 Office of Naval Research, Arlington, VA USA

A Cat's Eye Multiple Quantum Well Modulating Retro-reflector

Rabinovich, W S; Mahon, R; Goetz, P; Waluschka, E; Katzer, D S; Binari, S; Gilbreath, G C; Jan 2006; 4 pp.; In English Report No.(s): AD-A462492; No Copyright; Avail.: CASI: [A01](http://hdl.handle.net/100.2/ADA462492), Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA462492>

A new kind of modulating retro-reflector using cat's eye optics and a multiple quantum well electro-absorption modulator array is described. The device exhibits retroreflection over a 30 degree field of view and can support data rates of up to 50 Mbps using 1 mm pixels. The use of the device in free space optical communication is discussed.

DTIC

Cats; Eye (Anatomy); Modulation; Optical Communication; Quantum Wells; Reflectors; Retroreflectors; Space Communication

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)*.

20070010653 NASA Stennis Space Center, Stennis Space Center, MS, USA, Science Systems and Applications, Inc., Bay Saint Louis, MS, USA

Stennis Space Center Verification & Validation Capabilities

Pagnutti, Mary; Ryan, Robert E.; Holekamp, Kara; O'Neal, Duane; Knowlton, Kelly; Ross, Kenton; Blonski, Slawomir; [2007]; 1 pp.; In English; JACIE 2007 Civil Commercial Imagery Evaluation Workshop, 20-22 Mar. 2007, Fairfax, VA, USA Contract(s)/Grant(s): NNS04AB54T

Report No.(s): SSTI-2220-0100; No Copyright; Avail.: Other Sources; Abstract Only

Scientists within NASA's Applied Research & Technology Project Office (formerly the Applied Sciences Directorate) have developed a well-characterized remote sensing Verification & Validation (V&V) site at the John C. Stennis Space Center (SSC). This site enables the in-flight characterization of satellite and airborne high spatial resolution remote sensing systems and their products. The smaller scale of the newer high resolution remote sensing systems allows scientists to characterize geometric, spatial, and radiometric data properties using a single V&V site. The targets and techniques used to characterize data from these newer systems can differ significantly from the techniques used to characterize data from the earlier, coarser spatial resolution systems. Scientists have used the SSC V&V site to characterize thermal infrared systems. Enhancements are being considered to characterize active lidar systems. SSC employs geodetic targets, edge targets, radiometric tarps, atmospheric monitoring equipment, and thermal calibration ponds to characterize remote sensing data products. Similar techniques are used to characterize moderate spatial resolution sensing systems at selected nearby locations. The SSC Instrument Validation Lab is a key component of the V&V capability and is used to calibrate field instrumentation and to provide National Institute of Standards and Technology traceability. This poster presents a description of the SSC characterization capabilities and examples of calibration data.

Author

Remote Sensing; Proving; Spatial Resolution; Aerial Reconnaissance; High Resolution; Calibrating

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*.

20070009609 Air Force Research Lab., Wright-Patterson AFB, OH USA

Network Centricity and the Flight-Line Mechanic

Satterthwaite, Charles P; Tomashefsky, Steve; Jan 2000; 21 pp.; In English; Original contains color illustrations

Report No.(s): AD-A461145; No Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA461145>

Network Centricity and the Flight-line Mechanic looks at the efforts of the Electronic Distribution of Technical Information via Satellites (EDTIS) Program managed by the Air Force Research Laboratory (AFRL) for the Robins Air Logistics Centers Special Operations Office (WR-ALC/LU). The EDTIS Program is being performed by the Raytheon Corporation, which brings to the project its expertise in electronically formatted technical documentation, satellite interoperability, and radar weapon system technology and documentation. EDTIS is developing the technologies necessary to provide a link between technical information repositories (such as Technical Order Libraries, vendor services, and skill pools) and flight-line personnel over a satellite network. This type of network link frees the technical person from a dependence on bulky paper technical manuals, and allows him to select what he wants, where he wants it, and when he wants it. The EDTIS program has proven the technical feasibility of distributing timely technical information between remote sites. It is now working on improving the presentation of the technical information to the technician through improved portable maintenance aides, visualization and vocalization techniques, and data links between satellite nodes and the maintenance activity. If this type of system could be fully implemented, the requirement to transport complete sets of hard copies of technical documents

for every fleet mission deployment would be eliminated, saving millions of dollars in storage, transportation, and document configuration management.

DTIC

Data Links; Flight Mechanics; Satellite Communication

20070010785 Air Force Research Lab., Edwards AFB, CA USA

Micropropulsion Research at AFRL (Postprint)

Gulczynski, III, Frank S; Dulligan, Michael J; Lake, James P; Spanjers, Gregory G; Jul 2000; 14 pp.; In English

Contract(s)/Grant(s): Proj-2308

Report No.(s): AD-A462314; AFRL-PR-ED-TP-2000-101; No Copyright; Avail.: CASI: [A03](#), Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA462314>

There is an increased requirement for microsattellites to support such future missions as formation-flying space-based surveillance, space control, and on-orbit satellite servicing. Devices that can provide precise impulse bits in the 10-micro-Newton range may be enabling for a new fleet of 25-kg class spacecraft supporting these missions. In response to this need, the Air Force Research Laboratory is developing a miniaturized propulsion unit: the Micro-Pulsed Plasma Thruster (Micro-PPT). Like a standard PPT, the Micro-PPT uses a surface discharge across the face of a solid Teflon(trademark) propellant to create and accelerate a combination of plasma and neutral vapor. The Micro-PPT substantially differs from the standard design by using a self-igniting discharge, eliminating the separate igniter circuit from the thruster. This simplification enables order-of-magnitude reductions in the thruster size and operational power level. A technique for accurately measuring the performance of microthrusters has also been developed. Proof-of-concept performance measurements have been performed that indicate a non-optimized Micro-PPT has a thrust-to-power ratio that is approximately half that of LES-8/9 with a 60X reduction in mass.

DTIC

Low Thrust Propulsion; Microthruster; Plasma Engines; Spacecraft Propulsion

20070010810 Naval Postgraduate School, Monterey, CA USA

Ballistic Missile Trajectory Estimation

Dituri, Joseph; Dec 2006; 77 pp.; In English; Original contains color illustrations

Report No.(s): AD-A462349; No Copyright; Avail.: CASI: [A05](#), Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA462349>

Angles measurements from optical systems are the primary source of data for maintaining the orbits of high altitude satellites. Radar measurements are used primarily for low Earth orbit (LEO) satellites. Recently it has been shown that the accuracy of the orbit updates using only optical system angles-only data is just as good, if not better, than the performance from radar systems for LEO satellites. The purpose of this thesis is to investigate the use of optical angles data with and without laser ranging data in determining the trajectories of missiles. Analytical Graphics, Inc. Satellite Tool Kit is used to model the trajectory of a ballistic missile. Several scenarios are developed for determining the orbit when acquired by sensors providing various combinations of range, range rate and angles data. It is found that the combination of range, azimuth and elevation sensor data yields an orbit determination that has enough merit to be called accurate. The error of the orbit determined by the angles-only data is two orders of magnitude larger than the error of the range and angles measurement. Additionally completed was an analysis of what would happen if the sensors could only track to the maximum altitude of the orbit. As was assumed, the known position of the object drifts ranged from minimal to significant predicated on the final known position. This is indicated by the error ellipsoid. It was again found that the combination of range, azimuth and elevation sensor data until the maximum altitude yields an orbit determination that has enough merit to be called accurate. Also considered was the addition of a second sensor that had the capacity to always track range, azimuth and elevation to increase the time that is afforded to track the object, increasing the overall accuracy of the orbit determination.

DTIC

Artificial Satellites; Ballistic Missiles; Ballistic Trajectories; Missile Trajectories; Optical Equipment; Reentry Vehicles

20070010847 Naval Air Warfare Center, China Lake, CA USA

Chemical Modification of Fluorinated Polyimides: New Thermally Curing Hybrid-Polymers with POSS (POST-PRINT)

Wright, Michael E; Petteys, Brian J; Guenther, Andrew J; Fallis, Stephen; Yandek, Gregory R; Tomczak, Sandra J; Minton, Timothy K; Brunsvold, Amy; Jan 2006; 10 pp.; In English

Report No.(s): AD-A462410; No Copyright; Avail.: CASI: [A02](#), Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA462410>

A series of four new end-capped and hydroxymethyl-functionalized polyimides were prepared. Through a two-step chemical modification process 3-aminopropylisobutyl-POSS was covalently attached to the polymer backbone. POSS loading levels as high as 40 wt-% could be obtained while maintaining excellent processability and optical clarity of thin films. Concurrent attachment of either a cyanate ester or hydroxyethyl methacrylate (HEMA) group afforded processable POSS-polyimides that underwent thermal curing to yield solvent resistant films, both having final Tg's of 251 deg. C. Kinetic analysis of the cure reactions yielded energy of activations of 93 kJ/mol (cyanate ester) and 103 kJ/mol (HEMA). Exposure of a POSS polyimide containing ~31 wt-% POSS to atomic oxygen displayed no measurable level of erosion relative to a Kapton(registered) standard.

DTIC

Curing; Plastics; Polyimides; Thin Films

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*.

20070010460 NASA Langley Research Center, Hampton, VA, USA

Mars Reconnaissance Orbiter Operational Aerobraking Phase Assessment

Prince, Jill L.; Striepe, Scott A.; [2007]; 15 pp.; In English; 17th AAS/AIAA Space Flight Mechanics Meeting, 28 Jan. - 1 Feb. 2007, Sedona, AZ, USA; Original contains color illustrations

Report No.(s): AAS 07-244; No Copyright; Avail.: CASI: **A03**, Hardcopy

ONLINE: <http://hdl.handle.net/2060/20070010460>

The Mars Reconnaissance Orbiter (MRO) was inserted into orbit around Mars on March 10, 2005. After a brief delay, it began the process of aerobraking - using the atmospheric drag on the vehicle to reduce orbital period. The aerobraking phase lasted approximately 5 months (April 4 to August 30, 2006), during which teams from the Jet Propulsion Laboratory, Lockheed Martin Space Systems Corporation, and NASA Langley Research Center worked together to monitor and maneuver the spacecraft such that thermal margin on the solar arrays was maintained while schedule margin was upheld to provide a final local mean solar time (LMST) at ascending node of 3:00pm on the final aerobraking orbit. This paper will focus on the contribution of the flight mechanics team at NASA Langley Research Center (LaRC) during the aerobraking phase of the MRO mission.

Author

Aerobraking; Aerospace Systems; Flight Mechanics; Mars Reconnaissance Orbiter

20070010604 NASA Marshall Space Flight Center, Huntsville, AL, USA

Pitting and Repair of the Space Shuttle's Inconel(Registered TradeMark) Honeycomb Conical Seal Panel

Zimmerman, Frank R.; Gentz, Steven J.; Miller, James B.; MacKay, Rebecca A.; Bright, Mark L.; July 12, 2006; 33 pp.; In English; 42nd AIAA/ASME/SAE/ASEE Joint Propulsion Conference and Exhibit/Aerojet, 9-12 Jul. 2006, Sacramento, CA, USA; Original contains color illustrations

Contract(s)/Grant(s): WBS 843515.02.01.03.01.07

Report No.(s): AIAA Paper 2006-4600; Copyright; Avail.: CASI: **A03**, Hardcopy

During return to flight servicing of the rudder speed brake (RSB) for each Space Shuttle Orbiter, inspectors discovered numerous small pits on the surface of the #4 right hand side honeycomb panel that covers the rudder speed brake actuators. Shortly after detection of the problem, concurrent investigations were initiated to determine the extent of damage, the root cause, and to develop a repair plan, since fabrication of a replacement panel is impractical for cost, schedule, and sourcing considerations. This paper describes the approach, findings, conclusions and recommendations associated with the investigation of the conical seal pitting. It documents the cause and contributing factors of the pitting, the means used to isolate each contributor, and the supporting evidence for the primary cause of the pitting. Finally, the selection, development and verification of the repair procedure used to restore the conical seal panel is described with supporting process and metallurgical rationale for selection.

Author

Honeycomb Structures; Space Shuttle Orbiters; Actuators; Pitting; Fabrication; Space Shuttles

20070010702 NASA Johnson Space Center, Houston, TX, USA

CEV Seat Attenuation System System Design Tasks

Goodman, Jerry R.; McMichael, James H.; [2007]; 7 pp.; In English; University of Houston, CL, Graduate Class (Capstone), 25-28 Jan. 2007, Houston, TX, USA; Original contains black and white illustrations; No Copyright; Avail.: CASI: [A02](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20070010702>

The Apollo crew / couch restraint system was designed to support and restrain three crew members during all phases of the mission from launch to landing. The crew couch used supported the crew for launch, landing and in-flight operations, and was foldable and removable for EVA ingress/egress through side hatch access and for in-flight access under the seat and in other areas of the crew compartment. The couch and the seat attenuation system was designed to control the impact loads imposed on the crew during landing and to remain non-functional during all other flight phases.

Derived from text

Couches; Seats; Spacecraft Design; Flight Crews; Systems Engineering; Management Planning

20070010758 NASA Glenn Research Center, Cleveland, OH, USA

Characterization of Cold Sprayed CuCrAl-Coated and Uncoated GRCop-84 Substrates for Space Launch Vehicles

Raj, S. V.; Karthikeyan, J.; Lerch, B. A.; Barrett, C.; Garlich, R.; [2007]; 21 pp.; In English; TMS Annual Spring Meeting, 25 Feb. - 1 Mar. 2007, Orlando, FL, USA; Original contains color illustrations

Contract(s)/Grant(s): 561581.02.08.03.15.03; Copyright; Avail.: CASI: [A03](#), Hardcopy

A newly developed Cu-23(wt.%)Cr-5%Al (CuCrAl) alloy is currently being considered as a protective coating for GRCop-84 (Cu-8(at.%)Cr-4%Nb). The coating was deposited on GRCop-84 substrates by the cold spray deposition technique. Cyclic oxidation tests conducted in air on both coated and uncoated substrates between 773 and 1073 K revealed that the coating remained intact and protected the substrate up to 1073 K. No significant weight loss of the coated specimens were observed at 773 and 873 K even after a cumulative cyclic time of 500 h. In contrast, the uncoated substrate lost as much as 80% of its original weight under similar test conditions. Low cycle fatigue tests revealed that the fatigue lives of thinly coated GRCop-84 specimens were similar to the uncoated specimens within the limits of experimental scatter. It is concluded that the cold sprayed CuCrAl coating is suitable for protecting GRCop-84 substrates.

Author

Protective Coatings; Sprayed Coatings; Spacecraft Launching; Substrates; Fatigue Tests; Launch Vehicles; Oxidation

20070010766 NASA Glenn Research Center, Cleveland, OH, USA

Technology Development for Fire Safety in Exploration Spacecraft and Habitats

Ruff, Gary A.; Urban, David L.; [2006]; 14 pp.; In English; AIAA Aerospace Sciences Meeting and Exhibit, 8-11 Jan. 2007, Reno, NV, USA; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 567524.04.02.06

Report No.(s): AIAA 2007-0350; No Copyright; Avail.: CASI: [A03](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20070010766>

Fire during an exploration mission far from Earth is a particularly critical risk for exploration vehicles and habitats. The Fire Prevention, Detection, and Suppression (FPDS) project is part of the Exploration Technology Development Program (ETDP) and has the goal to enhance crew health and safety on exploration missions by reducing the likelihood of a fire, or, if one does occur, minimizing the risk to the mission, crew, or system. Within the past year, the FPDS project has been formalized within the ETDP structure and has seen significant progress on its tasks in fire prevention, detection, and suppression. As requirements for Constellation vehicles and, specifically, the CEV have developed, the need for the FPDS technologies has become more apparent and we continue to make strides to infuse them into the Constellation architecture. This paper describes the current structure of the project within the ETDP and summarizes the significant programmatic activities. Major technical accomplishments are identified as are activities planned for FY07.

Author

Fire Prevention; Spacecrews; Aerospace Medicine; Risk; Safety

20070010767 Draper (Charles Stark) Lab., Inc., Houston, TX, USA

Robust Constrained Optimization Approach to Control Design for International Space Station Centrifuge Rotor Auto Balancing Control System

Postma, Barry Dirk; April 2005; 4 pp.; In English; No Copyright; Avail.: Other Sources; Abstract Only

This thesis discusses application of a robust constrained optimization approach to control design to develop an Auto Balancing Controller (ABC) for a centrifuge rotor to be implemented on the International Space Station. The design goal is to minimize a performance objective of the system, while guaranteeing stability and proper performance for a range of uncertain plants. The Performance objective is to minimize the translational response of the centrifuge rotor due to a fixed worst-case rotor imbalance. The robustness constraints are posed with respect to parametric uncertainty in the plant. The proposed approach to control design allows for both of these objectives to be handled within the framework of constrained optimization. The resulting controller achieves acceptable performance and robustness characteristics.

Author

Controllers; Optimization; International Space Station; Centrifuges; Robustness (Mathematics)

19

SPACECRAFT INSTRUMENTATION AND ASTRIONICS

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

20070010461 NASA Goddard Space Flight Center, Greenbelt, MD, USA

On Orbit Receiver Performance Assessment of the Geoscience Laser Altimeter System (GLAS) on ICESAT

Sun, Xiaoli; Abshire, James B.; Spinhirne, James D.; McGarry, Jan; Jester, Peggy L.; Yi, Donghui; Palm, Stephen P.; Lancaster, Redgie S.; [2006]; 4 pp.; In English; 23rd International Laser Radar Conference, 23-28 Jul. 2006, Nara, Japan; Copyright; Avail.: CASI: [A01](#), Hardcopy

The GLAS instrument on the NASA's ICESat mission has provided over a billion measurements of the Earth surface elevation and atmosphere backscattering at both 532 and 1064-nm wavelengths. The receiver performance has stayed nearly unchanged since ICESat launch in January 2003. The altimeter receiver has achieved a less than 3-cm ranging accuracy when excluding the effects of the laser beam pointing angle determination uncertainties. The receiver can also detect surface echoes through clouds of one-way transmission as low as 5%. The 532-nm atmosphere backscattering receiver can measure aerosol and clouds with cross section as low as $1e-7/m.sr$ with a 1 second integration time and molecular backscattering from upper atmosphere with a 60 second integration time. The 1064-nm atmosphere backscattering receiver can measure aerosol and clouds with a cross section as low as $4e-6/m.sr$. This paper gives a detailed assessment of the GLAS receiver performance based on the in-orbit calibration tests.

Author

Laser Altimeters; Rangefinding; Aerosols; Beams (Radiation); Geophysics; Ice, Cloud and Land Elevation Satellite; Backscattering; Calibrating

20070010741 NASA Goddard Space Flight Center, Greenbelt, MD, USA

The NASA Electronic Parts and Packaging (NEPP) Program: Results and Direction

LaBel, Kenneth A.; [2007]; 10 pp.; In English; Radiation Hardened Electronics Technology (RHET) Meeting, 24-25 Oct. 2006, Denver, CO, USA; Original contains color illustrations; No Copyright; Avail.: CASI: [A02](#), Hardcopy
ONLINE: <http://hdl.handle.net/2060/20070010741>

The NASA Electronic Parts and Packaging (NEPP) Program's mission is to provide guidance to NASA for the selection and application of microelectronic technologies, to improve understanding of the risks related to the use of these technologies in the space environment and to ensure that appropriate research is performed to meet NASA mission assurance needs. This viewgraph presentation reviews the NEPP program's goals and objectives, and reviews many of the missions that the NEPP program has impacted, both in and out of NASA. Also included are examples of the evaluation that the program performed. CASI

Aerospace Environments; Electronic Packaging; Microelectronics; Radiation Damage; Spacecraft Electronic Equipment

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*.

20070010432 NASA Stennis Space Center, Stennis Space Center, MS, USA

Determination of Combustion Product Radicals in a Hydrocarbon Fueled Rocket Exhaust Plume

Langford, Lester A.; Allgood, Daniel C.; Junell, Justin C.; [2007]; 6 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): NN04AB62C

Report No.(s): SSTI-2200-0074; No Copyright; Avail.: CASI: [A02](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20070010432>

The identification of metallic effluent materials in a rocket engine exhaust plume indicates the health of the engine. Since 1989, emission spectroscopy of the plume of the Space Shuttle Main Engine (SSME) has been used for ground testing at NASA's Stennis Space Center (SSC). This technique allows the identification and quantification of alloys from the metallic elements observed in the plume. With the prospect of hydrocarbon-fueled rocket engines, such as Rocket Propellant 1 (RP-1) or methane (CH₄) fueled engines being considered for use in future space flight systems, the contributions of intermediate or final combustion products resulting from the hydrocarbon fuels are of great interest. The effect of several diatomic molecular radicals, such as Carbon Dioxide, Carbon Monoxide, Molecular Carbon, Methylene Radical, Cyanide or Cyano Radical, and Nitric Oxide, needs to be identified and the effects of their band systems on the spectral region from 300 nm to 850 nm determined. Hydrocarbon-fueled rocket engines will play a prominent role in future space exploration programs. Although hydrogen fuel provides for higher engine performance, hydrocarbon fuels are denser, safer to handle, and less costly. For hydrocarbon-fueled engines using RP-1 or CH₄, the plume is different from a hydrogen fueled engine due to the presence of several other species, such as CO₂, C₂, CO, CH, CN, and NO, in the exhaust plume, in addition to the standard H₂O and OH. These species occur as intermediate or final combustion products or as a result of mixing of the hot plume with the atmosphere. Exhaust plume emission spectroscopy has emerged as a comprehensive non-intrusive sensing technology which can be applied to a wide variety of engine performance conditions with a high degree of sensitivity and specificity. Stennis Space Center researchers have been in the forefront of advancing experimental techniques and developing theoretical approaches in order to bring this technology to a more mature stage.

Author

Rocket Exhaust; Hydrocarbon Fuels; Emission Spectra; Carbon Dioxide; Carbon Monoxide; Combustion Products; Nitric Oxide; Methane; Spectral Bands

20070010444 NASA Glenn Research Center, Cleveland, OH, USA

An Experimental Investigation of the Laminar Flamelet Concept for Soot Properties

Diez, F. J.; Aalburg, C.; Sunderland, P. B.; Urban, D. L.; Yuan, Z.-G.; Faeth, G. M.; [2007]; 11 pp.; In English; 45th Aerospace Science Meeting, 8 Jan. 2007, Reno, NV, USA

Contract(s)/Grant(s): NAG3-2404; WBS 732759.03.01.01.10; Copyright; Avail.: CASI: [A03](#), Hardcopy

The soot properties of round, nonbuoyant, laminar jet diffusion flames are described, based on experiments at microgravity carried out on orbit during three flights of the Space Shuttle Columbia, (Flights STS-83, 94 and 107). Experimental conditions included ethylene- and propane-fueled flames burning in still air at an ambient temperature of 300 K and ambient pressures of 35-100 kPa. Measurements included soot volume fraction distributions using deconvoluted laser extinction imaging, and soot temperature distributions using deconvoluted multiline emission imaging. Flowfield modeling based on the work of Spalding is presented. The present work explores whether soot properties of these flames are universal functions of mixture fraction, i.e., whether they satisfy soot state relationships. Measurements are presented, including radiative emissions and distributions of soot temperature and soot volume fraction. It is shown that most of the volume of these flames is bounded by the dividing streamline and thus should follow residence time state relationships. Most streamlines from the fuel supply to the surroundings are found to exhibit nearly the same maximum soot volume fraction and temperature. The radiation intensity along internal streamlines also is found to have relatively uniform values. Finally, soot state relationships were observed, i.e., soot volume fraction was found to correlate with estimated mixture fraction for each fuel/pressure selection. These results support the existence of soot property state relationships for steady nonbuoyant laminar diffusion flames, and thus in a large class of practical turbulent diffusion flames through the application of the laminar flamelet concept.

Author

Jet Flow; Laminar Flow; Diffusion Flames; Turbulent Diffusion; Temperature Distribution; Microgravity; Space Transportation System Flights; Soot

20070010544 NASA Glenn Research Center, Cleveland, OH, USA

The Stretched Lens Array SquareRigger (SLASR) for Space Power

Piszezor, Michael F.; O'Neill, Mark J.; Eskenazi, Michael I.; Brandhorst, Henry W.; [2006]; 8 pp.; In English; 4th International Energy Conversion Engineering Conference and Exhibit, 26-29 Jun. 2006, San Diego, CA, USA; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 22-629-80-10; Copyright; Avail.: CASI: [A02](#), Hardcopy

For the past three years, our team has been developing, refining, and maturing a unique solar array technology known as Stretched Lens Array SquareRigger (SLASR). SLASR offers an unprecedented portfolio of state-of-the-art performance metrics, including areal power density, specific power, stowed power density, high-voltage capability, radiation hardness, modularity, scalability, mass-productibility, and cost-effectiveness. SLASR is particularly well suited to high-power space missions, including solar electric propulsion (SEP) space tugs, major exploration missions to the Moon and Mars, and power-intensive military spacecraft. SLASR is also very well suited to high-radiation missions, since the cell shielding mass penalty is 85% less for the SLASR concentrator array than for one-sun planar arrays. The paper describes SLASR technology and presents significant results of developments to date in a number of key areas, from advances in the key components to full-scale array hardware fabrication and evaluation. A summary of SLASR's unprecedented performance metrics, both near-term and longer term, will be presented. Plans for future SLASR developments and near-term space applications will also be outlined.

Author

Solar Electric Propulsion; Solar Arrays; Lenses

20070010858 Naval Postgraduate School, Monterey, CA USA

Study of a Novel Ionizer Configuration for the Ion Thruster

Cooper, Jason T; Dec 2006; 81 pp.; In English; Original contains color illustrations

Report No.(s): AD-A462425; No Copyright; Avail.: CASI: [A05](#), Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA462425>

Micro-satellites often require the adaptation of existing propulsion systems. Electric propulsion thrusters are perhaps the best candidates to meet these needs and ion engines are among the most scalable. Miniaturizing the ion engine will require novel concepts for the ionizer with perhaps novel propellants. MEMS, nanotechnology and other technological advances are expected to impact on new designs. Our work shows that the ionization of Argon, which is an alternate fuel to Xenon, can be achieved at low voltages by utilizing Micro-Structured Electrode (MSE) Arrays. Copper-clad sheets separated by a dielectric material (fiberglass laminate epoxy resin system combined with a glass fabric substrate) of varying thickness (0.1 mm to 0.4 mm) form the discharge electrodes in the MSE arrays. The wafers are drilled with an array of holes and this geometry serves to concentrate the electric field between electrodes enhancing electron emission at the cathode. Minimum breakdown voltages between 240 and 280 Volts at pressures of around 100 mTorr (0.133N/square meters) were consistently obtained with arrays of hole diameter ranging from 300 to 500 micrometers. These results are consistent with conventional Paschen-curves with two empirical constants that arise from our unconventional geometrical arrangements and from the different material properties.

DTIC

Ion Engines; Ion Propulsion; Ionizers; Ions; Propulsion System Configurations; Propulsion System Performance

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*.

20070009616 Andrews and Kurth, LLP, Houston, TX, USA

Low Torque Hydrodynamic Lip Geometry for Bi-Directional Rotation Seals

Dietel, L. L.; Schroeder, J. E.; 22 May 06; 47 pp.; In English

Contract(s)/Grant(s): DE-FG02-05ER8-4206

Patent Info.: Filed Filed 22 May 06; US-Patent-Appl-SN-11-386-209

Report No.(s): PB2007-101439; No Copyright; Avail.: CASI: [A03](#), Hardcopy

A hydrodynamically lubricating geometry for the generally circular dynamic sealing lip of rotary seals that are employed

to partition a lubricant from an environment. The dynamic sealing lip is provided for establishing compressed sealing engagement with a relatively rotatable surface, and for wedging a film of lubricating fluid into the interface between the dynamic sealing lip and the relatively rotatable surface in response to relative rotation that may occur in the clockwise or the counter-clockwise direction. A wave form incorporating an elongated dimple provides the gradual convergence, efficient impingement angle, and gradual interfacial contact pressure rise that are conducive to efficient hydrodynamic wedging. Skewed elevated contact pressure zones produced by compression edge effects provide for controlled lubricant movement within the dynamic sealing interface between the seal and the relatively rotatable surface, producing enhanced lubrication and low running torque.

NTIS

Lubrication; Rotation; Sealing; Torque

20070009651 Los Alamos National Lab., NM USA

Effects of Temperature and Humidity on Wilethane 44 Cure

Weigle, J. C.; Oct. 2006; 18 pp.; In English

Report No.(s): DE2006-893289; LA-14299; No Copyright; Avail.: Department of Energy Information Bridge

Wilethane 44 is a polyurethane adhesive developed by the Materials Team within ESA-MEE at Los Alamos National Laboratory as a replacement for Hexcel Corporation Urethane 7200. Urethane 7200 is used in numerous weapon systems, but it was withdrawn from the market in 1989. The weapons complex requires a replacement material for use in the W76-1 LEP and the W88, as well as for assembly of JTAs for other warheads. All polyurethane systems are susceptible to moisture reacting with unreacted isocyanate groups. This side reaction competes with the curing reaction and results in CO(sub 2) formation. Therefore, a polyurethane adhesive can exhibit foaming if appropriate environmental controls are not in place while it cures. A designed experiment has been conducted at TA-16-304 to determine the effects of ambient conditions on the properties of cured Wilethane 44. Temperature was varied from 15 C to 30 C and relative humidity from 15% to 40%. The density, hardness at 24 hours, and butt tensile strength on aluminum substrates were measured and fitted to quadratic equations over the experimental space. Additionally, the loss and storage moduli during cure were monitored as a function of cure temperature. These experiments provide a stronger basis for establishing appropriate environmental conditions and cure times when using Wilethane 44. The current guidelines are a working time of 90 minutes, a cure time of 18 hours, and a relative humidity of less than 25%, regardless of ambient temperature. Viscosity measurements revealed that the working time is a strong function of temperature and can be as long as 130 minutes at 15 C or as short as 90 minutes at 30 C. The experiments also showed that the gel time is much longer than originally thought, as long as 13 hours at 15 C. Consequently, it may be necessary to extend the required cure time at temperatures below 20 C. Allowable humidity varies as a function of temperature from 34% at 15 C to 15% at 30 C.

NTIS

Adhesives; Atmospheric Temperature; Humidity; Polyurethane Resins; Temperature Effects

20070009678 National Inst. of Standards and Technology, Gaithersburg, MD USA

Assessment of a Possible Bench Scale Screening Protocol for Predicting Full-Scale Mattress Fire Behavior

Ohlemiller, T. J.; Sep. 2006; 35 pp.; In English

Report No.(s): PB2007-105078; NISTIR-7341; No Copyright; Avail.: National Technical Information Service (NTIS)

This report summarizes a study of the feasibility of developing a bench-scale protocol for possible use in Code of Federal Regulations (CFR) 1633 (open flame) compliance testing of commercial mattress designs. It was shown that local resistance to the CFR 1633 gas burner exposure could successfully be done in one step with a composite consisting of a mattress top panel, tape edge seam and side panel (or analogous components for a foundation), rather than with separate tests for each component. A second type of test (with a different apparatus) is indicated for assessing resistance to commonly encountered, persistent mattress/foundation crevice flames which represent a different mode of mattress design vulnerability. An apparatus for this was developed but not systematically applied. Other vulnerability modes may require other tests. The real goal of bench-scale testing, faster and more economical assessments, is thus unlikely to be achieved and the best approach appears to be full-scale testing.

NTIS

Fires; Predictions; Protocol (Computers); Regulations

20070009681 National Inst. of Standards and Technology, Gaithersburg, MD USA

Exploring the Role of Polymer Melt Viscosity in Melt Flow and Flammability Behavior

Ohlemiller, T. J.; Shields, J.; Butler, K.; Collins, B.; Seck, M.; January 2000; 29 pp.; In English

Report No.(s): PB2007-105069; No Copyright; Avail.: CASI: [A03](#), Hardcopy

Thermoplastic polymers are widely used in roles where molding facilitates cost effective, high volume applications. Such polymers exhibit uniquely complex behavior in a fire because of their tendency to liquefy and flow. This behavior was explored in two stages. In the first, the melt behavior was examined in a non-flaming situation that subjected one face of a polymer slab to a radiant heat flux. The transient flow behavior was recorded for comparison to a model that uses the separately-measured melt viscosity as an input. In the second stage of the study, the burning behavior was examined in a facility that allows heat release rate measurements. These experiments explored the sensitivity of the evolved heat release rate to polymer type, polymer melt viscosity and physical aspects of the experimental set-up. The results demonstrate that the burning behavior of a thermoplastic object can vary strongly with the conditions under which it is burned if its melt viscosity permits appreciable flow.

NTIS

Flammability; Viscosity; Polymers; Melts (Crystal Growth)

20070009732 Hovey Williams LLP, Kansas City, MO, USA

Adhesives From Modified Soy Protein

Sun, X. S.; Wang, D.; Zhong, Z.; Yang, G.; 3 Jan 05; 22 pp.; In English

Contract(s)/Grant(s): DE-FC07-011D14217

Patent Info.: Filed 3 Jan 05; US-Patent-Appl-SN-11-028 013

Report No.(s): PB2007-102930; No Copyright; Avail.: CASI: [A03](#), Hardcopy

The present invention provides useful adhesive compositions having similar adhesive properties to conventional UF and PPF resins. The compositions generally include a protein portion and modifying ingredient portion selected from the group consisting of carboxyl-containing compounds, aldehyde-containing compounds, epoxy group-containing compounds, and mixtures thereof. The composition is preferably prepared at a pH level at or near the isoelectric point of the protein. In other preferred forms, the adhesive composition includes a protein portion and a carboxyl-containing group portion.

NTIS

Adhesives; Proteins

20070009736 Naval Research Lab., Washington, DC USA

Impact of a Hydrate-Based Marine Desalination Technology on Marine Microbiota and Water Quality

Coffin, Richard B; Montgomery, Michael T; Osburn, Christopher L; Dec 27, 2006; 22 pp.; In English; Original contains color illustrations

Report No.(s): AD-A461868; NRL/MR/6110--06-9005; No Copyright; Avail.: CASI: [A03](#), Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA461868>

Marine Desalination Systems (MDS) is currently developing new technology in gas hydrate formation to supply potable water. To scale this technology to support different country needs there is a requirement to assess the environmental impact of desalination. The NRL MDS collaboration on biological influence of marine desalination focuses on water quality of processed water and environmental impact of the marine desalination application. With this segment of the project accomplished, the subsequent evaluation will focus on the impact of large scale marine desalination on environmental quality. To assess the environmental impact of the marine desalination system there is a need to understand resulting changes to key bacterial and elemental cycles. Seawater vertical transport, alteration of water flow, and filtration have potential to change the microbial community diversity, substrate availability, electron acceptors and key element speciation. Microorganisms surveyed in this analysis control elemental cycles that set environmental quality for the entire aquatic food chain. This study initiates assessment of the effect of the MDS process on water quality and the growth rate of the natural bacterial assemblage. We measured heterotrophic bacterial production, dissolved organic carbon (DOC) concentration and stable isotope values, and fluorescence spectra of the organic matter that partition into the hydrate and waste water streams.

DTIC

Bacteria; Carbon; Carbon Dioxide; Desalination; Hydrates; Marine Technology; Microorganisms; Water; Water Quality

20070009856 NASA Johnson Space Center, Houston, TX, USA

Chemistry of Martian Soils from the Mars Exploration Rover APXS Instruments

Mittlefehldt, D. W.; Gellert, R.; Yen, A.; [2007]; 2 pp.; In English; Lunar and Planetary Science Conference, 12-16 Mar. 2007, Houston, TX, USA; Original contains color illustrations; Copyright; Avail.: CASI: [A01](#), Hardcopy

The martian surface is covered with debris formed by several mechanisms and mobilized by various processes. Volcanism, impact, physical weathering and chemical alteration combine to produce particles of sizes from dust to boulders

composed of primary mineral and rock fragments, partially altered primary materials, alteration minerals and shock-modified materials from all of these. Impacts and volcanism produce localized deposits. Winds transport roughly sand-sized material over intermediate distances, while periodic dust storms deposit a global dust layer of the finest fraction. The compositions of clastic sediments can be used to evaluate regional differences in crustal composition and/or weathering processes. Here we examine the growing body of chemical data on soils in Gusev crater and Meridiani Planum returned by the Alpha Particle X-ray Spectrometer (APXS) instruments on the rovers Spirit (MERA) and Opportunity (MERB), following on earlier results based on smaller data sets [1-4].

Derived from text

Chemical Effects; Mars Surface; Mars Exploration; Volcanology; Weathering; Minerals; Mars Craters; Soils

20070009941 Uppsala Univ., Uppsala, Sweden

3D Highly Oriented Nanoparticulate and Microparticulate Array of Metal Oxide Materials

Vayssieres, L.; Guo, J.; Nordgren, J.; Sep. 15, 2006; 6 pp.; In English

Report No.(s): DE2006-892936; LBNL-50926; No Copyright; Avail.: National Technical Information Service (NTIS)

Advanced nano and micro particulate thin films of 3d transition and post-transition metal oxides consisting of nanorods and microrods with parallel and perpendicular orientation with respect to the substrate normal, have been successfully grown onto various substrates by heteronucleation, without template and/or surfactant, from the aqueous condensation of solution of metal salts or metal complexes (aqueous chemical growth). Three-dimensional arrays of iron oxide nanorods and zinc oxide nanorods with parallel and perpendicular orientation are presented as well as the oxygen K-edge polarization dependent x-ray absorption spectroscopy (XAS) study of anisotropic perpendicularly oriented microrod array of ZnO performed at synchrotron radiation source facility.

NTIS

Absorption Spectroscopy; Iron Oxides; Metal Oxides; Nanoparticles; Thin Films

20070010502 Sandia National Labs., Albuquerque, NM USA

Report on ASC Project Degradation of Organic Materials

Budzien, J.; Lo, D. C. S.; Curro, J. G.; Thompson, A. P.; Grest, G. S.; Sep. 01, 2006; 80 pp.; In English

Report No.(s): DE2006-893971; SAND2006-5668; No Copyright; Avail.: National Technical Information Service (NTIS)

Using molecular dynamics simulations, a constitutive model for the chemical aging of polymer networks was developed. This model incorporates the effects on the stress from the chemical crosslinks and the physical entanglements. The independent network hypothesis has been modified to account for the stress transfer between networks due to crosslinking and scission in strained states. This model was implemented in the finite element code Adagio and validated through comparison with experiment. Stress relaxation data was used to deduce crosslinking history and the resulting history was used to predict permanent set. The permanent set predictions agree quantitatively with experiment.

NTIS

Degradation; Molecular Dynamics; Organic Materials

20070010566 Fuylbright and Jaworski, LLP, Austin, TX, USA

Insulating Medium

Nuckols, M. L.; Henkener, J. A.; 6 Sep 05; 16 pp.; In English

Contract(s)/Grant(s): N61331-99-C0027

Patent Info.: Filed Filed 6 Sep 05; US-Patent-Appl-SN-11-221 340

Report No.(s): PB2007-101484; No Copyright; Avail.: CASI: [A03](#), Hardcopy

The disclosed invention provides a composition that possesses insulation values approaching that of uncompressed foam neoprene. The liquid composition is incompressible and may be formulated to be neutrally buoyant in water. The composition is suitable for a use in a number of applications where insulation is required, including divers' suits and underwater cabins, such as chambers, submersible hulls, and waterproof housings.

NTIS

Insulation; Foams; Chloroprene Resins

20070010630 Los Alamos National Lab., NM USA

Nanocrystal/sol-gel Nanocomposites

Klimov, V. L.; Petruska, M. A.; 17 Nov 03; 11 pp.; In English

Contract(s)/Grant(s): DE-W-7405-ENG-36

Patent Info.: Filed Filed 17 Nov 03; US-Patent-Appl-SN-10-715-733

Report No.(s): PB2007-101581; No Copyright; Avail.: CASI: [A03](#), Hardcopy

The present invention is directed to a process for preparing a solid composite having colloidal nanocrystals dispersed within a sol-gel matrix, the process including admixing colloidal nanocrystals with an amphiphilic polymer including hydrophilic groups selected from the group consisting of --COOH, --OH, --SO.sub.3H, --NH.sub.2, and --PO.sub.3H.sub.2 within a solvent to form an alcohol-soluble colloidal nanocrystal-polymer complex, admixing the alcohol-soluble colloidal nanocrystal-polymer complex and a sol-gel precursor material, and, forming the solid composite from the admixture. The present invention is also directed to the resultant solid composites and to the alcohol-soluble colloidal nanocrystal-polymer complexes.

NTIS

Nanocomposites; Nanocrystals; Sol-Gel Processes

20070010632 Bacon and Thomas, PPLC, Alexandria, VA, USA

Ethylene-C4-C20-Alkene Copolymers

Coates, G. W.; Fujita, M.; 9 Nov 04; 4 pp.; In English

Contract(s)/Grant(s): NSF-DMR-0079992

Patent Info.: Filed Filed 9 Nov 04; US-Patent-Appl-SN-10-983-680

Report No.(s): PB2007-101582; No Copyright; Avail.: CASI: [A01](#), Hardcopy

Poly (ethylene-co-C. sub.4-C.sub.20-alkene) copolymers or segments with polydispersities less than 1.3 and/or predominantly enchainment in a cis-1,2 fashion and/or poly(ethylene-co-C.sub.4-C.sub.20 monocyclic alkene) copolymers or segments provide in some cases substitutes for ultra high molecular weight polyethylenes and in some cases substitutes for polypropylenes and in some cases utility as gas barrier coatings.

NTIS

Alkenes; Copolymers; Ethylene

20070010658 Iowa State Univ. of Science and Technology, Ames, IA USA

Structural and Magnetothermal Properties of the Gd(5)Sb(x)Ge(4-x) System

Chernyshov, A. S.; Mudryk, Y. S.; Pecharsky, V. K.; Gschneidner, K. A.; January 2006; 3 pp.; In English

Report No.(s): DE2006-893093; No Copyright; Avail.: National Technical Information Service (NTIS)

The crystallographic and magnetic properties of the Gd(sub 5)Sb(sub x)Ge(sub 4-x) pseudobinary system were studied by x-ray powder diffraction at room temperature, and the heat capacity, magnetization, and electrical resistivity in the temperature interval 5-320 K in applied dc magnetic fields between 0 and 100 kOe. The Gd(sub 5)Sb(sub 2.1)Ge(sub 1.9) compound adopts the Tm(sub 5)Sb(sub 2)Si(sub 2)-type structure (space group Cmca) and orders magnetically via a second order ferromagnetic-paramagnetic transition at 200 K, whereas the Gd(sub 5)Sb(sub x)Ge(sub 4-x) compounds with x=0.7 and x=1 crystallize in the Sm(sub 5)Ge(sub 4)-type structure (space group Pnma) and exhibit first order phase transformations at 45 and 37 K, respectively, and therefore, the giant magnetocaloric effect. The heat capacity and electrical resistivity measurements of Gd(sub 5)Sb(sub 0.7)Ge(sub 3.3) indicate a second order antiferromagnetic transition at 60 K in fields 20 kOe and lower.

NTIS

Crystallography; Diffraction; Temperature Effects; Magnetic Properties

20070010722 Brookhaven National Lab., Upton, NY, USA

Chemistry of SO(2) and DeSO(x) Processes on Oxide Nanoparticles

Rodriguez, J. A.; Jun. 2006; 35 pp.; In English

Report No.(s): DE2006-893860; BNL-76856-2006-BC; No Copyright; Avail.: Department of Energy Information Bridge

On bulk stoichiometric oxides, SO(sub 2) mainly reacts with the O centers to form SO(sub 3) or SO(sub 4) species that decompose at elevated temperatures. Adsorption on the metal cations occurs below 300 K and does not lead to cleavage of the S-O bonds. In bulk oxides, the occupied cation bands are too stable for effective bonding interactions with the LUMO of SO(sub 2). The effects of quantum confinement on the electronic properties of oxide nanoparticles and the structural defects

that usually accompany these systems in general favor the bonding and dissociation of SO(sub 2). Thus, nanoparticles of MgO, CaO, SrO, Al(sub 2)O(sub 3), Fe(sub 2)O(sub 3) and CeO(sub 2) are all more efficient for sequestering SO(sub 2) than the corresponding bulk oxides. Structural imperfections in pure or metal-doped ceria nanoparticles accelerate the reduction of SO(sub 2) by CO by facilitating the formation and migration of O vacancies in the oxide surface.

NTIS

Additives; Nanoparticles; Oxides; Stoichiometry; Sulfur Oxides; Chemical Reactions

20070010725 Savannah River National Lab., Aiken, SC, USA

Traditional and Digital Autoradiography Techniques: A Comparison Study

Gibbs, K. M.; Kestin, C. S.; Aug. 29, 2006; 54 pp.; In English

Report No.(s): DE2006-893947; WSRC-STI-2006-00086; No Copyright; Avail.: National Technical Information Service (NTIS)

This report fulfills the FY 2006 Enhanced Surveillance Campaign Level 3 milestones for Task TSR 11.1 as defined in the execution plan (1, 2). The purpose of this task is to reduce the cycle time necessary to complete analytical evaluations required for surveillance of reservoirs. The development of the digital autoradiography system supports this task. The digital autoradiography system is currently operational and ready for implementation in reservoir surveillance performed in the Materials Test Facility (MTF) at Savannah River Site (SRS). SRS requests design agency (Los Alamos National Laboratory and Sandia National Laboratory) concurrence for the implementation of this system and on the establishment, in conjunction with the Savannah River National Laboratory (SRNL), of the implementation requirements for this system. Stainless steel tritium reservoirs and pinch welded tubes, which have been exposed to tritium for a prolonged period, are destructively evaluated at the end of their service lives for a variety of reasons. One requirement of this evaluation is to assess the tritium diffusion into the reservoir material. The current method used to determine the geometry and depth of tritium penetration is autoradiography. This technique employs a photographic emulsion and has been effective for a number of years. The primary disadvantage of this technique is the time required to obtain results. The success of the traditional technique is dependent on many variables, such as the proficiency of the operators in conducting sample preparation, the geometry of the sample and the shelf life of the photographic chemicals. If results are not satisfactory, several repetitions are often required and usually add weeks to the total analysis time for the sample. Due to the extensive time required for the liquid emulsion autoradiography method, a new, faster technique was desired. Personnel from the Savannah River National Laboratory (SRNL) have been working on a system based on digital imaging technology to replace the current method. The purpose of this report is to provide a description of the current method, a description of the equipment for the new digital method and its capabilities, and a direct comparison of the results between the existing and proposed techniques. The advantages of the digital method is the reduced time of exposure (from 24 hours to around 10 minutes), increased sample throughput, reduced rework of samples, and the elimination of chemical processing.

NTIS

Autoradiography; Digital Systems; Photographic Emulsions; Imaging Techniques

20070010796 Naval Research Lab., Washington, DC USA

Ion Beam Deposited Cu-Mo Coatings as High Temperature Solid Lubricants

Wahl, K J; Seitzman, L E; Bolster, R N; Singer, I L; Peterson, M B; Jan 1997; 8 pp.; In English

Report No.(s): AD-A462329; No Copyright; Avail.: CASI: [A02](#), Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA462329>

No abstract available

High Temperature Lubricants; Ion Beams; Metal Coatings; Solid Lubricants

20070010845 Idaho Univ., Moscow, ID USA

Polyazido Pyrimidines: High Energy Compounds and Precursors to Carbon Nanotubes (PREPRINT)

Ye, Chengfeng; Gao, Haoxiang; Twamley, Brendan; Shreeve, Jean'ne M; Drake, Gregory W; Boatz, Jerry A; Jul 13, 2006; 18 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): Proj-2303

Report No.(s): AD-A462405; No Copyright; Avail.: CASI: [A03](#), Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA462405>

Organic polyazido substituted compounds are at the forefront of high energy research. Polyazido organic compounds have high relative heats of formation as one azido group adds about 87 kcal/mol of endothermicity to a hydrocarbon compound.

In this family of compounds, 3,6-di(azido)-tetrazine (1), has the highest reported heat of formation ~ 1101 kJ mol⁻¹(6709 kJ kg⁻¹). The compound 4,4',6,6'-tetra(azido)azo-1,3,5-triazine (2), has a heat of formation of 2171 (6164 kJ kg⁻¹). Recently it was demonstrated that 1 and 4 were good precursors to nano carbon nitride materials. Thermal decomposition of 1 and 4 yields nitrogen-rich nanolayered, nanoclustered and nanodendritic carbon nitrides depending on the different heating processes.

DTIC

Azides (Inorganic); Azides (Organic); Carbon Nanotubes

20070010872 Naval Postgraduate School, Monterey, CA USA

Processing and Characterization of NiTi Shape Memory Alloy Particle Reinforced Sn-In Solders

Chung, Kohn C; Dec 2006; 73 pp.; In English; Original contains color illustrations

Report No.(s): AD-A462441; No Copyright; Avail.: CASI: [A04](#), Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA462441>

In the typical packaging of a printed circuit board, the tiny-yet-critical solder joints provide both electrical connection and mechanical support for the silicon chips and their substrate. These solders are subjected to serve thermo-mechanical strains during usage and the most common failure arise from thermo-mechanical fatigue (thermal cycling). This is due to the mismatch in the coefficient of thermal expansion between the chip and the packaging substrate. In previous work, it was proposed that reinforcement of solder by NiTi shape memory alloy particles to form smart composite solder reduces the inelastic strain of the solder and hence, may enhance the low cycle fatigue life of the solder. In this thesis, a new fabrication process for incorporating NiTi particles (10 vol.% NiTi) into Sn-In solder (80Sn-20In) using liquid phase sintering has been developed. The microstructures of the solders were characterized. The behavior of the solder joints during thermomechanical cycling was also characterized and the results showed that the shear stress induced in the composite solder joint is significantly reduced relative to that in the monolithic solder joint due to the generation of a back-stress associated with the B19' → B2 phase transformation of the NiTi particles during the heating part of the cycle. This causes an appreciable reduction of the total inelastic strain range during cycling.

DTIC

Binary Alloys; Nickel Alloys; Shape Memory Alloys; Soldering; Solders; Tin Alloys; Titanium Alloys

20070011085 Wisconsin Univ., Madison, WI USA

Oxidation of Light Alkanes Using Photocatalytic Thin Films

Twesme, Troy M; Jan 2006; 159 pp.; In English; Original contains color illustrations

Report No.(s): AD-A462487; No Copyright; Avail.: CASI: [A08](#), Hardcopy

This investigation studied the photocatalytic oxidation of light alkanes using photocatalytic thin films. In the research presented, nearly complete oxidation of isobutane, n-butane and propane using ZrO₂/TiO₂ thin films in a single pass reactor was demonstrated. The importance of reactor design on the effectiveness of the photocatalytic reaction is discussed in terms of photocatalyst packing and adequate illumination for catalyst activation. The influence of relative humidity in the contaminant feed stream and the reactor operating temperature were evaluated to establish optimal operating conditions for the photocatalytic reactor. Further photocatalytic studies used propane as a probe compound to investigate metal-modification of photocatalytic thin films as a means to improve propane oxidation and mineralization. Six precious metals (Ag, Au, Pd, Pt, Rh, and Ru) were tested at 1 weight percent loadings in TiO₂, SiO₂/TiO₂, and ZrO₂/TiO₂ thin films. The photocatalytic reactor was operated at temperatures up to 100 C with the expectation that a thermal catalytic enhancement due to the precious metals would be observed. Propane conversion data revealed that at 1% loading, the addition of metals to the thin films reduced the activity for conversion of propane, regardless of temperature. However, the reactor temperature significantly affected light irradiance. Reaction rates adjusted for the influence of temperature on reactor irradiance revealed the highest reaction rates occurred at 100 C, but evaluation of Langmuir-Hinshelwood-Hougen-Watson kinetics showed that temperature significantly reduced the surface adsorption of propane. Of the 21 materials tested, an unmodified ZrO₂/TiO₂ thin film had the best activity for propane conversion and mineralization. Lastly, a novel method to investigate the photoinduced change in surface potential of photocatalytic thin films was investigated.

DTIC

Alkanes; Noble Metals; Oxidation; Thin Films

20070011196 Northwestern Univ., Evanston, IL USA

Nature Inspired Strategies for New Organic Materials

Scheidt, Karl A; Galliford, Chris; Jan 14, 2007; 6 pp.; In English

Contract(s)/Grant(s): FA9550-06-1-0007

Report No.(s): AD-A462830; No Copyright; Avail.: CASI: [A02](#), Hardcopy

This report accounts for the technical accomplishments during the single year of funding for this program. It includes, but is not limited to, a list of publications, transitions, visits, and awards earned by the participating researchers. This grant has been instrumental in initiating organic materials research in the Scheidt laboratory. Key discoveries made in this small time period include the development of an efficient synthesis of bidentate organic 'rods' to be used for material assembly. The basic fundamentals of the chemical reaction and the construction of various organic architectures were established. Furthermore, the interest in new methods and protocols to assemble tailor-made organic materials has been kindled and resulted in collaborations with additional high profile researchers at Northwestern University, including Chad Mirkin, Joe Hupp and SonBinh Nguyen.

DTIC

Carbenes; Catalysis; Organic Materials

24

COMPOSITE MATERIALS

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

20070010452 NASA Langley Research Center, Hampton, VA, USA

Interfacial Strength and Physical Properties of Functionalized Graphene - Epoxy Nanocomposites

Miller, Sandi G.; Heimann, Paula; Scheiman, Daniel; Adamson, Douglas H.; Aksay, Iihan A.; Prud'homme, Robert K.; [2006]; 6 pp.; In English; SAMPE, 6-9 Nov. 2006, Dallas, TX, USA; Original contains black and white illustrations

Contract(s)/Grant(s): NCC1-02037; WBS 984754.02.07.03.05.01; Copyright; Avail.: CASI: [A02](#), Hardcopy

The toughness and coefficient of thermal expansion of a series of functionalized graphene sheet - epoxy nanocomposites are investigated. Functionalized graphene sheets are produced by splitting graphite oxide into single graphene sheets through a rapid thermal expansion process. These graphene sheets contain approx. 10% oxygen due to the presence of hydroxide, epoxide, and carboxyl functional groups which assist in chemical bond formation with the epoxy matrix. Intrinsic surface functionality is used to graft alkyl amine chains on the graphene sheets, and the addition of excess hardener insures covalent bonding between the epoxide matrix and graphene sheets. Considerable improvement in the epoxy dimensional stability is obtained. An increase in nanocomposite toughness is observed in some cases.

Author

Epoxy Resins; Nanocomposites; Mechanical Properties; Graphite; Oxides; Interfacial Tension

20070010454 NASA Glenn Research Center, Cleveland, OH, USA

High Thermal Conductivity Polymer Matrix Composites (PMC) for Advanced Space Radiators

Shin, E. Eugene; Bowman, Cheryl; Beach, Duane, et al.; [2007]; 37 pp.; In English; High Temple Workshop 2007, 12-15 Feb. 2007, Sedona, AZ, USA; Original contains color and black and white illustrations

Contract(s)/Grant(s): NNC06ZA07A; WBS 997180.10.03.01; Copyright; Avail.: CASI: [A03](#), Hardcopy

High temperature polymer matrix composites (PMC) reinforced with high thermal conductivity (approx. 1000 W/mK) pitch-based carbon fibers are evaluated for a facesheet/fin structure of large space radiator systems. Significant weight reductions along with improved thermal performance, structural integrity and space durability toward its metallic counterparts were envisioned. Candidate commercial resin systems including Cyanate Esters, BMIs, and polyimide were selected based on thermal capabilities and processability. PMC laminates were designed to match the thermal expansion coefficient of various metal heat pipes or tubes. Large, but thin composite panels were successfully fabricated after optimizing cure conditions. Space durability of PMC with potential degradation mechanisms was assessed by simulated thermal aging tests in high vacuum, 1-3 x 10(exp -6) torr, at three temperatures, 227 C, 277 C, and 316 C for up to one year. Nanocomposites with vapor-grown carbon nano-fibers and exfoliated graphite flakes were attempted to improve thermal conductivity (TC) and microcracking resistance. Good quality nanocomposites were fabricated and evaluated for TC and durability including radiation resistance. TC was measured in both in-plan and thru-the-thickness directions, and the effects of microcracks on TC are also being evaluated. This paper will discuss the systematic experimental approaches, various performance-durability

evaluations, and current subcomponent design and fabrication/manufacturing efforts.

Author

High Temperature; Polymer Matrix Composites; Carbon Fibers; Thermal Conductivity; Spacecraft Radiators; Resins; Laminates; Nanocomposites

20070010459 NASA Glenn Research Center, Cleveland, OH, USA

Formation and Growth of Micro and Macro Bubbles on Copper-Graphite Composite Surfaces

Chao, David F.; Sankovic, John M.; Motil, Brian J.; Zhang, Nengli; [2007]; 8 pp.; In English; 45th AIAA Aerospace Science Meeting and Exhibit, 8-12 Jan. 2007, Reno, NV, USA; Original contains black and white illustrations

Contract(s)/Grant(s): WBS 138494.01.04.01; Copyright; Avail.: CASI: [A02](#), Hardcopy

Micro scale boiling behavior in the vicinity of graphite micro-fiber tips on the coppergraphite composite boiling surfaces is investigated. It is discovered that a large number of micro bubbles are formed first at the micro scratches and cavities on the copper matrix in pool boiling. In virtue of the non-wetting property of graphite, once the growing micro bubbles touch the graphite tips, the micro bubbles are sucked by the tips and merged into larger micro bubbles sitting on the tips. The micro bubbles grow rapidly and coalesce to form macro bubbles, each of which sitting on several tips. The growth processes of the micro and macro bubbles are analyzed and formulated followed by an analysis of bubble departure on the composite surfaces. Based on these analyses, the enhancement mechanism of the pool boiling heat transfer on the composite surfaces is clearly revealed. Experimental results of pool boiling heat transfer both for water and Freon-113 on the composite surfaces convincingly demonstrate the enhancement effects of the unique structure of Cu-Gr composite surfaces on boiling heat transfer.

Author

Bubbles; Copper; Microfibers; Metal Surfaces; Graphite; Boiling; Heat Transfer

20070010537 NASA Glenn Research Center, Cleveland, OH, USA

Effects of Different Braze Materials and Composite Substrates on Composite/Ti Joints

Morscher, Gregory N.; Singh, Mrityunjay; Asthana, Rajiv; Shpargel, Tarah; January 26, 2007; 19 pp.; In English; 31st International Cocoa Beach Conference and Exposition Advanced Ceramics and Composites: American Ceramic Society, 21-26 Jan. 2007, Daytona Beach, FL, USA; Original contains color illustrations

Contract(s)/Grant(s): NNC06ZA03A; WBS 22-973-80-50; Copyright; Avail.: CASI: [A03](#), Hardcopy

An ever increasing number of applications require robust joining technologies of dissimilar materials. In this study, three types of ceramic composites (C-C, C-SiC, and SiC-SiC) were vacuum brazed to commercially pure Ti using the Cusi-ABA (63 Ag - 35.5 Cu - 1.75 Ti) active metal braze alloy. The study also compared composite specimens as-fabricated and after surface grinding/polishing. A butt-strap tensile shear strength test was used to evaluate the joined structures at room temperature, 270 and 500 C. The elevated temperatures represent possible use temperatures for some heat rejection type applications. Joint strength will be discussed in light of braze wetting and spreading properties, composite properties, and test temperature.

Author

Titanium Alloys; Ceramic Matrix Composites; Shear Strength; Tensile Strength; High Temperature; Brazing

20070010588 NASA Johnson Space Center, Houston, TX, USA

Nondestructive Methods and Special Test Instrumentation Supporting NASA Composite Overwrapped Pressure Vessel Assessments

Saulsberry, Regor; Greene, Nathanael; Cameron, Ken; Madaras, Eric; Grimes-Ledesma, Lorie; Thesken, John; Phoenix, Leigh; Murthy, Pappu; Revilock, Duane; [2007]; 58 pp.; In English; 48th AIAA/ASME/ASCE/AHS/ASC Structures, 23-26 Apr. 2007, Reston, VA, USA; Original contains color and black and white illustrations

Report No.(s): AIAA Paper 2007-2324; Copyright; Avail.: CASI: [A04](#), Hardcopy

Many aging composite overwrapped pressure vessels (COPVs), being used by the National Aeronautics and Space Administration (NASA) are currently under evaluation to better quantify their reliability and clarify their likelihood of failure due to stress rupture and age-dependent issues. As a result, some test and analysis programs have been successfully accomplished and other related programs are still in progress at the NASA Johnson Space Center (JSC) White Sands Test Facility (WSTF) and other NASA centers, with assistance from the commercial sector. To support this effort, a group of Nondestructive Evaluation (NDE) experts was assembled to provide NDE competence for pretest evaluation of test articles and for application of NDE technology to real-time testing. Techniques were required to provide assurance that the test article

had adequate structural integrity and manufacturing consistency to be considered acceptable for testing and these techniques were successfully applied. Destructive testing is also being accomplished to better understand the physical and chemical property changes associated with progression toward 'stress rupture' (SR) failure, and it is being associated with NDE response, so it can potentially be used to help with life prediction. Destructive work also includes the evaluation of residual stresses during dissection of the overwrap, laboratory evaluation of specimens extracted from the overwrap to evaluate physical property changes, and quantitative microscopy to inform the theoretical micromechanics.

Author

Composite Wrapping; Nondestructive Tests; Pressure Vessels; Residual Stress; Structural Failure; Filament Winding

20070010850 Missouri Univ., Rolla, MO USA

Disbond Thickness Evaluation Employing Multiple-Frequency Near-Field Microwave Measurements (Preprint)

Abou-Khousa, M; Zoughi, R; Jul 2006; 19 pp.; In English

Contract(s)/Grant(s): FA8650-04-C-5704; Proj-2510

Report No.(s): AD-A462413; No Copyright; Avail.: CASI: [A03](#), Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA462413>

Near-field microwave nondestructive evaluation (NDE) techniques have shown great potential for disbond detection in multi-layer dielectric composite structures. The high detection capability associated with these techniques stems from the fact that near-field microwave signals are sensitive to minute variations in the dielectric properties and geometry of the medium in which they propagate. In the past, the sensitivity of the near-field microwave NDE techniques to the presence and properties of disbonds in multi-layer dielectric composites has been investigated extensively. However, a quantitative disbond thickness estimation method has yet to be introduced. In this paper, we propose a maximum-likelihood (ML) disbond thickness evaluation method utilizing multiple independent measurements obtained at different frequencies. We also introduce a statistical lower limit on the thickness resolution based on the mean squared error (MSE) in thickness estimation and a given confidence interval. The effectiveness of the proposed ML method is also verified by comparing simulation results with actual measurements.

DTIC

Composite Materials; Debonding (Materials); Dielectric Properties; Frequencies; Microwaves; Near Fields; Thickness

25

INORGANIC, ORGANIC AND PHYSICAL CHEMISTRY

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

20070009605 Battelle Energy Alliance, LLC., Idaho Falls, ID, USA

Actinium Radioisotope Products of Enhanced Purity

Melkrantz, D. H.; Todd, T. A.; Tood, T. J.; Tranter, T. J.; Horwitz, E. P.; 3 Apr 06; 14 pp.; In English

Contract(s)/Grant(s): DE-AC07-99ID13727

Patent Info.: Filed Filed 3 Apr 06; US-Patent-Appl-SN-11-278-522

Report No.(s): PB2007-101428; No Copyright; Avail.: CASI: [A03](#), Hardcopy

A product includes actinium-225 (.sup.225Ac) and less than about 1 microgram (.mu.g) of iron (Fe) per millicurie (mCi) of actinium-225. The product may have a radioisotopic purity of greater than about 99.99 atomic percent (at %) actinium-225 and daughter isotopes of actinium-225, and may be formed by a method that includes providing a radioisotope mixture solution comprising at least one of uranium-233 (.sup.233U) and thorium-229 (.sup.229Th), extracting the at least one of uranium-233 and thorium-229 into an organic phase, substantially continuously contacting the organic phase with an aqueous phase, substantially continuously extracting actinium-225 into the aqueous phase, and purifying the actinium-225 from the aqueous phase. In some embodiments, the product may include less than about 1 nanogram (ng) of iron per millicurie (mCi) of actinium-225, and may include less than about 1 microgram (.mu.g) each of magnesium (Mg), Chromium (Cr), and manganese (Mn) per millicurie (mCi) of actinium-225.

NTIS

Actinium; Purity; Radioactive Isotopes

20070009634 Battelle Columbus Labs., OH USA

Literature Review of Wipe Sampling Methods for Chemical Warfare Agents and Toxic Industrial Chemicals

Jan. 2007; 56 pp.; In English

Report No.(s): PB2007-106103; No Copyright; Avail.: CASI: [A04](#), Hardcopy

Wipe sampling is an important technique for the estimation of contaminant deposition in buildings, homes, or outdoor surfaces as a source of possible human exposure. Numerous methods of wipe sampling exist, and each method has its own specification for the type of wipe, wetting solvent, and determinative step to be used, depending upon the contaminant of concern. The objective of this report is to concisely summarize the findings of a literature review that was conducted to identify the state-of-the-art wipe sampling techniques for a target list of compounds. This report describes the methods used to perform the literature review; a brief review of wipe sampling techniques in general; an analysis of physical and chemical properties of each target analyte; an analysis of wipe sampling techniques for the target analyte list; and a summary of the wipe sampling techniques for the target analyte list, including existing data gaps. In general, no overwhelming consensus can be drawn from the current literature on how to collect a wipe sample for the chemical warfare agents, organophosphate pesticides, and other toxic industrial chemicals of interest to this study. Different methods, media, and wetting solvents have been recommended and used by various groups and different studies. For many of the compounds of interest, no specific wipe sampling methodology has been established for their collection. Before a wipe sampling method (or methods) can be established for the compounds discussed in this report, two steps must be taken: (1) conduct investigative research to fill in the gaps in wipe sampling knowledge, and (2) conduct method validation to optimize the methods.

NTIS

Chemical Warfare; Contamination; Exposure; Sampling; Toxicity

20070009645 California Univ., Berkeley, CA, USA, Lawrence Livermore National Lab., Livermore, CA USA

Lipid Nanotube or Nanowire Sensor

Noy, A.; Bakajin, O.; Letant, S.; Stadermann, M.; Artyukhin, A. B.; 23 Jan 06; 12 pp.; In English

Contract(s)/Grant(s): DE-W-7405-ENG-485

Patent Info.: Filed Filed 23 Jan 06; US-Patent-Appl-SN-11-338-512

Report No.(s): PB2007-101441; No Copyright; Avail.: CASI: [A03](#), Hardcopy

A sensor apparatus comprising a nanotube or nanowire, a lipid bilayer around the nanotube or nanowire, and a sensing element connected to the lipid bilayer. Also a biosensor apparatus comprising a gate electrode; a source electrode; a drain electrode; a nanotube or nanowire operatively connected to the gate electrode, the source electrode, and the drain electrode; a lipid bilayer around the nanotube or nanowire, and a sensing element connected to the lipid bilayer.

NTIS

Lipids; Nanotubes; Nanowires; Detection

20070009665 Pacific Northwest National Lab., Richland, WA, USA

Sonochemical Digestion of Soil and Sediment Samples

Sinkov, S. I.; Lumetta, G. J.; Oct. 2006; 25 pp.; In English

Report No.(s): DE2006-893671; PNNL-16036; No Copyright; Avail.: National Technical Information Service (NTIS)

This work was performed as part of a broader effort to automate analytical methods for determination of plutonium and other radioisotopes in environmental samples. The work described here represented a screening study to determine the potential for applying ultrasonic irradiation to sample digestion. Two standard reference materials (SRMs) were used in this study: Columbia River Sediment and Rocky Flats Soil. The key experiments performed are listed below along with a summary of the results. The action of nitric acid, regardless of its concentration and liquid-to-solid ratio, did not achieve dissolution efficiency better than 20%. The major fraction of natural organic matter (NOM) remained undissolved by this treatment. Sonication did not result in improved dissolution for the SRMs tested. The action of hydrofluoric acid at concentrations of 8 M and higher achieved much more pronounced dissolution (up to 97% dissolved for the Rocky Flats soil sample and up to 78% dissolved for the Columbia River Sediment sample). Dissolution efficiency remains constant for solid-to-liquid ratios of up to 0.05 to 1 and decreases for the higher loadings of the solid phase. Sonication produced no measurable effect in improving the dissolution of the samples compared with the control digestion experiments. Combined treatment of the SRM by mixtures of HNO₃ and HF showed inferior performance compared with the HF alone. An adverse effect of sonication was found for the Rocky Flats soil material, which became more noticeable at higher HF concentrations. Sonication of the Columbia River sediment samples had no positive effect in the mixed acid treatment. The results indicate that applying ultrasound in an isolated cup horn configuration does not offer any advantage over conventional 'heat and mix' treatment for dissolution of the soil and sediment based on the SRM examined here. This conclusion, however, is based on an approach that uses gravimetric analysis

to determine gross dissolution efficiency. This approach does not allow any conclusion regarding the possible advantage of sonication in selective dissolution of plutonium traces incorporated into an inorganic or organic fraction of the samples.

NTIS

Digesting; Plutonium; Radioactive Isotopes; Sediments; Soil Sampling; Soils

20070009667 Pacific Northwest National Lab., Richland, WA, USA

Sonochemical Digestion of High-Fired Plutonium Dioxide Samples

Sinkov, S. I.; Lumetta, G. J.; Oct. 2006; 23 pp.; In English

Report No.(s): DE2006-893670; PNNL-16035; No Copyright; Avail.: National Technical Information Service (NTIS)

This work was performed as part of a broader effort to automate analytical methods for determining plutonium and other radioisotopes in environmental samples. The work described here represented a screening study to evaluate the effect of applying ultrasonic irradiation to dissolve high-fired plutonium oxide. The major findings of this work can be summarized as follows: (1) High-fired plutonium oxide does not undergo measurable dissolution when sonicated in nitric acid solutions, even at a high concentration range of nitric acid where the calculated thermodynamic solubility of plutonium oxide exceeds the g/mL level. (2) Applying organic complexants (nitrilotriacetic acid) and reductants (hydroxyurea) in 1.5 M nitric acid does not significantly increase the dissolution compared with digestion in nitric acid alone. Nearly all (99.5%) of the plutonium oxide remains undissolved under these conditions. (3) The action of a strong inorganic reductant, titanium trichloride in 25 wt% HCl, results in 40% dissolution of the plutonium oxide when the titanium trichloride concentration is 1 wt% under sonication. (4) Oxidative treatment of plutonium oxide by freshly dissolved AgO ((approx)20 mg/mL) in 1.5 M nitric acid with sonication resulted in 95% plutonium oxide dissolution. However, the same treatment of plutonium oxide mechanically mixed with 50 mg of Columbia River sediment (CRS) results in a significant decrease of dissolution yield of plutonium oxide (h20% dissolved at the same AgO loading) because of parasitic consumption of AG(II) by oxidizable components of the CRS. (5) Digesting plutonium oxide in HF resulted in dissolution yields slightly higher than 80% for HF concentration from 6 M to 14 M. Sonication did not result in any improvement in dissolution efficiency in HF. (6) Mixed nitric acid/HF solutions result in a higher dissolution yield of plutonium oxide compared with digestion in HF alone (at the same HF concentrations). Practically quantitative dissolution of PuO₂ can be achieved with 6 to 8 M nitric acid + 14 M HF or 8 M nitric acid + 4 M HF mixtures. In the latter case, quantitative dissolution of plutonium oxide was demonstrated only with sonication. Overall, the results indicate that applying ultrasound in an isolated cup horn configuration to dissolve refractory plutonium oxide does not offer any substantial advantage over conventional heat and mix treatment. Oxidative treatment by AgO appears to be effective only when very little or no oxidizable materials are present in the digested sample. The catalytic use of Ag(II) in the 'Catalyzed Electrolytic Plutonium Oxide Dissolution' technology would probably be more effective than using AgO because the Ag(II) is continually regenerated electrochemically. Reductive treatment with titanium trichloride in HCl solution proves to be less efficient than the previously observed effect based on in situ generation of Ti(III) in phosphoric acid and sulfuric acid media using a dip probe sonication setup. The previous experiments, however, were performed at higher temperature and with non-steady concentration profiles of Ti(III) ion in the process of sonochemical digestion.

NTIS

Digesting; Plutonium Oxides; Radioactive Isotopes; Ultrasonic Processing

20070009799 Massachusetts Inst. of Tech., Cambridge, MA USA

Two Phase Transitions of Octa(ethylsilsesquioxane) (C₂H₅SiO_{1.5})₈ (PREPRINT)

Mueller, Peter; Poliskie, Georgia M; Haddad, Timothy S; Blasni, Rusty L; Gleason, Karen K; May 30, 2006; 12 pp.; In English

Contract(s)/Grant(s): Proj-2303

Report No.(s): AD-A461447; AFRL-PR-ED-JA-2006-179; No Copyright; Avail.: CASI: [A03](#), Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA461447>

Crystals of the ethyl substituted octa-silsesquioxane (C₂H₅SiO_{1.5})₈ (ethyl POSS) undergo two phase transitions within the temperature range from 300K to 100K. At room temperature, crystalline ethyl POSS exhibits a plastic phase (phase I). When the temperature drops below about 255K, the molecular motion in the crystal slows to a rigid limit. This transition from phase I to phase II lowers the symmetry from rhombohedral to triclinic, corresponding to the change from one sixth of a molecule per asymmetric unit in the rhombohedral phase to half an independent molecule in phase II. In addition, this transition is fully reversible and is accompanied by the appearance (or disappearance when reversed) of threefold non-merohedral twinning. The second phase transition -- from phase II to phase III -- occurs around 240K and lowers the symmetry again: there are two half molecules per asymmetric unit in phase III, which is also triclinic. Even though the

transition to phase III destroys the crystal, warming it to temperatures above 255K restores the plastic phase and the crystal 'heals'

DTIC

Phase Transformations; Siloxanes; Crystal Structure

20070009934 American Ceramic Society, Westerville, OH, USA, American Inst. of Chemical Engineers, New York, NY, USA

Evaluation of Organic Vapor Release from Cement based Waste Forms

Cozzi, A. D.; Eibling, R. E.; Marinik, A. R.; Zamecnik, J. R.; Sep. 01, 2006; 12 pp.; In English

Report No.(s): DE2006-892720; WSRC-MS-2006-00139; No Copyright; Avail.: Department of Energy Information Bridge

A cement based waste form was evaluated to determine the rates at which various organics were released during heating caused by the cementitious heat-of-hydration reaction. Saltstone is a cement-based waste form for the disposal of low-level salt solution. Samples were prepared with either Isopar(reg-sign) L, a long straight chained hydrocarbon, or (Cs,K) tetraphenylborate, a solid that, upon heating, decomposes to benzene and other aromatic compounds. The saltstone samples were heated over a range of temperatures. Periodically, sample headspaces were purged and the organic constituents were captured on carbon beds and analyzed. Isopar(reg-sign) L was released from the saltstone in a direct relationship to temperature. An equation was developed to correlate the release rate of Isopar(reg-sign) L from the saltstone to the temperature at which the samples were cured. The release of benzene was more complex and relied on both the decomposition of the tetraphenylborate as well as the transport of the manufactured benzene through the curing saltstone. Additional testing with saltstone prepared with different surface area/volume also was performed.

NTIS

Cements; Curing; Vapors

20070009989 NASA White Sands Test Facility, NM, USA

Chemical Characterization and Reactivity Testing of Fuel-Oxidizer Reaction Product (Test Report)

March 15, 1996; 81 pp.; In English; Original contains black and white illustrations

Report No.(s): TR-833-001; No Copyright; Avail.: CASI: A05, Hardcopy

ONLINE: <http://hdl.handle.net/2060/20070009989>

The product of incomplete reaction of monomethylhydrazine (MMH) and nitrogen tetroxide (NTO) propellants, or fuel-oxidizer reaction product (FORP), has been hypothesized as a contributory cause of an anomaly which occurred in the chamber pressure (PC) transducer tube on the Reaction Control Subsystem (RCS) aft thruster 467 on flight STS-51. A small hole was found in the titanium-alloy PC tube at the first bend below the pressure transducer. It was surmised that the hole may have been caused by heat and pressure resulting from ignition of FORP. The NASA Johnson Space Center (JSC) White Sands Test Facility (WSTF) was requested to define the chemical characteristics of FORP, characterize its reactivity, and simulate the events in a controlled environment which may have lead to the Pc-tube failure. Samples of FORP were obtained from the gas-phase reaction of MMH with NTO under laboratory conditions, the pulsed firings of RCS thrusters with modified PC tubes using varied oxidizer or fuel lead times, and the nominal RCS thruster firings at WSTF and Kaiser-Marquardt. Fourier transform infrared spectroscopy (FTIR), differential scanning calorimetry (DSC), accelerating rate calorimetry (ARC), ion chromatography (IC), inductively coupled plasma (ICP) spectrometry, thermogravimetric analysis (TGA) coupled to FTIR (TGA/FTIR), and mechanical impact testing were used to qualitatively and quantitatively characterize the chemical, thermal, and ignition properties of FORP. These studies showed that the composition of FORP is variable but falls within a limited range of compositions that depends on the fuel loxidizer ratio at the time of formation, composition of the post-formation atmosphere (reducing or oxidizing), and reaction or postreaction temperature. A typical composition contains methylhydrazinium nitrate (MMHN), ammonium nitrate (AN), methylammonium nitrate (MAN), and trace amounts of hydrazinium nitrate and 1,1-dimethylhydrazinium nitrate. The thermal decomposition reactions of FORP compositions used in this study were unremarkable. Neither the various compositions of FORP, the pure major components of FORP, nor mixtures of FORP with propellant-system corrosion products showed any unusual thermal activity when decomposed under laboratory conditions. Off-limit thruster operations were simulated by rapid mixing of liquid MMH and liquid NTO in a confined space. The test hardware was constructed with pressure- and temperature-measurement devices to determine if the expected fuel oxidizer reaction would result in increased energy release when FORP, FORP constituents, or propellant-system corrosion products were present. These tests demonstrated that FORP, MMHN, AN, or Inconel corrosion products can induce a mixture of MMH and NTO to produce component-damaging energies. The simulation-test program was not extensive enough to provide statistical probabilities for these events but did show that such events can occur. Damaging events required FORP or metal salts to be present at the initial mixing of MMH and NTO. Based on the results of these studies, it is suggested

that removal or mitigation of a buildup of these materials may decrease the incidence of these high-energy, potentially damaging events.

Author

Oxidizers; Chemical Reactions; Chemical Properties; Characterization; Fuel Injection; Propellants

20070010477 Lawrence Livermore National Lab., Livermore, CA USA

Selection of Corrosion Resistant Materials for Nuclear Waste Repositories

Rebak, R. B.; January 2006; 16 pp.; In English

Report No.(s): DE2006-894820; No Copyright; Avail.: Department of Energy Information Bridge

Several countries are considering geological repositories to dispose of nuclear waste. The environment of most of the currently considered repositories will be reducing in nature, except for the repository in the U.S., which is going to be oxidizing. For the reducing repositories, alloys such as carbon steel, stainless steels and titanium are being evaluated. For the repository in the U.S., some of the most corrosion resistant commercially available alloys are being investigated. This paper presents a summary of the behavior of the different materials under consideration for the repositories and the current understanding of the degradation modes of the proposed alloys in ground water environments from the point of view of general corrosion, localized corrosion and environmentally assisted cracking.

NTIS

Corrosion Resistance; Radioactive Wastes; Waste Disposal

20070010492 Pacific Northwest National Lab., Richland, WA, USA

Alternative Treatment of Trace Chemical Constituents in Calculated Chemical Source Terms for Hanford Tank Farms Safety Analyses

Huckaby, J. L.; Sep. 2006; 14 pp.; In English

Report No.(s): DE2006-894876; PNNL-16089; No Copyright; Avail.: Department of Energy Information Bridge

Hanford Site high-level radioactive waste tank accident analyses require chemical waste toxicity source terms to assess potential accident consequences. Recent reviews of the current methodology used to generate source terms and the need to periodically update the source terms has brought scrutiny to the manner in which trace waste constituents are included in the source terms. This report examines the importance of trace constituents to the chemical waste source terms, which are calculated as sums of fractions (SOFs), and recommends three changes to the manner in which trace constituents are included in the calculation SOFs.

NTIS

Radioactive Wastes; Safety; Waste Management

20070010499 Lawrence Livermore National Lab., Livermore, CA USA, Case Western Reserve Univ., Cleveland, OH USA
Passive Corrosion Behavior of Alloy 22

Rebak, R. B.; Payer, J. H.; Jan. 20, 2006; 7 pp.; In English

Report No.(s): DE2006-893919; UCRL-CONF-218309; No Copyright; Avail.: Department of Energy Information Bridge

Alloy 22 (NO6022) was designed to stand the most aggressive industrial applications, including both reducing and oxidizing acids. Even in the most aggressive environments, if the temperature is lower than 150 F (66 C) Alloy 22 would remain in the passive state having particularly low corrosion rates. In multi-ionic solutions that may simulate the behavior of concentrated ground water, even at near boiling temperatures, the corrosion rate of Alloy 22 is only a few nano-meters per year because the alloy is in the complete passive state. The corrosion rate of passive Alloy 22 decreases as the time increases. Immersion corrosion testing also show that the newer generation of Ni-Cr-Mo alloys may offer a better corrosion resistance than Alloy 22 only in some highly aggressive conditions such as in hot acids.

NTIS

Corrosion; Radioactive Wastes; Waste Management

20070010500 Ohio State Univ., Columbus, OH, USA, Akita Univ., Japan

Localized Corrosion Behavior of Type 304SS with a Silica Layer under Atmospheric Corrosion Environments

Tada, E.; Frankel, G. S.; Mar. 13, 2006; 5 pp.; In English

Report No.(s): DE2006-893925; No Copyright; Avail.: Department of Energy Information Bridge

The U.S. Department of Energy (DOE) has proposed a potential repository for spent nuclear fuel and high-level radioactive waste at the Yucca Mountain site in Nevada. (I) The temperature could be high on the waste packages, and it is

possible that dripping water or humidity could interact with rock dust particulate to form a thin electrolyte layer with concentrated ionic species. Under these conditions, it is possible that highly corrosion-resistant alloys (CRAs) used as packages to dispose the nuclear waste could suffer localized corrosion. Therefore, to better understand long-term corrosion performance of CRAs in the repository, it is important to investigate localized corrosion under a simulated repository environment. We measured open circuit potential (OCP) and galvanic current ($i_{\text{sub g}}$) for silica-coated Type 304SS during drying of salt solutions under controlled RH environments to clarify the effect of silica layer as a dust layer simulant on localized corrosion under atmospheric environments. Type 304SS was used as a relatively susceptible model CRA instead of the much more corrosion resistant alloys, such as Alloy 22, that are being considered as, waste package materials.

NTIS

Atmospheric Effects; Corrosion; Corrosion Resistance; Radioactive Wastes; Silicon Dioxide; Waste Management

20070010501 Virginia Univ., Charlottesville, VA, USA, Case Western Reserve Univ., Cleveland, OH, USA

Consideration of the Role of the Cathodic Region in Localized Corrosion

Kelly, R. G.; Agarwal, A.; Cui, F.; Shan, X.; Lanau, U.; Mar. 2006; 7 pp.; In English

Report No.(s): DE2006-893928; MOL.20060705.0167; No Copyright; Avail.: National Technical Information Service

(NTIS)

The ability of wetted cathodes of limited area to support localized corrosion sites on passive materials exposed to atmospheric conditions was studied computationally. The analysis pertains to conditions where metal surfaces are covered by thin layers of moisture in contrast to conditions of full immersion. The moisture may be a continuous layer or in patches with and without particulate on the surface. These conditions are of interest for the surfaces of the waste packages at the proposed Yucca Mountain Repository where waste packages are supported in air. The cathode capacity was characterized by the total net cathodic current, $I_{\text{sub net}}$, which the surface surrounding a localized corrosion site (i.e., a pit or crevice) could supply. The cathode capacity increases with increasing cathode area, but it saturates at finite cathode sizes due to the resistance of the thin electrolyte layer. The magnitude of the capacity depends on the water layer thickness, the solution conductivity, and the electrochemical reaction kinetics. The presence of particulates is treated by considering both volume and surface coverage effects. The limited electrolyte volume under thin film conditions can lead to rapid pH changes which decrease the cathode capacity due to the slower electrochemical kinetics at elevated pH. These effects can make localized corrosion less likely to be sustained.

NTIS

Cathodes; Corrosion; Mountains; Radioactive Wastes; Waste Management

20070010542 NASA Langley Research Center, Hampton, VA, USA

Atmospheric Chemistry Experiment (ACE) Measurements of Tropospheric and Stratospheric Chemistry and Long-Term Trends

Rinsland, Curtis P.; Bernath, Peter; Boone, Chris; Nassar, Ray; [2007]; 3 pp.; In English; Hyperspectral Imaging and Sounding of the Environment Topical Meeting and Tabletop Exhibit (HISE), 11-15 Feb. 2007, Santa Fe, NM, USA

Contract(s)/Grant(s): WBS 281945.02.32.01.07; Copyright; Avail.: CASI: [A01](#), Hardcopy

We highlight chemistry and trend measurement results from the Atmospheric Chemistry Experiment (ACE) which is providing precise middle troposphere to the lower thermosphere measurements with a 0.02/cm resolution Fourier transform spectrometer covering 750-4400/cm

Author

Atmospheric Chemistry; Stratosphere; Troposphere; Thermosphere

20070010559 Department of Energy, Washington, DC USA

Laboratory Investigation of Organic Aerosol Formation from Aromatic Hydrocarbons

Molina, L. T.; Zhang, R.; Molina, M. J.; January 2006; 6 pp.; In English

Report No.(s): DE2006-889933; No Copyright; Avail.: Department of Energy Information Bridge

The work for this DOE funded project includes: (1) measurements of the kinetics and mechanism of the gas-phase oxidation reactions of the aromatic hydrocarbons initiated by OH; (2) measurements of aerosol formation from the aromatic hydrocarbons; and (3) theoretical studies to elucidate the OH-toluene reaction mechanism using quantum-chemical and rate theories.

NTIS

Aerosols; Hydrocarbons

20070010563 Ohio State Univ., Columbus, OH, USA

Unimolecular Reaction Dynamics of Free Radicals. Final Technical Report

Miller, T. A.; Sep. 01, 2006; 6 pp.; In English

Report No.(s): DE2006-890741; DE-FG02-02ER15284; No Copyright; Avail.: National Technical Information Service (NTIS)

Free radical reactions are of crucial importance in combustion and in atmospheric chemistry. Reliable theoretical models for predicting the rates and products of these reactions are required for modeling combustion and atmospheric chemistry systems. Unimolecular reactions frequently play a crucial role in determining final products. The dissociations of vinyl, CH₂=CH, and methoxy, CH₃O, have low barriers, about 13,000 cm⁻¹ and 8,000 cm⁻¹, respectively. Since barriers of this magnitude are typical of free radicals these molecules should serve as benchmarks for this important class of reactions. To achieve this goal, a detailed understanding of the vinyl and methoxy radicals is required. Results for dissociation dynamics of vinyl and selectively deuterated vinyl radical are reported. Significantly, H-atom scrambling is shown not to occur in this reaction. A large number of spectroscopic experiments for CH₃O and CHD₂O have been performed. Spectra recorded include laser induced fluorescence (LIF), laser excited dispersed fluorescence (LEDf), fluorescence dip infrared (FDIR) and stimulated emission pumping (SEP). Such results are critical for implementing dynamics experiments involving the dissociation of methoxy.

NTIS

Free Radicals; Chemical Reactions

20070010640 Westinghouse Savannah River Co., Aiken, SC, USA

Use of Electron Shuttles to Biologically Enhance Abiotic Dechlorination

Sep. 19, 2006; 90 pp.; In English

Report No.(s): DE2006-895043; WSRC-STI-2006-00189; No Copyright; Avail.: National Technical Information Service (NTIS)

Biological anaerobic reductive dechlorination is a robust attenuation mechanism for chlorinated solvents and, under appropriate site conditions, is the dominant attenuation process. When conditions do not favor anaerobic biodegradation, other processes need to be assessed and quantified (EPA, 1998). Abiotic reductive dechlorination is one such mechanism that may contribute to attenuation. A team of researchers conducted studies to develop a method to measure acetylene as an indicator of abiotic reductive dechlorination and to develop a method to enhance this process using electron shuttles. The results of their work indicate additional research is needed to understand and measure this mechanism.

NTIS

Aerobes; Chlorination; Biodegradation; Electrons

20070010643 Lawrence Livermore National Lab., Livermore, CA USA

Framework for the Analysis of Localized Corrosion at the Proposed Yucca Mountain Repository

Payer, J. H.; Carroll, S. A.; Gdowski, G. E.; Rebak, R. B.; Jan. 17, 2006; 10 pp.; In English

Report No.(s): DE2006-895089; UCRL-CONF-218085; No Copyright; Avail.: National Technical Information Service (NTIS)

The proposed Repository presents a familiar materials performance application that is regularly encountered in energy, transportation and other industries. The widely accepted approach to dealing with materials performance is to identify the performance requirements, to determine the operating conditions to which materials will be exposed and to select materials of construction that perform well in those conditions. A special feature of the proposed Yucca Mountain Repository is the extremely long time frame of interest, i.e. 10,000's of years and longer. Thus, the time evolution of the environment in contact with waste package surfaces and the time evolution of corrosion damage that may result are of primary interest in the determination of expected performance. An approach is presented to the analysis of localized corrosion during a time period when it is possible for waters from drips and seepage to contact the waste package surfaces, and the analysis is demonstrated for the water chemistry of mixed salt solutions and a set of time-temperature-relative humidity profiles for a hot, mid and cool temperature waste package. Based on the analysis, there are large time periods when localized corrosion can not be supported, and no corrosion damage will occur. Further analysis can then focus on time periods when it is possible for localized corrosion to occur and the determination of the evolution of any corrosion damage.

NTIS

Corrosion; Mountains; Radioactive Wastes; Waste Management

20070010660 Lawrence Livermore National Lab., Livermore, CA USA

Passive Corrosion Behavior of Alloy 22

Rebak, R. B.; Payer, J. H.; Jan. 20, 2006; 9 pp.; In English

Report No.(s): DE2006-894333; UCRL-CONF-218309; No Copyright; Avail.: Department of Energy Information Bridge

Alloy 22 (N06022) was designed to stand the most aggressive industrial applications, including both reducing and oxidizing acids. Even in the most aggressive environments, if the temperature is lower than 150 degrees F (66 degrees C) Alloy 22 would remain in the passive state having particularly low corrosion rates. In multi-ionic solutions that may simulate the behavior of concentrated ground water, even at near boiling temperatures, the corrosion rate of Alloy 22 is only a few nanometers per year because the alloy is in the complete passive state. The corrosion rate of passive Alloy 22 decreases as the time increases. Immersion corrosion testing also show that the newer generation of Ni-Cr-Mo alloys may offer a better corrosion resistance than Alloy 22 only in some highly aggressive conditions such as in hot acids.

NTIS

Corrosion; Corrosion Resistance; Nickel Alloys; Radioactive Wastes; Waste Management

20070010683 Lawrence Livermore National Lab., Livermore, CA USA

Progress Towards a PETN Lifetime Prediction Model

Burnham, A. K.; Overturf, G. E.; Gee, R.; Lewis, P.; Qiu, R.; Sep. 13, 2006; 7 pp.; In English

Report No.(s): DE2006-894357; UCRL-COPNF-224411; No Copyright; Avail.: National Technical Information Service (NTIS)

Dinegar showed that decreases in PETN surface area causes EBW detonator function times to increase. Thermal aging causes PETN to agglomerate, shrink, and densify indicating a 'sintering' process. It has long been a concern that the formation of a gap between the PETN and the bridgewire may lead to EBW detonator failure. These concerns have led us to develop a model to predict the rate of coarsening that occurs with age for thermally driven PETN powder (50% TMD). To understand PETN contributions to detonator aging we need three things: (1) Curves describing function time dependence on specific surface area, density, and gap. (2) A measurement of the critical gap distance for no fire as a function of density and surface area for various wire configurations. (3) A model describing how specific surface area, density and gap change with time and temperature. We've had good success modeling high temperature surface area reduction and function time increase using a phenomenological deceleratory kinetic model based on a distribution of parallel nth-order reactions having evenly spaced activation energies where weighing factors of the reactions follows a Gaussian distribution about the reaction with the mean activation energy.

NTIS

Chemical Explosions; Detonators; Mathematical Models; PETN; Predictions

20070010684 Lawrence Livermore National Lab., Livermore, CA USA

What Have We Learned From Decades of CRT, and Where Do We Go From Here

Burnham, A. K.; Souers, P. C.; Gagliardi, F. J.; Weese, R. K.; DePiero, S. C.; Sep. 15, 2006; 6 pp.; In English

Report No.(s): DE2006-894358; UCRL-CONF-224457; No Copyright; Avail.: Department of Energy Information Bridge

The Chemical Reactivity Test, or CRT, has been the workhorse for determining short-to-medium term compatibility and thermal stability for energetic materials since the mid 1960s. The concept behind the CRT is quite simple. 0.25 g of material is heated in a 17 cm(sup 3) vessel for 22 hours at 80, 100, or 120 C, and the yield of gaseous products are analyzed by gas chromatography to determine its thermal stability. The instrumentation is shown in this document and the vessel configuration is shown. For compatibility purposes, two materials, normally 0.25 g of each, are analyzed as a mixture. Recently, data from the past 4 decades have been compiled in an Excel spreadsheet and inspected for reliability and internal consistency. The resulting processed data will be added this year to the LLNL HE Reference Guide. Also recently, we have begun to assess the suitability of the CRT to answer new compatibility issues, especially in view of more modern instrumentation now available commercially. One issue that needs to be addressed is the definition of thermal stability and compatibility from the CRT.

NTIS

Cathode Ray Tubes; Chemical Explosions; Chemical Reactions; Explosives

20070010687 Lawrence Livermore National Lab., Livermore, CA USA

Study of the Structure and Metabolic Processes of a Novel Membrane Cytochrome in an Extreme Microbial Community

Wong, S. E.; Jeans, C.; Thelen, M. P.; Sep. 13, 2006; 27 pp.; In English

Report No.(s): DE2006-894351; UCRL-TR-224396; No Copyright; Avail.: National Technical Information Service (NTIS)

The action of iron oxidizing microbes can generate acid mine drainage (AMD), characterized by acidic, toxic metal-tainted water that pollutes various water resources. The acidophilic biofilm community populating the Richmond mine, a pyrite (FeS(sub 2)) deposit in Northern California, is a key component of the oxidation of Fe(II) as well as subsequent pyrite dissolution. These natural biofilms contain many novel proteins that are being studied in order to understand how these microbes oxidize iron. The focus of this study is on the structure and characteristics of one novel, abundant outer membrane protein, cytochrome 572 (Cyt(sub 572)), which is perhaps important to the function of the entire community. To detect and study this cytochrome, monoclonal antibodies (mAb) were produced and screened for specificity to Cyt(sub 572), both purified and membrane-bound. This was accomplished using enzyme linked immunosorbent assay (ELISA) and western blot analysis. Using western blotting, the presence of three high molecular weight bands at positions of dimer, trimer and tetramer corroborate chromatographic results that Cyt(sub 572) is a tetramer. Immunoprecipitation was used to detect a Cyt(sub 572) specific multiprotein complex, and these experiments are in progress. Apart from its novel amino acid sequence, Cyt(sub 572) binds to a heme group that exhibits unique spectral properties.

NTIS

Cytochromes; Drainage; Membranes; Metabolism; Microorganisms

20070010689 Pacific Northwest National Lab., Richland, WA, USA

Corrosion of Metal Inclusions in Bulk Vitrification Waste Packages

Bacon, D. H.; Pierce, E. M.; Wellman, D. M.; Strachan, D. M.; Josephson, G. B.; Jul. 2006; 65 pp.; In English
Report No.(s): DE2006-894473; PNNL-15947; No Copyright; Avail.: National Technical Information Service (NTIS)

The primary purpose of the work reported here is to analyze the potential effect of the release of technetium (Tc) from metal inclusions in bulk vitrification waste packages once they are placed in the Integrated Disposal Facility (IDF). As part of the strategy for immobilizing waste from the underground tanks at Hanford, selected wastes will be immobilized using bulk vitrification. During analyses of the glass produced in engineering-scale tests, metal inclusions were found in the glass product. This report contains the results from experiments designed to quantify the corrosion rates of metal inclusions found in the glass product from AMEC Test ES-32B and simulations designed to compare the rate of Tc release from the metal inclusions to the release of Tc from glass produced with the bulk vitrification process. In the simulations, the Tc in the metal inclusions was assumed to be released congruently during metal corrosion as soluble TcO₄⁻. The experimental results and modeling calculations show that the metal corrosion rate will, under all conceivable conditions at the IDF, be dominated by the presence of the passivating layer and corrosion products on the metal particles. As a result, the release of Tc from the metal particles at the surfaces of fractures in the glass releases at a rate similar to the Tc present as a soluble salt. The release of the remaining Tc in the metal is controlled by the dissolution of the glass matrix.

NTIS

Corrosion; Inclusions; Metals; Radioactive Wastes; Vitrification; Waste Disposal

20070010716 Lawrence Livermore National Lab., Livermore, CA USA

Validity of Various Approaches to Global Kinetic Modeling of Material Lifetimes

Burnham, A. K.; Dinh, L. N.; Sep. 13, 2006; 7 pp.; In English
Report No.(s): DE2006-894350; UCRL-CONF-224386; No Copyright; Avail.: National Technical Information Service (NTIS)

Chemical kinetic modeling has been used for many years in process optimization, estimating real-time material performance, and lifetime prediction. Chemists have tended towards developing detailed mechanistic models, while engineers have tended towards global or lumped models. Many, if not most, applications use global models by necessity, since it is impractical or impossible to develop a rigorous mechanistic model. Model fitting acquired a bad connotation in the thermal analysis community after that community realized a decade after other disciplines that deriving kinetic parameters for an assumed model from a single heating rate produced unreliable and sometimes nonsensical results. In its place, advanced isoconversional methods, which have their roots in the Friedman and Ozawa-Flynn-Wall methods of the 1960s, have become increasingly popular. In fact, as pointed out by the ICTAC kinetics project in 2000, valid kinetic parameters can be derived by both isoconversional and model fitting methods as long as a diverse set of thermal histories are used to derive the kinetic parameters. The current paper extends the understanding from that project to give a better appreciation of the strengths and weaknesses of isoconversional and model-fitting approaches. Examples are given from a variety of data sets.

NTIS

Computerized Simulation; Reaction Kinetics; Materials Handling

20070010723 Lawrence Livermore National Lab., Livermore, CA USA

Localized Corrosion Susceptibility of Alloy 22 In Na-K-Cl-NO₃ Brines at 110 to 150 degrees C

Lian, T.; Felker, S. J.; Hailey, P. D.; Staggs, K. J.; Gdowski, G. E.; Apr. 04, 2006; 6 pp.; In English
Report No.(s): DE2006-894340; UCERL-PROC-220367; No Copyright; Avail.: National Technical Information Service (NTIS)

Electrochemical cyclic potentiodynamic polarization experiments were conducted to assess crevice corrosion of Alloy 22 in de-aerated aqueous solutions of chloride and nitrate salts of potassium and sodium in the temperature range 110-150 degrees C. The tests were run in neutral and slightly acidic aqueous solutions. The Alloy 22 specimens were multiple creviced weld prisms. No evidence of crevice corrosion was observed in the range 125-150 degrees C. In the 120 to 160 degrees C temperature range, the anionic concentration of stable aqueous solutions is dominated by nitrate relative to chloride. At nominally 120 degree C, the minimum nitrate to chloride ratio is about 4.5, and it increases to about 22 at nominally 155 degrees C. The absence of localized corrosion susceptibility in these solutions is attributed to the known inhibiting effect of the nitrate anion. Aqueous solution chemistry studies indicate that nitrate to chloride ratios of less than 0.5 are possible for temperatures up to nominally 116 C. At 110 degrees C, aqueous solutions can have dissolved chloride well in excess of nitrate. Localized corrosion was observed at nitrate to chloride ratios up to 1.0, the highest ratio tested. The extent of localized corrosion was confined to the crevice region of the samples, and was limited for nitrate to chloride ratios greater than or equal to 0.3.

NTIS

Brines; Corrosion; Radioactive Wastes; Waste Management

20070010728 Lawrence Livermore National Lab., Livermore, CA USA

Chemical Identification of a Long-Lived Isotope of Dubnium, a Descendant of Element 115

Stoyer, N. J.; Landrum, J. H.; Wilk, P. A.; Moody, K. J.; Kenneally, J. M.; Sep. 27, 2006; 10 pp.; In English
Report No.(s): DE2006-894346; UCRL-PROC-224777; No Copyright; Avail.: National Technical Information Service (NTIS)

The recognition criterion for discovery of a new chemical element includes two aspects, the characterization properties and the assignment properties. In this paper, we will discuss the status of element 115 experiments that have been performed in Dubna, Russia, highlighting the characterization and assignment properties as they specifically relate to a recent experiment. After discussing the status of what is known about the decay properties of element 115, observed previously using the Dubna Gas-Filled Recoil Separator, we will discuss the prior chemical studies that have been performed on the Db descendant of element 115. Following the success of that experiment, some additional chemical information was desired. Two separation chemistries were then developed at LLNL and JINR. LLNL utilized reversed phase chromatography and JINR utilized anion exchange chromatography to perform not only +4/+5 separations, but also intra-group separations, where Nb-like and Ta-like fractions were eluted. The results from an experiment using these chemistries for the first time during December 2005 in Dubna, Russia, will be compared with prior chemical results.

NTIS

Dubnium; Isotopes; Radiation Chemistry

20070010743 NASA Glenn Research Center, Cleveland, OH, USA

Composite Electrolytes for Lithium Batteries: Ionic Liquids in APTES Crosslinked Polymers

Tigelaar, Dean M.; Meador, Mary Ann B.; Bennett, William R.; [2007]; 12 pp.; In English
Contract(s)/Grant(s): NNC06AA05A; WBS 083229.04.15.01.01.01; Copyright; Avail.: CASI: A03, Hardcopy

Solvent free polymer electrolytes were made consisting of Li(+) and pyrrolidinium salts of trifluoromethanesulfonimide added to a series of hyperbranched poly(ethylene oxide)s (PEO). The polymers were connected by triazine linkages and crosslinked by a sol-gel process to provide mechanical strength. The connecting PEO groups were varied to help understand the effects of polymer structure on electrolyte conductivity in the presence of ionic liquids. Polymers were also made that contain poly(dimethylsiloxane) groups, which provide increased flexibility without interacting with lithium ions. When large amounts of ionic liquid are added, there is little dependence of conductivity on the polymer structure. However, when smaller amounts of ionic liquid are added, the inherent conductivity of the polymer becomes a factor. These electrolytes are more conductive than those made with high molecular weight PEO imbibed with ionic liquids at ambient temperatures, due to the amorphous nature of the polymer.

Author

Crosslinking; Electrolytes; Liquids; Polymers; Lithium Batteries; Metal Ions

20070010759 NASA Glenn Research Center, Cleveland, OH, USA

Development of a Reactor Model for Chemical Conversion of Lunar Regolith

Hedge, Uday; Balasubramaniam, R.; Gokoglu, S.; January 2007; 10 pp.; In English; STAIR 2007, 11-15 Feb. 2005, Albuquerque, NM, USA

Contract(s)/Grant(s): NCC3-975; WBS 387498.04.04.05.01.03; No Copyright; Avail.: CASI: [A02](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20070010759>

Lunar regolith will be used for a variety of purposes such as oxygen and propellant production and manufacture of various materials. The design and development of chemical conversion reactors for processing lunar regolith will require an understanding of the coupling among the chemical, mass and energy transport processes occurring at the length and time scales of the overall reactor with those occurring at the corresponding scales of the regolith particles. To this end, a coupled transport model is developed using, as an example, the reduction of ilmenite-containing regolith by a continuous flow of hydrogen in a flow-through reactor. The ilmenite conversion occurs on the surface and within the regolith particles. As the ilmenite reduction proceeds, the hydrogen in the reactor is consumed, and this, in turn, affects the conversion rate of the ilmenite in the particles. Several important quantities are identified as a result of the analysis. Reactor scale parameters include the void fraction (i.e., the fraction of the reactor volume not occupied by the regolith particles) and the residence time of hydrogen in the reactor. Particle scale quantities include the time for hydrogen to diffuse into the pores of the regolith particles and the chemical reaction time. The paper investigates the relationships between these quantities and their impact on the regolith conversion. Application of the model to various chemical reactor types, such as fluidized-bed, packed-bed, and rotary-bed configurations, are discussed.

Author

Lunar Rocks; Ilmenite; Regolith; Chemical Reactors; Chemical Energy; Oxygen Production; Continuum Flow

20070010760 Lawrence Livermore National Lab., Livermore, CA USA

Kinetics of PBX9404 Aging

Burnham, A. K.; Fried, L. E.; Sep. 13, 2006; 6 pp.; In English

Report No.(s): DE2006-894349; UCRL-CONF-224391; No Copyright; Avail.: National Technical Information Service (NTIS)

PBX 9404 is an early formulation of HMX from which we can learn about the effects of aging in the weapons stockpile. Of particular interest is the presence of 3% nitrocellulose in PBX 9404 as an energetic binder. Nitrocellulose is used pervasively in smokeless gunpowders and was formerly used extensively in the film and art preservation industries. It is well known that nitrocellulose decomposes autocatalytically, and stabilizers, such as the diphenylamine used in PBX 9404, are used to retard its decomposition. Even so, its lifetime is still limited, and the reactions eventually leading to catastrophic autocatalysis are still not understood well despite years of work. In addition to reducing the available energy in the explosive, degradation of nitrocellulose affects the mechanical properties of the pressed PBX 9404 parts by the associated reduction in molecular weight, which reduces the strength of the binder. A structural formula for a monomer of the nitrocellulose used in PBX 9404 is shown. The initial nitration level is 2.3 of 3.0 possible sites, and they have different reactivities. Degradation of nitrocellulose affects many properties. As an aid in examining historical chemical analysis data, several measures of degradation are given for the simple replacement of a nitro group with a hydrogen. The weight percent of nitrocellulose remaining for an initial concentration of 3% as used in PBX 9404 is also given. Of course, the real degradation reaction is more complicated, including chain scission and crosslinking reactions giving other gas species.

NTIS

Explosives; Kinetics; Reaction Kinetics

20070010817 California Univ., Berkeley, CA USA

In-Situ Bioreduction and Removal of Ammonium Perchlorate

Coates, John D; Achenbach, Laurie A; May 9, 2006; 138 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): Proj-CU-1162

Report No.(s): AD-A462361; No Copyright; Avail.: CASI: [A07](#), Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA462361>

The objective of the studies described in this report were to gain a better understanding of the microbiology involved in microbial perchlorate reduction with an aim of enhancing the application of this novel metabolism to the attenuation of perchlorate contaminated environments.

DTIC

Ammonium Perchlorates; Microbiology

20070010826 Naval Postgraduate School, Monterey, CA USA

Design of a Premixed Gaseous Rocket Engine Injector for Ethylene and Oxygen

Dausen, David F; Dec 2006; 115 pp.; In English; Original contains color illustrations

Report No.(s): AD-A462373; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA462373>

A premixed gaseous rocket injector was designed and successfully operated over a limited range of fuel-rich operating conditions for the purpose of soot modeling for ethylene and oxygen mixtures. The injector had the advantage of delivering a homogenous mixture to the combustion chamber, lower soot production, and higher performance potential by removing the fuel atomization process which affects the combustion process and is inherent for non-premixed injectors. The premixed injector was operated at oxygen-fuel ratios from 1.0 to 1.8 with a mass flow of 0.024 kg/sec achieving a chamber pressure of 76 psi without propensity of flashback for 0.032' injector orifices. Increased mass flow rates of 0.027 kg/sec were achieved by increasing the injector orifice diameters to 0.0625' which produced a chamber pressure of 127 psi and a characteristic exhaust velocity efficiency of 90.1%. Flashback was eventually observed at an oxygen-to-fuel ratio of 1.2 where the pressure drop was across the injector was less than 388.6 kPa and the bulk mixture velocity through the injector orifices was approximately 90 m/s. Maintaining bulk velocity sufficiently above this value should prevent flashback from occurring, but will likely need to be characterized for additional orifice diameters and pressure differentials.

DTIC

Ethylene; Fuel Injection; Injectors; Oxygen; Premixing; Rocket Engines; Soot

20070010844 Engineering Research and Consulting, Inc., Edwards AFB, CA USA

Synthesis and Characterization of Silyldichloramines, Their Reactions with F Ions, Stability of N₂Cl(2) and NCl(2), and Formation of NCl(3) (PREPRINT)

Schneider, Stefan; Gerken, Michael; Haiges, Ralf; Schroer, Thorsten; Boatz, Jerry A; Christe, Karl O; Jan 2007; 33 pp.; In English

Contract(s)/Grant(s): Proj-2303

Report No.(s): AD-A462404; No Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA462404>

Only two silyldichloramines, (C₆H₅)₃SiNCl(2) and (CH₃)₃SiNCl(2), have been reported in the literature. The synthesis of the former was successfully repeated, and its structure was established by single crystal X-ray diffraction and vibrational spectroscopy. Attempts to prepare (CH₃)₃SiNCl(2) were unsuccessful, however, a new trialkylsilyldichloramine, t-BuMe₂SiNCl(2), was prepared and characterized by Raman and multinuclear NMR spectroscopy. The reaction of t-BuMe₂SiNCl(2) with (CH₃)₄NF in CHF₃ solution at -78 deg. C, followed by removal of all volatile products at -30 deg. C, produced the expected t-BuMe₂SiF by-product and a white solid consisting of NCl(3) absorbed on Me₄NCl. The NCl(3) could be reversibly desorbed from the substrate and was identified as a neat liquid at room temperature by Raman spectroscopy. The observed final reaction products are consistent with the formation of an unstable N(CH₃)₄+NCl(2)- intermediate which decomposes to N(CH₃)₄+Cl- and NCl molecules which can dimerize to N₂Cl(2). Theoretical calculations confirm that NCl(2)- can readily lose Cl- and that N₂Cl(2) also possesses a low barrier towards loss of N₂ to give chlorine atoms and, thus, can account for the formation of NCl(3).

DTIC

Chlorine Compounds; Ions; Nitrogen Compounds; Stability

20070010851 Naval Research Lab., Washington, DC USA

Methane Hydrate Exploration, Atwater Valley, Texas-Louisiana Shelf: Geophysical and Geochemical Profiles

Coffin, Richard B; Gardner, Joan; Pohlman, John; Downer, Ross; Wood, Warren; Dec 27, 2006; 38 pp.; In English; Original contains color illustrations

Report No.(s): AD-A462414; NRL/MR/6110--06-9002; No Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA462414>

From May 14-20, 2004, piston core and heat flow measurements were collected across two mound structures, mound D and mound F, in an area designated as Atwater Valley, a shallow trough on the continental slope south of the Mississippi Delta. Atwater Valley lies at 1,200 to 1,500 m water depth. Several small mound structures occur in the valley, rising less than 50 m above the surrounding seafloor. The UNOLS vessel RV Gyre was contracted to support this work. The work took place in about 1,300-m water depth through a 4-km transect at lat. 27.9356 degrees N, lon. 89.2794 degrees W (lease block Atwater Valley 14). Previous USGS seismic lines AV65, AV97 and AV82 and a 3.5 kHz echosounder profile collected during the cruise were used to guide operations. Total sampling included mounds D and F and a transect between the mounds. During 4 days

on site, we acquired 15 piston cores and 23 thermal profiles on a transect from mound F to mound D. Extensive piston coring and heatflow was conducted at mound F. Dense heat flow measurements and one piston core were obtained at mound D. All coring and heat flow measurements were conducted at the sites planned for deep drilling by the Chevron-Exxon JIP. All cores had good penetration (shortest was 255 cm, longest 842 cm), and no carbonate pavement or hydrate mounds were encountered. The cores were immediately sectioned and sampled for chemical analysis. All attempts at thermal probing resulted in sufficient penetration, except for one instance where the instrument laid horizontal on the seafloor. The sulfate-methane interface (SMI) estimated from pore water sulfate profiles indicated a range in the vertical flux of methane. Sulfate and methane pore water profiles from piston cores on mound F indicated the greatest vertical methane flux in this study region.

DTIC

Continental Shelves; Deltas; Geochemistry; Geophysics; Hydrates; Methane; Sulfates; Valleys

20070011078 University of Southern California, Los Angeles, CA USA

Experimental Evidence for Linear Metal-Azide Coordination: The Binary Group 5 Azides [Nb(N3)5], [Ta(N3)5], [Nb(N3)6], and [Ta(N3)6], and 1:1 Acetonitrile Adducts [Nb(N3)5(CH3CN)] and (Ta(N3)5(CH3CN))

Haiges, Ralf; Schroer, Thorsten; Yousufuddin, Muhammed; Christe, Karl; Boatz, Jerry A; Mar 20, 2006; 7 pp.; In English
Contract(s)/Grant(s): Proj-2303

Report No.(s): AD-A462409; No Copyright; Avail.: CASI: [A02](#), Hardcopy

Whereas the existence of numerous binary transition metal azido-complexes has been reported, no binary Group 5 azides are known. Only a limited number of partially azide-substituted compounds of vanadium, niobium and tantalum have previously been reported. In this paper, we wish to communicate the synthesis and characterization of Nb(N3)5, Ta(N3)5 and their 1:1 adducts with CH3CN, and of the anions [Nb(N3)6]- and [Ta(N3)6]-. The crystal structures of [Nb(N3)5(CH3CN)] and [PPH4][Nb(N3)6] and the first experimental evidence for the existence of azido compounds with linear metal-N-N bonds are also reported.

DTIC

Acetonitrile; Adducts; Azides (Inorganic); Azides (Organic); Ligands

20070011087 Cincinnati Univ., OH USA

Organic Electronic Devices Using Crosslinked Polyelectrolyte Multilayers as an Ultra-Thin Dielectric Material

Stricker, Jeffery T; Sep 2006; 152 pp.; In English; Original contains color illustrations

Report No.(s): AD-A462510; No Copyright; Avail.: CASI: [A08](#), Hardcopy

The purpose of this study is to use the layer-by-layer assembly (LbL) method to investigate the incorporation of ultra-thin insulating films into organic electronic device architectures and to improve the understanding of structure-property relationships as applied to how nanoscale architecture affects device performance. Initially, reflective Fourier transform infrared (FT-IR) spectroscopy is used to quantify the degree of cross-linking in poly(allylamine hydrochloride)/poly(acrylic acid) (PAH/PAA) polyelectrolyte multilayers with a change in their intrinsic ionic interaction (solution pH) and an increase in post-deposition heat-treatment temperature. The breakdown strength of these dielectric films is then analyzed as a function of their degree of cross-linking, layer morphology, and film thickness to determine their applicability for use in metallized polymer film capacitors. Similar efforts are then directed toward the incorporation of these dielectric layers into both semi-conducting and doped organic thin film transistors (TFTs). While a field effect is observed when using a semi-conducting active layer, an electrochemical effect involving water is responsible for a change in the conductivity of the active layer in doped organic TFTs (PEDOT:PSS secondary doped with ethylene glycol). Similar observations are also apparent when using a standard (less conductive) active layer, whether it is deposited by spin-coating or with LbL assembly, but their response upon exposure to different environments is unique.

DTIC

Crosslinking; Dielectrics; Electronic Equipment; Organic Materials; Thin Films

20070011172 Southwest Research Inst., San Antonio, TX USA

Lowering USAF Diesel Engine NOx Emissions With Utilizing B20 Biodiesel Fuel

Yost, Douglas M; Sep 2005; 30 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAAE07-99-C-L053-WD25

Report No.(s): AD-A462800; TFLRF-380; No Copyright; Avail.: CASI: [A03](#), Hardcopy

The USA Air Force can utilize B20 biodiesel fuel to partially meet EPA requirements for alternative fuel use, and to lower criteria pollutants except for NOx. Relatively minor production component changes, and selected minor operating

condition changes can alter engine out NO_x emissions with biodiesel fuels in a 6.5L HMMWV engine. For a nonroad ISO 8178 test cycle, weighted average Smoke/PM emissions can be similar to DF-2 levels at the condition that gives equivalent NO_x emissions with B20 biodiesel fuel. In other words, Smoke/PM emissions with B20 biodiesel can be traded-off for improved NO_x emissions. For the 6.5L HMMWV engine tested the composite control strategy did not severely impact emissions or fuel consumption when the engine operated on JP-8 fuel.

DTIC

Combustion Products; Diesel Engines; Diesel Fuels; Exhaust Emission; Exhaust Gases; Nitrogen Oxides

20070011219 Old Dominion Univ., Norfolk, VA USA

Electron-Impact Dissociative Ionization Of Ethylene (Postprint)

Popovic, S; Vuskovic, L; Williams, S; Feb 2006; 9 pp.; In English

Contract(s)/Grant(s): Proj-2308

Report No.(s): AD-A462859; No Copyright; Avail.: CASI: [A02](#), Hardcopy

The ionization rates of the electron-impact ionization and dissociative ionization of ethylene for two typical cases: thermal plasmas with an electron temperature in the range between 1,000 and 24,000 K; and nonthermal plasmas with the reduced electric field in the range between 10 and 200 Td are presented. Electron-impact dissociative ionization rates were calculated for 11 fragment ions of ethylene in the case of low temperature thermal plasma, and in a case of nonthermal ionized mixture of argon and ethylene. Dissociative ionization cross sections were calculated using a semiempirical binary-encounter bethe (BEB) model [Y. K. Kim and M. E. Rudd, Phys. Rev. A 50, 3954 (1994)], with each of the four most dominant fragments, C₂H₄⁺, C₂H₃⁺, C₂H₂⁺, and H⁺, being associated with a single molecular orbital. Calculated cross sections are used in this analysis due to the fact that the existing experimental data are the least accurate in the threshold region and the calculated results can improve the accuracy in that region. Also, the procedure may be extended to molecules for which experimental data are not available.

DTIC

Dissociation; Electric Discharges; Electron Impact; Ethylene; Ionization; Plasmas (Physics)

20070011221 Louisiana State Univ., Baton Rouge, LA USA

High-Pressure Liquid Chromatograph with Mass Spectrometric Detection for Analysis of Supercritical Fuels Pyrolysis Products

Wornat, Mary J; Somers, Michelle L; McClaine, Jennifer W; Ona, Jorge O; Aug 1, 2006; 52 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): FA9550-05-1-0253; Proj-5094

Report No.(s): AD-A462863; No Copyright; Avail.: CASI: [A04](#), Hardcopy

A high-pressure liquid chromatograph with ultraviolet-visible diode-array detection and mass spectrometer (HPLC/UV/MS), purchased with DURIP funds, was used to analyze polycyclic aromatic hydrocarbons (PAH) produced in supercritical pyrolysis experiments with the model fuels 1-methylnaphthalene and toluene. The HPLC/UV/MS instrument facilitated the identification of fifteen 5- to 9-ring PAH from supercritical 1-methylnaphthalene pyrolysis and five 7- to 9-ring PAH from supercritical toluene pyrolysis none of which had ever before been identified as products of these fuels. Most of the newly identified products were large PAH thought to be intermediates in the formation of carbonaceous solids. The new PAH product identifications, along with determination of which PAH were not formed, contributed to the elucidation of radical reaction pathways responsible for PAH formation from aromatic fuels in the supercritical pyrolysis environment. Use of the HPLC/UV/MS instrument in the analysis of a stressed Fischer-Tropsch synthetic jet fuel sample from United Technologies Research Center led to the identification of fifteen 6- to 10-ring PAH, not previously identified by HPLC/UV alone four of which had never before been unequivocally identified in the products of any fuel in any context.

DTIC

Chromatography; Combustion Products; Detection; Fuels; High Pressure; Jet Engine Fuels; Mass Spectroscopy; Pyrolysis

METALS AND METALLIC MATERIALS

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

20070009612 Virginia Univ., Charlottesville, VA, USA

Non-Ferromagnetic Amorphous Steel Alloys Containing Large-Atom Metals

Shifflet, G. J.; Poon, S. J.; Gu, X.; 21 Dec 05; 34 pp.; In English

Contract(s)/Grant(s): N00014-01-1010961

Patent Info.: Filed Filed 21 Dec 05; US-Patent-Appl-SN-11-313-595

Report No.(s): PB2007-101431; No Copyright; Avail.: CASI: [A03](#), Hardcopy

The present invention relates to novel non-ferromagnetic amorphous steel alloys represented by the general formula: Fe--Mn-(Q)-B-M, wherein Q represents one or more elements selected from the group consisting of Sc, Y, Ce, Pr, Nd, Pm, Sm, Eu, Gd, Tb, Dy, Ho, Er, Tm, Yb and Lu, and M represents one or more elements selected from the group consisting of Cr, Co, Mo, C and Si. Typically the atomic percentage of the Q constituent is 10 or less. An aspect is to utilize these amorphous steels as coatings, rather than strictly bulk structural applications. In this fashion any structural metal alloy can be coated by various technologies by these alloys for protection from the environment. The resultant structures can utilize surface and bulk properties of the amorphous alloy.

NTIS

Alloys; Amorphous Materials; Ferromagnetic Materials; Metals; Steels

20070009858 NASA Johnson Space Center, Houston, TX, USA

Diverse Metals and Sulfides in Polymict Ureilites EET 83309 and EET 87720

Herrin, J. S.; Mittlefehldt, D. W.; Downes, H.; Humayun, M.; [2007]; 2 pp.; In English; Lunar and Planetary Science Conference, 12-16 Mar. 2007, Houston, TX, USA; Original contains color illustrations; Copyright; Avail.: CASI: [A01](#),

Hardcopy

Ureilites are a group of carbon-bearing ultramafic achondrites. The majority of samples are monomict with major and trace element compositions consistent with a restitic origin after extensive loss of basaltic melts and significant loss of their metallic component during anatexis. Monomict ureilites are thought to represent largely intact samples of the ureilite parent body (UPB) mantle. Polymict ureilites, by contrast, are fragmental breccias consisting of welded lithic clasts and isolated mineral fragments thought to be regolith that assembled after major disruption fragmented large portions of the UPB mantle. In most polymict ureilites, the majority of clasts consist of material similar to monomict ureilites gardened from the UPB mantle but other materials, both endogenic and xenogenic to the UPB are also found in polymict ureilites, including clasts texturally and compositionally similar to known chondrite types as well as feldspathic melt rocks and clasts of Ca-Al-Ti-rich assemblages. In this study, we demonstrate that polymict ureilites also contain a variety of metal and sulfide compositions of diverse origins. They offer insight into the final equilibrium conditions of disrupted portions of the UPB mantle and the diversity of materials locally available for regolith formation, and provide evidence for only limited post-regolith formation thermal metamorphism.

Derived from text

Achondrites; Metals; Sulfides; Ureilites; Trace Elements; Metamorphism (Geology); Mineralogy

20070009999 NASA Johnson Space Center, Houston, TX, USA

Effects of Different R ratios on Fatigue Crack Growth in Laser Peened Friction Stir Welds

Hatamleh, Omar; Hackel, Lloyd; Forth, Scott; [2007]; 5 pp.; In English; International Welding/Joining Conference 2007, 10-12 May 2007, Seoul, Korea, Republic of; Copyright; Avail.: CASI: [A01](#), Hardcopy

The influence of laser peening on the fatigue crack growth behavior of friction stir welded (FSW) Aluminum Alloy (AA) 7075-T7351 sheets was investigated. The surface modification resulting from the peening process on the fatigue crack growth of FSW was assessed for two different R ratios. The investigation indicated a significant decrease in fatigue crack growth rates resulting from using laser shock peening compared with unpeened, welded and unwelded specimens. The slower fatigue crack growth rate was attributed to the compressive residual stresses induced by the peening.

Author

Welded Joints; Fatigue (Materials); Friction Stir Welding; Aluminum Alloys; Crack Propagation; Residual Stress; Peening

20070010446 Lawrence Livermore National Lab., Livermore, CA USA

Evidence for the Spectroscopic Signature of Aging in (δ)-Pu(Ga)

Chung, B. W.; Schwartz, A. J.; Ebbinghaus, B. B.; Fluss, M. J.; Haslam, J. J.; Dec. 05, 2005; 5 pp.; In English
Report No.(s): DE2006-894797; UCRL-PROC-217512; No Copyright; Avail.: Department of Energy Information Bridge

Plutonium, because of its radioactive nature, ages from the 'inside out' by means of self-irradiation damage and thus produces nanoscale internal defects. The self-irradiation induced defects come in the form of Frenkel-type defects (vacancies and self-interstitial atoms), helium in-growth, and defect clusters. At present there are neither experimental nor theoretical models describing the changes in the electronic structure caused by the aging in Pu. This fact appears to be associated primarily with the absence of reasonably convincing spectroscopic evidence of the changes. This paper demonstrates that Resonant Photoemission, a variant of Photoelectron Spectroscopy, has strong sensitivity to aging of Pu samples. The spectroscopic results are correlated with an extra-atomic screening model, and are shown to be the fingerprint of mesoscopic or nanoscale internal damage in the Pu physical structure. This means that a spectroscopic signature of internal damage due to aging in Pu has been established.

NTIS

Plutonium Alloys; Signatures; Spectroscopy

20070010506 Lawrence Livermore National Lab., Livermore, CA USA

Modelling Thermodynamics of Alloys for Fusion Application

Caro, A.; Sadigh, B.; Turchi, P. E. A.; Caro, M.; Lopasso, E.; Jan. 26, 2006; 9 pp.; In English
Report No.(s): DE2006-893979; UCRL-TR-218448; No Copyright; Avail.: National Technical Information Service (NTIS)

This research has two main objectives: (1) On one side is the development of computational tools to evaluate alloy properties, using the information contained in thermodynamic functions to improve the ability of classic potentials to account for complex alloy behavior. (2) On the other hand, to apply the tools so developed to predict properties of alloys under irradiation. Atomistic simulations of alloys at the empirical level face the challenge of correctly modeling basic thermodynamic properties. In this work we develop a methodology to generalize many-body classic potentials to incorporate complex formation energy curves. Application to Fe-Cr allows us to predict the implications of the ab initio results of formation energy on the phase diagram of this alloy.

NTIS

Irradiation; Thermodynamics

20070010533 California Univ., Berkeley, CA, USA, California Univ., Lawrence Berkeley National Lab., Berkeley, CA, USA

Reduced-Temperature Transient-Liquid-Phase Bonding of Alumina Using a Ag-Cu-Based Brazing Alloy

Hong, S. M.; Glaeser, A. M.; Dec. 01, 2005; 8 pp.; In English
Report No.(s): DE2006-894976; No Copyright; Avail.: National Technical Information Service (NTIS)

The mechanical properties and microstructural evolution of metal-ceramic bonds produced using a transient liquid phase (TLP) are described. Alumina (Al_2O_3) was joined at 500 degrees C, 600 degrees C, and 700 degrees C using a multilayer In/Cu-Sil-ABA (R) (commercial copper-silver eutectic brazing alloy)/In interlayer. The introduction of thin In cladding layers allows the system to bond at much lower temperatures than those typically used for brazing with Cu-Sil-ABA (R), thereby protecting temperature-sensitive components. After chemical homogenization, the interlayers retain an operating temperature ranges similar to that of the brazed joints. TLP bonds made at 500 degrees C, 600 degrees C, and 700 degrees C with holding times ranging from as low as 1.5 h to 24 h had average fracture strengths above 220 MPa. The effects of bonding temperature and time on fracture strength are described. Preliminary analysis of the interlayers shows that the Ag-In or Cu-In intermetallic phases do not form. Considerations unique to systems with two-phase core layers are discussed. Experiments using single-crystal sapphire indicate rapid formation of a reaction layer at 700 degrees C, suggesting the possibility of making strong bonds using lower temperatures and/or shorter processing times.

NTIS

Aluminum Oxides; Bonding; Brazing; Ceramics; Liquid Phases

20070010541 NASA Glenn Research Center, Cleveland, OH, USA

Direct Observations of Nucleation in a Nondilute Multicomponent Alloy

Sudbrack, Chantal K.; Noebe, Ronald D.; Seidman, David N.; Physical Review B; January 2006; Volume 73, pp. 212101; In English

Contract(s)/Grant(s): NSF DMR-0241928; WBS 953033.01.03.17; Copyright; Avail.: Other Sources

The chemical pathways leading to gamma'(L1(sub 2)) nucleation from nondilute Ni-5.2 Al-14.2 Cr at. %, gamma(fcc), at 873 K are followed with radial distribution functions and isoconcentration surface analyses of direct-space atom-probe tomographic images. Although Cr atoms initially are randomly distributed, a distribution of congruent Ni3Al short-range-order domains (SRO), [R] approx. equals 0.6 nm, results from Al diffusion during quenching. Domain site occupancy develops as their number density increases leading to Al-rich phase separation by gamma'-nucleation, [R]=0.75 nm, after SRO occurs.

Author

Nucleation; Nickel Alloys; Aluminum Alloys; Diffusion; Distribution Functions; Intermetallics; Radial Distribution

20070010545 NASA Glenn Research Center, Cleveland, OH, USA

Diffusion Bonding of Silicon Carbide for MEMS-LDI Applications

Halbig, Michael C.; Singh, Mrityunjay; Shpargel, Tarah P.; Kiser, J. Douglas; [2007]; 21 pp.; In English; 31st. International Conference and Exposition on Advanced Ceramics and Composites, 21-26 Jan. 2007, Daytona Beach, FL, USA; Original contains color and black and white illustrations

Contract(s)/Grant(s): NAS3-01138; WBS 561581.02.08.03.16.02; Copyright; Avail.: CASI: [A03](#), Hardcopy

A robust joining approach is critically needed for a Micro-Electro-Mechanical Systems-Lean Direct Injector (MEMS-LDI) application which requires leak free joints with high temperature mechanical capability. Diffusion bonding is well suited for the MEMS-LDI application. Diffusion bonds were fabricated using titanium interlayers between silicon carbide substrates during hot pressing. The interlayers consisted of either alloyed titanium foil or physically vapor deposited (PVD) titanium coatings. Microscopy shows that well adhered, crack free diffusion bonds are formed under optimal conditions. Under less than optimal conditions, microcracks are present in the bond layer due to the formation of intermetallic phases. Electron microprobe analysis was used to identify the reaction formed phases in the diffusion bond. Various compatibility issues among the phases in the interlayer and substrate are discussed. Also, the effects of temperature, pressure, time, silicon carbide substrate type, and type of titanium interlayer and thickness on the microstructure and composition of joints are discussed.

Author

Microelectromechanical Systems; Diffusion Welding; Silicon Carbides; Injectors; Metal Bonding; Metal Coatings; Temperature Effects; Titanium Carbides

20070010550 Lawrence Livermore National Lab., Livermore, CA USA

Electrochemical Testing of Gas Tungsten Arc Welded and Reduced Pressure Electron Beam Welded Alloy 22

Day, S. D.; Wong, F. M. G.; Gordon, S. R.; Wong, L. L.; Rebak, R. B.; Feb. 07, 2006; 13 pp.; In English

Report No.(s): DE2006-894774; UCRL-PROC-218715; No Copyright; Avail.: Department of Energy Information Bridge

Alloy 22 (N06022) is the material selected for the fabrication of the outer shell of the nuclear waste containers for the Yucca Mountain high-level nuclear waste repository site. A key technical issue in the waste package program has been the integrity of the container weld joints. The currently selected welding process for fabricating and sealing the containers is the traditional gas tungsten arc welding (GTAW) or TIG method. An appealing faster alternative technique is reduced pressure electron beam (RPEB) welding. It was of interest to compare the corrosion properties of specimens prepared using both types of welding techniques. Standard electrochemical tests were carried on GTAW and RPEB welds as well as on base metal (non-welded) to determine their relative corrosion behavior in simulated concentrated water (SCW) at 90 C (alkaline), 1 M HCl at 60 C (acidic) and 1 M NaCl at 90 C (neutral) solutions. Results show that for all practical purposes, the three tested materials had the same electrochemical behavior in the three tested electrolytes.

NTIS

Corrosion; Electron Beams; Gas Pressure; Mountains; Radioactive Wastes; Tungsten; Waste Management

20070010577 NASA Glenn Research Center, Cleveland, OH, USA

Temporal Evolution of the Nanostructure and Phase Compositions in a Model Ni-Al-Cr Alloy

Sudbrack, Chantal K.; Yoon, Kevin E.; Seidman, David N.; Seidman, David N.; Acta Materialia; May 19, 2006; ISSN 1359-6454; Volume 54, pp. 3199-3210; In English; Original contains color illustrations

Contract(s)/Grant(s): NSF DMR-02-41928; WBS 953033.01.03.17; Copyright; Avail.: Other Sources

ONLINE: <http://dx.doi.org/10.1016/j.actamat.2006.03.015>

In a Ni-5.2 Al-14.2 Cr at.% alloy with moderate solute supersaturations and a very small gamma/gamma prime lattice parameter misfit, the nanostructural and compositional pathways during gamma prime(L12) precipitation at 873 K are investigated using atom-probe tomography, conventional transmission electron microscopy, and hardness measurements. Nucleation of high number densities ($N(\text{sub } v)$ greater than $10(\text{sup } 23)$ per cubic meters) of solute-rich precipitates (mean

radius = [R] = 0.75 nm), with a critical nucleus composition of Ni-18.3 plus or minus 0.9 Al-9.3 plus or minus 0.7 Cr at.%, initiates between 0.0833 and 0.167 h. With increasing aging time (a) the solute concentrations decay in spheroidal precipitates ([R] less than 10 nm); (b) the observed early-stage coalescence peaks at maximum $N(\text{sub } v)$ in coincidence with the smallest interprecipitate spacing; and (c) the reaction enters a quasi-stationary regime where growth and coarsening operate concomitantly. During this quasi-stationary regime, the c (face-centered cubic)-matrix solute supersaturations decay with a power-law dependence of about $-1/3$, while the dependencies of [R] and $N(\text{sub } v)$ are 0.29 plus or minus 0.05 and -0.64 plus or minus 0.06 at a coarsening rate slower than model predications. Coarsening models allow both equilibrium phase compositions to be determined from the compositional measurements. The observed early-stage coalescence is discussed in further detail.

Author

Aluminum Alloys; Nanostructure (Characteristics); Nickel Alloys; Chromium Alloys; Composition; Phase Transformations; Three Dimensional Models

20070010593 National Inst. of Standards and Technology, Boulder, CO, USA

Federal Building and Fire Safety Investigation of the World Trade Center Disaster: Damage and Failure Modes of Structural Steel Components. NIST NCSTAR 1-3C. (Appendices not included)

Banovic, S. W.; Foecke, T.; Sep. 2005; 336 pp.; In English

Report No.(s): PB2007-104992; No Copyright; Avail.: National Technical Information Service (NTIS)

This report describes damage characteristics, failure modes, and fire-related degradation of the recovered structural components from the World Trade Center (WTC) 1 and WTC 2. Assessment of the structural components was divided into pre- and post-collapse analysis. Pre-collapse analysis concentrated on impact damage sustained by the exterior panel sections, with assessment based solely upon photographic and video images. These images were also used to locate areas on the recovered and identified (i.e., known as-built location) panels with pre-collapse fire exposure. The second portion of the analysis focused on direct visual examination of the recovered steel elements. Of particular importance were the samples located near the airplane impacts (north face of WTC 1 and south face of WTC 2) and those where fire was known to exist prior to collapse of the buildings. Metallographic analysis of components with specific or unique damage patterns was also conducted. The findings of this report were used for validation of the modeling efforts in the baseline structural performance and aircraft impact damage analysis, the reconstruction of the thermal environment, and the structural fire response and collapse analysis. WTC 7 steel was not evaluated in this study of the tower damage and failure modes.

NTIS

Damage; Failure Modes; Fire Prevention; Steels; Structural Design; Fires; Collapse

20070010595 National Inst. of Standards and Technology, Boulder, CO, USA

Federal Building and Fire Safety Investigation of the World Trade Center Disaster: Damage and Failure Modes of Structural Steel Components. Appendix A-G

Sep. 2005; 258 pp.; In English

Report No.(s): PB2007-104993; No Copyright; Avail.: National Technical Information Service (NTIS)

This report describes damage characteristics, failure modes, and fire-related degradation of the recovered structural components from the World Trade Center (WTC) 1 and WTC 2. Assessment of the structural components was divided into pre- and post-collapse analysis. Pre-collapse analysis concentrated on impact damage sustained by the exterior panel sections, with assessment based solely upon photographic and video images. These images were also used to locate areas on the recovered and identified (i.e., known as-built location) panels with pre-collapse fire exposure. The second portion of the analysis focused on direct visual examination of the recovered steel elements. Of particular importance were the samples located near the airplane impacts (north face of WTC 1 and south face of WTC 2) and those where fire was known to exist prior to collapse of the buildings. Metallographic analysis of components with specific or unique damage patterns was also conducted. The findings of this report were used for validation of the modeling efforts in the baseline structural performance and aircraft impact damage analysis, the reconstruction of the thermal environment, and the structural fire response and collapse analysis. WTC 7 steel was not evaluated in this study of the tower damage and failure modes.

NTIS

Damage; Failure Modes; Fire Prevention; Steels; Structural Design; Structural Analysis; Collapse; Fires

20070010596 National Inst. of Standards and Technology, Boulder, CO, USA

Federal Building and Fire Safety Investigation of the World Trade Center Disaster: Mechanical and Metallurgical Analysis of Structural Steel. NIST NCSTAR 1-3

Gayle, F. W.; Fields, R. J.; Luecke, W. E.; Banovic, S. W.; Foecke, T.; Sep. 2005; 184 pp.; In English
Report No.(s): PB2007-104989; No Copyright; Avail.: National Technical Information Service (NTIS)

This report is an overview of the results of the mechanical and metallurgical analysis of structural steel from the World Trade Center (WTC), part of the National Institute of Standards and Technology Investigation of the WTC disaster of September 11, 2001. The goal of the study was threefold: (1) Determine mechanical properties of WTC structural steel, (2) Determine the quality of the steel and if design requirements were met, and (3) Analyze the recovered steel to provide insight into failure mechanisms to guide and/or validate models of building performance. Structural steel recovered from the WTC site was analyzed for composition, microstructure, and mechanical properties, including room temperature properties (for modeling baseline building performance), high temperature properties (for modeling structural response of the building to fire), and behavior at high strain rates (for modeling airplane impact). Failure analysis of the recovered steel, complemented by pre-collapse photographs of the damaged building, was used to establish failure modes and temperature excursions experienced by the steel. In addition, documents from the construction era covering issues ranging from steel specifications to engineering design drawings were used to help interpret the results and supplement models of mechanical properties used in the models of building performance. The analysis focused on the WTC 1 and WTC 2. Although no steel was recovered from WTC 7, a 47-story building that also collapsed on September 11, properties for steel used in its construction were estimated based on literature and contemporaneous documents.

NTIS

Fire Prevention; Steels

20070010597 National Inst. of Standards and Technology, Boulder, CO, USA

Federal Building and Fire Safety Investigation of the World Trade Center Disaster: Mechanical Properties of Structural Steels. NIST NCSTAR 1-3D

Luecke, W. E.; McColskey, J. D.; McCowan, C. N.; Banovic, S. W.; Fields, R. J.; Sep. 2005; 322 pp.; In English
Report No.(s): PB2007-104994; No Copyright; Avail.: National Technical Information Service (NTIS)

This report provides five types of mechanical properties for steels from the World Trade Center (WTC): elastic, room-temperature tensile, room-temperature high strain rate, impact, and elevated-temperature tensile. Specimens of 29 different steels representing the 12 identified strength levels in the building as built were characterized. Elastic properties include modulus, E , and Poisson's ratio, ν for temperatures up to 900 DGC. The expression for $E(T)$ for $T \leq 723$ DGC is based on measurements of WTC perimeter column steels. Behavior for $T > 723$ DGC is estimated from literature data. Room temperature tensile properties include yield and tensile strength and total elongation for samples of all grades of steel used in the towers. The report provides model stress-strain curves for each type of steel, estimated from the measured stress-strain curves, surviving mill test reports, and historically expected values. With a few exceptions, the recovered steels, bolts, and welds met the specifications they were supplied to. In a few cases, the measured yield strengths of recovered steels were slightly lower than specified, probably because of a combination of mechanical damage, natural variability, and differences in testing methodology. High-strain-rate properties for selected perimeter and core column steels include yield and tensile strength, total elongation and strain rate sensitivity for rates up to 400 s⁻¹. Measured properties were consistent with literature reports on other structural steels. Impact properties were evaluated with Charpy testing. Properties for perimeter and core column steels were consistent with other structural steels of the era. The impact toughness at room temperature of nearly all WTC steels tested exceeded 15 ft-lbf at room temperature. Elevated-temperature stress-strain curves were collected for selected perimeter and core column and truss steels. The report presents a methodology for estimating high-temperature stress-strain curves for the steels not characterized based on room-temperature behavior and behavior of other structural steels from the literature. The measured elevated-temperature stress-strain behavior of WTC steels is consistent with other structural steels from that era. For the truss steels, the report presents a complete constitutive law for creep deformation based on experimental measurements. For the steels not characterized, the report presents a methodology for estimating the creep deformation law.

NTIS

Fire Prevention; Mechanical Properties; Steels; Strain Rate

20070010608 Lawrence Livermore National Lab., Livermore, CA USA

Long-Term Phase Instability in Water-Quenched U-6Nb

Hslung, L. L.; Zhou, J.; Jan. 19, 2006; 12 pp.; In English

Report No.(s): DE2006-895078; UCRL-CONF-218278; No Copyright; Avail.: National Technical Information Service (NTIS)

A combinative approach of microhardness testing, tensile testing, and TEM microstructural analysis was employed to study the microstructure and mechanical instability of a water-quenched U-6wt.% Nb (WQ-U6Nb) alloy subjected to different aging schedules including artificial aging at 200 C, 15-year natural aging at ambient temperatures, and 15-year natural aging followed by accelerative aging at 200 C. The changes in mechanical property during and after the aging processes were examined using microhardness and tensile-testing methods. During the early stages of artificial aging at 200 C, the microhardness of WQ-U6Nb alloy increased, i.e., age hardening, as a result of the development of nanoscale modulation caused by spinodal decomposition. Coarsening of the modulated structure occurred after a prolonged aging at 200 C for 16 hours, and it led to a decrease of microhardness, i.e., age softening. Phase instability was also found to occur in WQ-U6Nb alloy that was subjected to a 15-year natural aging at ambient temperatures. The formation of partially ordered domains resulting from a spinodal modulation with an atomic-scale wavelength rendered the appearance of swirl-shape antiphase domain boundaries (APBs) observed in TEM images. Although it did not cause a significant change in microhardness, 15-year natural aging has dramatically affected the aging mechanisms of the alloy isothermally aged at 200 C. Microhardness values of the NA alloy continuously increased after isothermal aging at 200 C for 96 hours as a result of the phase decomposition of partially ordered domains into Nb-depleted (α) phase and Nb-enriched $U_{(sub\ 3)}Nb$ ordered phase in the alloy. It is concluded that the long-term natural aging changes the transformation sequence of WQ-U6Nb, and it leads to order-disorder transformation, precipitation hardening, and ductility embrittlement of WQ-U6Nb alloy.

NTIS

Mechanical Properties; Microstructure; Niobium Alloys; Uranium Alloys; Water

20070010681 National Inst. of Standards and Technology, Boulder, CO, USA

Federal Building and Fire Safety Investigation of the World Trade Center Disaster: Physical Properties of Structural Steels. NIST NCSTAR 1-3E

Banovic, S. W.; Luecke, W. E.; Sep. 2005; 162 pp.; In English

Report No.(s): PB2007-104995; No Copyright; Avail.: National Technical Information Service (NTIS)

The National Institute of Standards and Technology investigation of active fire protection systems in World Trade Center (WTC) 1, 2, and 7 included the design, installation, capabilities, and performance on September 11, 2001, of the automatic fire sprinkler, standpipe, standpipe pre-connected hoses, fire alarm, and smoke management systems. The purpose and normally expected performance of each active fire protection system in the buildings are described, as well as details about the systems installed in WTC 1, 2, and 7. Using fire protection engineering methods, the capabilities of the installed systems to respond to various fire threats from normal office fires up to and including the extraordinary challenge of the fires ignited by the aircraft impacts on September 11, 2001, were assessed. Information from the Fire Department of the City of New York records was used to document the history of significant fire events in WTC 1, 2, and 7. Findings of the investigation are presented with regard to the fire suppression, fire alarm, and smoke management systems installed on the day the buildings collapsed.

NTIS

Fire Prevention; Steels; Towers

20070010713 Pennsylvania State Univ., State College, PA, USA, Foreign Policy Research Inst., Philadelphia, PA, USA, Michigan Univ., Ann Arbor, MI, USA, Hanyang Univ., Seoul, Korea, Republic of

Advanced Corrosion-Resistant Zirconium Alloys for High Burnup and Generation IV Applications. Final Report and Executive Summary

Motta, A. T.; Comstock, R. J.; Kim, Y. S.; Feb. 2003; 329 pp.; In English

Report No.(s): DE2006-895014; No Copyright; Avail.: National Technical Information Service (NTIS)

The objective of this collaboration between four institutions in the US and Korea is to demonstrate a technical basis for the improvement of the corrosion resistance of zirconium-based alloys in more extreme operating environments (such as those present in severe fuel cycles (high burnup, boiling, aggressive chemistry)) and to investigate the feasibility (from the point of view of corrosion rate) of using advanced zirconium-based alloys in a supercritical water environment.

NTIS

Corrosion Resistance; Zirconium Alloys

20070010751 NASA Glenn Research Center, Cleveland, OH, USA

Substitutional and Interstitial Diffusion in alpha2-Ti3Al(O)

Copland, Evan; Young, David J.; Gleeson, Brian; Jacobson, Nathan; [2007]; 24 pp.; In English; TMS 2007, 25 Feb. - 1 Mar. 2007, Orlando, FL, USA; Original contains color illustrations

Contract(s)/Grant(s): NNC05AA14A; WBS 659877.02.03.05.41.01; Copyright; Avail.: CASI: [A03](#), Hardcopy

The reaction between Al₂O₃ and alpha2-Ti₃Al was studied with a series of Al₂O₃/alpha2-Ti₃Al multiphase diffusion couples annealed at 900, 1000 and 1100 C. The diffusion-paths were found to strongly depend on alpha2-Ti₃Al(O) composition. For alloys with low oxygen concentrations the reaction involved the reduction of Al₂O₃, the formation of a gamma-TiAl reaction-layer and diffusion of Al and O into the alpha2-Ti₃Al substrate. Measured concentration profiles across the interaction-zone showed 'up-hill' diffusion of O in alpha2-Ti₃Al(O) indicating a significant thermodynamic interaction between O and Al, Ti or both. Diffusion coefficients for the interstitial O in alpha2-Ti₃Al(O) were determined independently from the interdiffusion of Ti and Al on the substitutional lattice. Diffusion coefficients are reported for alpha2-Ti₃Al(O) as well as gamma-TiAl. Interpretation of the results were aided with the subsequent measurement of the activities of Al, Ti and O in alpha 2-Ti₃Al(O) by Knudsen effusion-cell mass spectrometry.

Author

Interstitials; Diffusion Coefficient; Titanium Alloys; Aluminum Alloys; Intermetallics; Annealing; Oxygen; Low Concentrations

20070010754 NASA Glenn Research Center, Cleveland, OH, USA

Creep Property Characterization of Potential Brayton Cycle Impeller and Duct Materials

Gabb, Timothy P.; Gayda, John; Garg, Anita; [2007]; 12 pp.; In English; Space Technology and Applications International Forum-2007, 11-15 Feb. 2007, Albuquerque, NM, USA; Original contains black and white illustrations; Copyright; Avail.:

CASI: [A03](#), Hardcopy

Cast superalloys have potential applications in space as impellers within closed-loop Brayton cycle nuclear power generation systems. Likewise wrought superalloys are good candidates for ducts and heat exchangers transporting the inert working gas in a Brayton-based power plant. Two cast superalloys, Mar-M247LC and IN792, and a NASA GRC powder metallurgy superalloy, LSHR, have been screened to compare their respective capabilities for impeller applications. Mar-M247LC has been selected for additional long term evaluations. Initial tests in helium indicate this inert environment may debit long term creep resistance of this alloy. Several wrought superalloys including Hastelloy(Registered TradeMark) X, Inconel(Registered TradeMark) 617, Inconel(Registered TradeMark) 740, Nimonic(Registered TradeMark) 263, Incoloy(Registered TradeMark) MA956, and Haynes 230 are also being screened to compare their capabilities for duct applications. Haynes 230 has been selected for additional long term evaluations. Initial tests in helium are just underway for this alloy. These proposed applications would require sufficient strength and creep resistance for long term service at temperatures up to 1200 K, with service times to 100,000 h or more. Therefore, long term microstructural stability is also being screened.

Author

Creep Properties; Cast Alloys; Heat Resistant Alloys; Powder Metallurgy; Brayton Cycle; Impellers; Wrought Alloys

20070010764 NASA Glenn Research Center, Cleveland, OH, USA

Effectiveness of Shot Peening In Suppressing Fatigue Cracking At Non-Metallic Inclusions In Udimet(Registered Trademark)720

Barrie, Robert L.; Gabb, Timothy P.; Telesman, Jack; Kantzos, Peter T.; Prescenzi, Anthony; Biles, T.; Bonacuse, P. J.; [2006]; 30 pp.; In English; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 561581.02.07.03.06.02; Copyright; Avail.: CASI: [A03](#), Hardcopy

The fatigue lives of modern powder metallurgy disk alloys can be reduced over an order of magnitude by cracking at inherent non-metallic inclusions. The objective of this work was to study the effectiveness of shot peening in suppressing LCF crack initiation and growth at surface nonmetallic inclusions. Inclusions were carefully introduced at elevated levels during powder metallurgy processing of the nickel-base disk superalloy Udimet 720. Multiple strain-controlled fatigue tests were then performed on machined specimens with and without shot peened test sections at 427 C and 650 C. The low cycle fatigue lives and failure initiation sites varied as functions of inclusion content, shot peening, and fatigue conditions. A large majority of the failures in as-machined specimens with the introduced inclusions occurred at cracks initiating from inclusions intersecting the specimen surface. These inclusions reduced fatigue life by up to 100X, when compared to lives of material without inclusions residing at specimen surface. Large inclusions produced the greatest reductions in life for tests at low strain ranges

and high strain ratios. Shot peening improved life in many cases by reducing the most severe effects of inclusions.

Author

Shot Peening; Powder Metallurgy; Heat Resistant Alloys; Fatigue (Materials); Crack Propagation; Crack Initiation; Udimet Alloys; Nickel Alloys

20070010828 Missouri Univ., Rolla, MO USA

Applications of a Hybrid Manufacturing Process for Fabrication and Repair of Metallic Structures (Preprint)

Liou, Frank; Slattery, Kevin; Kinsella, Mary; Newkirk, Joseph; Chou, Hsin-Nan; Landers, Robert; Jul 2006; 13 pp.; In English

Contract(s)/Grant(s): FA8650-04-C-5704; Proj-2510

Report No.(s): AD-A462377; No Copyright; Avail.: CASI: [A03](#), Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA462377>

Since its appearance, rapid prototyping technology has been of interest to various industries that are looking for a process to produce/build a part directly from a CAD model in a short time. Among them, the direct metal deposition process is the only process which directly manufactures a fully dense metal part without intermediate steps. However, challenges of the direct metal deposition process include building overhang structures, producing precision surfaces, and making parts with complex structures. Coupled between the additive and the subtractive processes into a single workstation, the integrated process, or hybrid process, can produce a metal part with machining accuracy and surface finish. Therefore, the hybrid process is potentially a very competitive process to fabricate and repair metallic structures. This paper summarizes the current development of the hybrid process to process high temperature metallic materials, including tool steel and Ti64. Research in simulation and modeling, process development, and actual part building and repair are discussed.

DTIC

Deposition; Fabrication; Manufacturing; Metallizing; Metals; Rapid Prototyping

20070011121 Naval Postgraduate School, Monterey, CA USA

Friction Stir Processing Parameters and Property Distributions in Cast Nickel Aluminum Bronze

Rosemark, Brian P; Dec 2006; 67 pp.; In English; Original contains color illustrations

Report No.(s): AD-A462728; No Copyright; Avail.: CASI: [A04](#), Hardcopy

Cast nickel-aluminum bronze (NAB) alloy is specified for many marine applications, including ship propellers, due to its excellent corrosion-resistance combined with acceptable mechanical properties. Friction stir processing (FSP) can be used to improve the alloy's mechanical properties by localized microstructure modification in the cast material. FSP converts an as-cast microstructure to a wrought condition in the absence of macroscopic shape change, closes porosity, and provides a means to surface harden the castings. The closure of porosity near the surface of the material may shorten the manufacturing and processing time for ship propellers. The surface hardening of cast NAB alloy can be used to increase the wear life of ship propellers. Rockwell Scientific Corporation (now Teledyne Scientific Corporation) supplied three Nickel Aluminum Bronze alloy plates which have been friction stir processed in a raster pattern under a Defense Advanced Research Project Agency (DARPA) project. Each plate had been processed using a different tool RPM and IPM (inches per minute of transverse) combination. Miniature tensile samples were sectioned from the FSP zone and surrounding base metal and mechanical property distributions were determined in these regions. The material within the FSP zone exhibited consistently higher yield strengths, ultimate tensile strengths, and ductilities than the as-cast base metal.

DTIC

Aluminum; Bronzes; Corrosion Resistance; Friction Stir Welding; Microstructure; Nickel

20070011161 New Mexico Inst. of Mining and Technology, Socorro, NM USA

Dynamic Consolidation of TaC and Nano-YSZ Powders (POSTPRINT)

Xu, Lei; Marchant, Darrell; Matson, Lawrence; Majumdar, B S; Jan 2006; 10 pp.; In English

Contract(s)/Grant(s): Proj-4847047T

Report No.(s): AD-A462782; No Copyright; Avail.: CASI: [A02](#), Hardcopy

The high melting point of tantalum carbide (3880 deg. C), second amongst all known materials, along with good corrosion resistance makes TaC a potential candidate for Air Force applications. However, traditional methods of manufacturing, such as hot pressing or HIP-ing, give rise to rapid grain growth and low fracture toughness. In this work, we have utilized dynamic consolidation technique to overcome the grain growth problem, and thereby obtain stronger and more fracture resistant TaC. TaC powders of size less than 3 microns, and grain size ranging from 0.5 to 1 micron were packed in double-tube steel vessels

and subjected to explosive consolidation. The double-tube configuration was selected to increase pulse duration and aid plasticity induced consolidation. Almost full densification was observed near one end of the cylindrical containers, but this region also was accompanied with cracking. The hardness approached 15 GPa, similar to hardness values reported in the literature for dense TaC. In the central regions of the cylinders, the density was approximately 85% of theoretical density. However, the region was free of cracks. Post heat treatments aimed at achieving full density will be discussed in the context of improved sinterability of shock treated powders. Dynamic consolidation was also tried on nano-sized (30 - 60 nm particle size) yttria stabilized zirconia (YSZ), with the aim of obtaining nano-structured dense materials that can be further processed utilizing superplastic forming. Our results show that indeed fully dense material may be fabricated by this route, and our technique appears to overcome some of the major problems associated with consolidation of nano-materials.

DTIC

Consolidation; Powder (Particles); Tantalum Carbides; Yttria-Stabilized Zirconia

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NONMETALLIC MATERIALS

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

20070009618 City Univ. of New York Research Foundation, NY, USA

Methods and Devices for Making Carbon Nanotubes and Compositions Thereof

Akins, D. L.; Yang, H.; 16 Nov 05; 9 pp.; In English

Contract(s)/Grant(s): DAAD-19-01-1-0759; DAAD-4201-EL

Patent Info.: Filed Filed 16 Nov 05; US-Patent-Appl-SN-11-280-919

Report No.(s): PB2007-101440; No Copyright; Avail.: CASI: [A02](#), Hardcopy

A method of making carbon nanotubes includes reacting hydrogen and carbon monoxide in a reaction chamber and in the presence of stainless steel. Typically, the carbon nanotubes are formed on the stainless steel. These carbon nanotubes can be removed from the stainless steel and can be used in a variety of applications.

NTIS

Carbon Nanotubes; Methodology

20070009643 Rutgers - The State Univ., New Brunswick, NJ, USA

Radio-Opaque Polymeric Biomaterials

Kohn, J. B.; Bolikal, D.; Pendharkar, S. M.; 5 May 06; 15 pp.; In English

Contract(s)/Grant(s): NIH-GM-39455; NIH-GM-49849

Patent Info.: Filed Filed 5 May 06; US-Patent-Appl-SN-11-418-943

Report No.(s): PB2007-101443; No Copyright; Avail.: CASI: [A03](#), Hardcopy

Iodinated and/or brominated derivatives of aromatic dihydroxy monomers are prepared and polymerized to form radio-opaque polymers. The monomers may also be copolymerized with other dihydroxy monomers. The iodinated and brominated aromatic dihydroxy monomers can be employed as radio-opacifying, biocompatible non-toxic additives for other polymeric biomaterials. Radio-opaque medical implants and drug delivery devices for implantation prepared from the polymers of the present invention are also disclosed.

NTIS

Monomers; Polymerization

20070009673 Chiang Mai Univ., Thailand, California Univ., Lawrence Berkeley National Lab., Berkeley, CA, USA

Mo-containing Tetrahedral Amorphous Carbon Deposited by Dual Filtered Cathodic Vacuum Arc with Selective Pulsed Bias Voltage

Pasaja, N.; Sansongsiri, S.; Anders, A.; Vilaithong, T.; Intasiri, S.; January 2006; 15 pp.; In English

Report No.(s): DE2006-893616; No Copyright; Avail.: National Technical Information Service (NTIS)

Metal-containing tetrahedral amorphous carbon films were produced by dual filtered cathodic vacuum arc (FCVA) plasma sources operated in sequential pulsed mode. A negatively pulsed bias was applied to the substrate only when carbon plasma was generated. Films thickness was measured after deposition by profilometry. Glass slides with silver pads were used as substrate for the of the measurement sheet resistance. The microstructure and composition of the films were characterized by Raman spectroscopy and Rutherford backscattering, respectively. It found that the electrical resistivity decreases with an

increase of the Mo content, which can be ascribed to an increase of sp² content and an increase of the sp² cluster size.
NTIS

Amorphous Materials; Bias; Carbon; Electric Potential; Metals; Plasmas (Physics); Tetrahedrons; Vacuum

20070009755 Christensen, OConnor, Johnson, Kindness, PLLC, Seattle, WA, USA

Methods for Making Porous Ceramic Structures

Zhang, M.; Ramay, H.; 14 May 04; 16 pp.; In English

Contract(s)/Grant(s): NSF-EEC-9529161

Patent Info.: Filed Filed 14 May 04; US-Patent-Appl-SN-10-846 356

Report No.(s): PB2007-102785; No Copyright; Avail.: CASI: [A03](#), Hardcopy

In one aspect, the present invention provides methods for making porous ceramic structures. In another aspect, the present invention provides porous ceramic structures that have a compressive strength of greater than about 5 MPa. In another aspect, the present invention provides methods for growing bone.

NTIS

Ceramics; Porosity

20070010554 Jagtiani and Guttag, Fairfax, VA, USA

Ceramic Compositions for Thermal Barrier Coatings Stabilized in the Cubic Crystalline Phase

Boutwell, B. A.; Gorman, M. D.; Spitsberg, I.; Darolla, R.; Bruce, R. W.; 29 Nov 05; 9 pp.; In English

Contract(s)/Grant(s): N00421-00-3-0443

Patent Info.: Filed Filed 29 Nov 05; US-Patent-Appl-SN-11-288 366

Report No.(s): PB2007-101485; No Copyright; Avail.: CASI: [A02](#), Hardcopy

Zirconia-containing ceramic compositions that are capable of providing thermal barrier coatings wherein the zirconia is stabilized in the cubic crystalline phase. These compositions comprise at least about 50 mole % zirconia and a stabilizing amount up to about 49 mole % of a stabilizer component comprising: (1) a first metal oxide selected from the group consisting of ytterbia, neodymia, mixtures of ytterbia and neodymia, mixtures of ytterbia and lanthana, mixtures of neodymia and lanthana, and mixtures of ytterbia, neodymia and lanthana in an amount of from about 5 to about 49 mole % of the composition; and (2) a second metal oxide selected from the group consisting of yttria, calcia, ceria, scandia, magnesia, indium and mixtures thereof in an amount of about 4 mole % or less of the composition. The ceramic composition further comprises one or more of a third metal oxide selected from the group consisting of: (a) hafnia in an amount from about 0.5 to about 40 mole % of the composition; and (b) tantalum in an amount of from about 0.5 to about 10 mole % of the composition. These compositions are useful in preparing thermal barrier coatings for an underlying substrate of articles that operate at, or are exposed to, high temperatures.

NTIS

Ceramics; Crystallinity; Patent Applications; Thermal Control Coatings; Zirconium Oxides

20070010560 Lawrence Livermore National Lab., Livermore, CA USA

Mitigation of Laser Damage Growth in Fused Silica NIF Optics with a Galvanometer Scanned Carbon Dioxide Laser

Bass, I. L.; Draggoo, V.; Guss, G. M.; Hackel, R. P.; Norton, M. A.; Apr. 11, 2006; 12 pp.; In English

Report No.(s): DE2006-889432; UCRL-PROC-220549; No Copyright; Avail.: National Technical Information Service

(NTIS)

Economic operation of the National Ignition Facility at the Lawrence Livermore National Laboratory depends on controlling growth of laser damage in the large, high cost optics exposed to UV light at 351 nm. Mitigation of the growth of damage sites on fused silica surfaces greater than several hundred microns in diameter has been previously reported by us using galvanometer scanning of a tightly focused 10.6 (micro)m CO₂ laser spot over an area encompassing the laser damage. Further investigation revealed that fused silica vapor re-deposited on the surface as 'debris' led to laser damage at unexpectedly low fluences when exposed to multiple laser shots at 351 nm. Additionally, laser power and spatial mode fluctuations in the mitigation laser led to poor repeatability of the process. We also found that the shape of the mitigation pit could produce downstream intensification that could damage other NIF optics. Modifications were made to both the laser system and the mitigation process in order to address these issues. Debris was completely eliminated by these changes, but repeatability and downstream intensification issues still persist.

NTIS

Carbon Dioxide Lasers; Economics; Galvanometers; Laser Damage; Silica Glass; Silicon Dioxide

20070010561 Rutgers - The State Univ., Piscataway, NJ, USA

Hot Superplastic Powder Forging for Transparent Nanocrystalline Ceramics

Cannon, W. R.; Apr. 2006; 44 pp.; In English

Report No.(s): DE2006-890708; No Copyright; Avail.: National Technical Information Service (NTIS)

The program explored a completely new, economical method of manufacturing nanocrystalline ceramics, Hot Superplastic Powder Forging (HSPF). The goal of the work was the development of nanocrystalline/low porosity optically transparent zirconia/alumina. The high optical transparency should result from lack of grain boundary scattering since grains will be smaller than one tenth the wavelength of light and from elimination of porosity. An important technological potential for this process is manufacturing of envelopes for high-pressure sodium vapor lamps. The technique for fabricating monolithic nanocrystalline material does not begin with powder whose particle diameter is ≤ 100 nm as is commonly done. Instead it begins with powder whose particle diameter is on the order of 10-100 microns but contains nanocrystalline crystallites ≤ 100 nm. Spherical particles are quenched from a melt and heat treated to achieve the desired microstructure.

NTIS

Ceramics; Forging; Powder (Particles); Powder Metallurgy; Superplasticity; Transparency

20070010580 NASA Glenn Research Center, Cleveland, OH, USA

Solid Lubricants and Coatings for Extreme Environments: State-of-the-Art Survey

Miyoshi, Kazuhisa; January 2007; 23 pp.; In English

Contract(s)/Grant(s): WBS 106920.01.03.06

Report No.(s): NASA/TM-2007-214668; E-15212; No Copyright; Avail.: CASI: [A03](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20070010580>

An investigation was conducted to survey anticipated requirements for solid lubricants in lunar and Martian environments, as well as the effects of these environments on lubricants and their performance and durability. The success of habitats and vehicles on the Moon and Mars, and ultimately, of the human exploration of and permanent human presence on the Moon and Mars, are critically dependent on the correct and reliable operation of many moving mechanical assemblies and tribological components. The coefficient of friction and lifetime of any lubricant generally vary with the environment, and lubricants have very different characteristics under different conditions. It is essential, therefore, to select the right lubrication technique and lubricant for each mechanical and tribological application. Several environmental factors are hazardous to performance integrity on the Moon and Mars. Potential threats common to both the Moon and Mars are low ambient temperatures, wide daily temperature swings (thermal cycling), solar flux, cosmic radiation, and large quantities of dust. The surface of Mars has the additional challenges of dust storms, winds, and a carbon dioxide atmosphere. Solid lubricants and coatings are needed for lunar and Martian applications, where liquid lubricants are ineffective and undesirable, and these lubricants must perform well in the extreme environments of the Moon, Mars, and space, as well as on Earth, where they will be assembled and tested. No solid lubricants and coatings and their systems currently exist or have been validated that meet these requirements, so new solid lubricants must be designed and validated for these applications.

Author

Solid Lubricants; Thermal Cycling Tests; Lubrication; Coefficient of Friction; Lunar Environment; Mars Environment

20070010590 Guttag (Jagtani), Fairfax, VA, USA

Ceramic Compositions for Thermal Barrier Coatings Stabilized in the Cubic Crystalline Phase

Boutwell, B. A.; Gorman, M. D.; Spitsbert, I.; Darolia, R.; Bruce, R. W.; 30 Dec 03; 9 pp.; In English

Contract(s)/Grant(s): N00421-00-3-0443

Patent Info.: Filed Filed 30 Dec 03; US-Patent-Appl-SN-10-748 517

Report No.(s): PB2007-103175; No Copyright; Avail.: CASI: [A02](#), Hardcopy

Zirconia-containing ceramic compositions that are capable of providing thermal barrier coatings wherein the zirconia is stabilized in the cubic crystalline phase. These compositions comprise at least about 50 mole % zirconia and a stabilizing amount up to about 49 mole % of a stabilizer component comprising: (1) a first metal oxide selected from the group consisting of ytterbia, neodymia, mixtures of ytterbia and neodymia, mixtures of ytterbia and lanthana, mixtures of neodymia and lanthana, and mixtures of ytterbia, neodymia and lanthana in an amount of from about 5 to about 49 mole % of the composition; and (2) a second metal oxide selected from the group consisting of yttria, calcia, ceria, scandia, magnesia, india and mixtures thereof in an amount of about 4 mole % or less of the composition. The ceramic composition further comprises one or more of a third metal oxide selected from the group consisting of: (a) hafnia in an amount from about 0.5 to about 40 mole % of the composition; and (b) tantala in an amount of from about 0.5 to about 10 mole % of the composition. These

compositions are useful in preparing thermal barrier coatings for an underlying substrate of articles that operate at, or are exposed to, high temperatures.

NTIS

Ceramics; Crystallinity; Patent Applications; Thermal Control Coatings

20070010591 Jagtiani and Guttag, Fairfax, VA, USA

Thermal Barrier Coatings with Lower Porosity for Improved Impact and Erosion Resistance

Spitsberg, I.; Boutwell, B. A.; 30 Dec 03; 13 pp.; In English

Contract(s)/Grant(s): N00019-96-C-0176

Patent Info.: Filed Filed 30 Dec 03; US-Patent-Appl-SN-10-748 518

Report No.(s): PB2007-103176; No Copyright; Avail.: CASI: [A03](#), Hardcopy

A reduced thermal conductivity thermal barrier coating having improved impact and erosion resistance for an underlying metal substrate of articles that operate at, or are exposed to, high temperatures. This coating comprises a zirconia-containing ceramic composition having a c/a ratio in the range of from about 1.0057 to about 1.0123 and stabilized in the tetragonal phase by a stabilizing amount of a stabilizing metal oxide. The coating has a fraction of porosity of from about 0.15 to about 0.25, and an impact and erosion resistance property defined by at least one of the following formulas: (a) $I = \exp. (5.85 - (144 \cdot s) - (3.68 \cdot p))$; and/or; (b) $E = (187 - (261 \cdot p) - (9989 \cdot s))$, wherein $s = 1.0117 - c/a$ ratio; p is the fraction of porosity; I is least about 70 g/mil; and E is least about 80 g/mil. This coating can be used to provide a thermally protected article having a metal substrate and optionally a bond coat layer adjacent to and overlaying the metal substrate. The thermal barrier coating can be prepared by depositing the zirconia-containing ceramic composition on the bond coat layer, or the metal substrate in the absence of the bond coat layer.

NTIS

Corrosion Resistance; Erosion; Impact Resistance; Patent Applications; Porosity; Thermal Control Coatings

20070010592 Jagtiani and Guttag, Fairfax, VA, USA

Ceramic Compositions Useful in Thermal Barrier Coatings having Reduced Thermal Conductivity

Spitsberg, I.; Venkataramani, V. S.; Boutwell, B. A.; Gorman, M. D.; Bruce, R. W.; 30 Dec 03; 11 pp.; In English

Contract(s)/Grant(s): N00019-96-C-0176

Patent Info.: Filed Filed 30 Dec 03; US-Patent-Appl-SN-10-748 520

Report No.(s): PB2007-103177; No Copyright; Avail.: CASI: [A03](#), Hardcopy

Ceramic compositions comprising at least about 91 mole % zirconia and up to about 9 mole % of a stabilizer component comprising a first metal oxide having selected from the group consisting of yttria, calcia, ceria, scandia, magnesia, india and mixtures thereof. This stabilizer component further comprises a second metal oxide of a trivalent metal atom selected from the group consisting of lanthana, gadolinia, neodymia, samaria, dysprosia, erbia, ytterbia, and mixtures thereof. These ceramic compositions are useful in preparing thermal barrier coatings having reduced thermal conductivity for the metal substrate of articles that operate at, or are exposed to, high temperatures.

NTIS

Ceramics; Cerium Oxides; Thermal Conductivity; Thermal Control Coatings

20070010594 Finnegan, Henderson, Farabow, Garrett, Dunner, LLP, Washington, DC, DC, USA

Methods of Controlling Multilayer Foil Ignition

Van Heerden, D. P.; Besnoin, E.; Spey, S. J.; Rude, T. R.; Brown, M. V.; 7 Oct 04; 62 pp.; In English

Contract(s)/Grant(s): DMI-0115238; DMI-0232398

Patent Info.: Filed Filed 7 Oct 04; US-Patent-Appl-SN-10-959 502

Report No.(s): PB2007-103178; No Copyright; Avail.: CASI: [A04](#), Hardcopy

Embodiments of the invention include a method of simulating an ignition of a reactive multilayer foil. Other embodiments include various methods of igniting a reactive multilayer foil by transferring energy from an energy source to a reactive multilayer foil.

NTIS

Ignition; Patent Applications

20070010598 Jagtiani and Guttag, Fairfax, VA, USA

Ceramic Compositions Useful for Thermal Barrier Coatings Having Reduced Thermal Conductivity

Spitsberg, I.; Venkataramani, V. S.; Boutwell, B. A.; Gorman, M. D.; 30 Dec 03; 10 pp.; In English

Contract(s)/Grant(s): N00019-96-C-0176

Patent Info.: Filed Filed 30 Dec 03; US-Patent-Appl-SN-10-748 508

Report No.(s): PB2007-103174; No Copyright; Avail.: CASI: [A02](#), Hardcopy

Ceramic compositions comprising at least about 91 mole % zirconia and up to about 9 mole % of a stabilizer component comprising a first metal oxide having selected from the group consisting of yttria, calcia, ceria, scandia, magnesia, india and mixtures thereof. This stabilizer component further comprises a second metal oxide of a trivalent metal atom selected from the group consisting of lanthana, gadolinia, neodymia, samaria, dysprosium, and mixtures thereof and a third metal oxide of a trivalent metal atom selected from the group consisting of erbia, ytterbia and mixtures thereof. These ceramic compositions are useful in preparing thermal barrier coatings having reduced thermal conductivity for the metal substrate of articles that operate at, or are exposed to, high temperatures.

NTIS

Ceramics; Thermal Conductivity; Thermal Control Coatings; Chemical Composition

20070010645 Savannah River National Lab., Aiken, SC, USA

Effects of Tritium on UHMW-PTFE, and Vespel Polyimide

Clark, E. A.; Shanahan, K. L.; January 2006; 6 pp.; In English

Report No.(s): DE2006-895045; No Copyright; Avail.: Department of Energy Information Bridge

Samples of ultrahigh molecular weight polyethylene (UHMW-PE), polytetrafluoroethylene (PTFE), and the polyimide Vespel(reg-sign) were exposed to tritium gas in closed containers initially at 101 kPa (1 atmosphere) pressure and ambient temperature for various times up to 2.3 years. Tritium exposure effects on the samples were characterized by dynamic mechanical analysis (DMA) and radiolysis products were characterized by measuring the total final pressure and composition in the exposure containers at the end of exposure period.

NTIS

Ambient Temperature; Polyimides; Polytetrafluoroethylene; Tritium

20070011165 Universal Technology Corp., Dayton, OH USA

Collaborative Research and Development Delivery Order 0024: Synthesis, Processing, and Evaluation of Polymers for RF Applications

Vestal, Christy R; Jan 2006; 17 pp.; In English

Contract(s)/Grant(s): F33615-03-D-5801-0024; Proj-4349

Report No.(s): AD-A462792; S-531-024; No Copyright; Avail.: CASI: [A03](#), Hardcopy

This research in support of the Air Force Research Laboratory Materials and Manufacturing Directorate was conducted at the Air Force Research Laboratory (AFRL) from 1 June 2004 through 31 December 2005. RF polymer nanocomposites containing ferrite nanoparticle and core/shell nanoparticles dispersed in polyurethane have been prepared. The permittivity in the X-band was found to increase with increasing nanoparticle volume inclusion and with increasing nanoparticle size. In the CoFeO₄/FeO₄ core/shell nanoparticle nanocomposite, the addition of the Fe₃O₄ shell lowered the permittivity compared to the native CoFeO₄ particle and increasing the shell thickness further depressed the permittivity. In the FeO₄/CoFe₂O₄ core/shell, the permittivity increase with the addition of the shell.

DTIC

Polymers; Radio Frequencies

20070011176 Michigan Univ., Ann Arbor, MI USA

Multiscale Modeling for the Design of Autonomic Healing Structural Composite Materials (MEANS)

Kieffer, John; Jun 25, 2006; 14 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): F49620-02-1-0079

Report No.(s): AD-A462805; F006138; No Copyright; Avail.: CASI: [A03](#), Hardcopy

We developed a suite of molecular-scale simulation tools, which includes all-atom MD simulations and coarse-graining procedures to interface with CVFE calculations at the continuum level. Polymerization reaction mechanisms and rates are identified in all-atom simulations. A first coarse-graining procedure consists of eliminating atoms that are unimportant for the mechanical properties of the structure. In a second coarse-graining procedure representation of monomers is simplified to

spherically symmetric particles. This allows one to generate large-scale realistic polymer networks and predict the mechanical properties of polymer structures with specific chemistries. This computational approach was validated by studying polymerization of DCPD under strain. Conclusions are: (i) the numerical acceleration of the reaction and transport processes does not alter the network structure; (ii) the mechanical properties are independent of the catalyst concentration and reaction rates; (iii) reproducing the underlying reaction mechanisms correctly at the molecular level is essential to generating realistic network structures and predicting materials properties.

DTIC

Autonomic Nervous System; Composite Materials; Healing; Matrix Materials; Polymer Matrix Composites; Polymers; Simulation

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*.

20070010451 NASA Glenn Research Center, Cleveland, OH, USA

NASA's PEM Fuel Cell Power Plant Development Program for Space Applications

Hoberecht, Mark; [2006]; 14 pp.; In English; 2006 Fuel Cell Seminar, November 2006, Honolulu, HI, USA; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 038957.04.01.03.03; No Copyright; Avail.: CASI: [A03](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20070010451>

NASA embarked on a PEM fuel cell power plant development program beginning in 2001. This five-year program was conducted by a three-center NASA team of Glenn Research Center (lead), Johnson Space Center, and Kennedy Space Center. The program initially was aimed at developing hardware for a Reusable Launch Vehicle (RLV) application, but more recently had shifted to applications supporting the NASA Exploration Program. The first phase of the development effort, to develop breadboard hardware in the 1-5 kW power range, was conducted by two competing vendors. The second phase of the effort, to develop Engineering Model hardware at the 10 kW power level, was conducted by the winning vendor from the first phase of the effort. Both breadboard units and the single engineering model power plant were delivered to NASA for independent testing. This poster presentation will present a summary of both phases of the development effort, along with a discussion of test results of the PEM fuel cell engineering model under simulated mission conditions.

Author

Fuel Cells; Power Plants; Protons; Membranes; Technology Utilization; NASA Programs

20070010455 NASA Glenn Research Center, Cleveland, OH, USA

Hydrogen-Oxygen PEM Regenerative Fuel Cell Development at NASA Glenn Research Center

Bents, David J.; Scullin, Vincent J.; Chang, B. J.; Johnson, Donald W.; Garcia, Christopher P.; Jakupca, Ian J.; [2006]; 32 pp.; In English; 2006 Fuel Cell Seminar, 13-17 Nov. 2005, Honolulu, HI, USA; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 561581.02.08.03.06.02; Copyright; Avail.: CASI: [A03](#), Hardcopy

The closed-cycle hydrogen-oxygen PEM regenerative fuel cell (RFC) at NASA Glenn Research Center has demonstrated multiple back to back contiguous cycles at rated power, and round trip efficiencies up to 52 percent. It is the first fully closed cycle regenerative fuel cell ever demonstrated (entire system is sealed: nothing enters or escapes the system other than electrical power and heat). During FY2006 the system has undergone numerous modifications and internal improvements aimed at reducing parasitic power, heat loss and noise signature, increasing its functionality as an unattended automated energy storage device, and in-service reliability. It also serves as testbed towards development of a 600 W-hr/kg flight configuration, through the successful demonstration of lightweight fuel cell and electrolyser stacks and supporting components. The RFC has demonstrated its potential as an energy storage device for aerospace solar power systems such as solar electric aircraft, lunar and planetary surface installations; any airless environment where minimum system weight is critical. Its development process continues on a path of risk reduction for the flight system NASA will eventually need for the manned lunar outpost.

Author

Fuel Cells; Regenerative Fuel Cells; Closed Cycles; Energy Storage; Power Efficiency; Aerospace Systems

20070011148 George Washington Univ., Washington, DC USA

Breaking the Nation's Oil Addiction: Is Ethanol the Cure?

Davis, Bryan B; Sep 29, 2006; 76 pp.; In English

Report No.(s): AD-A462764; CI07-0025; No Copyright; Avail.: CASI: **A05**, Hardcopy

High gas prices, instability in the Middle East, growing concerns over the environment, amidst this backdrop the Clean Air Act (CAA) Amendments of 1977 were born. Fast forward thirty plus years. Once again the USA finds itself suffering from high gas prices. It is entrenched in Middle East affairs in an effort to stabilize that region of the world. Now the nation faces the major environmental problem of global warming stemming from its burning of fossil fuel. Many people conclude the nation's motor gasoline consumption lies at the root of the current dilemma. Although nearly everyone tackling this issue agrees that there is no silver bullet, which will solve the nation's addiction to petroleum. A growing number of advocates point to alternative fuels as a possible means to break the cycle of oil dependence. The use of such fuels may lower gas prices, strengthen national security, and address environmental issues that are associated with burning fossil fuels. Currently, ethanol is the alternative fuel grabbing headlines. Ethanol supporters are at every level of government as well as in the business arena. But, can ethanol really free the nation from oil's grip? Can it delivery on its promise of a cheaper and cleaner fuel source?

DTIC

Ethyl Alcohol; Fossil Fuels; Gasoline; Oils; Petroleum Products

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*.

20070009724 Army Research Inst. for the Behavioral and Social Sciences, Fort Knox, KY USA

Automated Measures of Staff Performance for Battle Command Reengineering III

Throne, May H; Holden, Jr , William T; Lickteig, Carl L; Jan 2000; 15 pp.; In English; Original contains color illustrations

Report No.(s): AD-A462107; No Copyright; Avail.: CASI: **A03**, Hardcopy

This paper documents the design, development, and demonstration of prototype automated performance measures for staffs using advanced command, control, communications, computer, and intelligence (C4I) systems. These prototype measures were implemented in a simulation based experiment to examine the impact of digital systems on future Battle Command training and performance assessment at the battalion and brigade level. A short review of previous research and relevant literature on automated measures is presented, followed by the design and development of the prototype measures, and a discussion of sample results and lessons learned. More detailed information can be found in Throne et al. (1999). The complete results produced from the automated measures are presented in the five-volume set of materials entitled Training and Measurement Support Package, Battle Command Reengineering III, Mounted Maneuver Battlespace Lab (Training and Measurement Support Package, 1999). Selected results from this effort are also included in the Mounted Maneuver Battlespace Lab's (1999a) Experiment Final Report.

DTIC

Command and Control; Digital Systems

20070009797 SRI International Corp., Menlo Park, CA USA

Many Agents Are Better Than One

Georgeff, Michael P; Mar 1987; 18 pp.; In English

Contract(s)/Grant(s): N00014-85-C-0251; NAS2-12521

Report No.(s): AD-A461424; TN-417; No Copyright; Avail.: CASI: **A03**, Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA461424>

This paper aims to show how much of the frame problem can be alleviated by using domain models that allow for the simultaneous occurrence of actions and events. First, a generalized situation calculus is constructed for describing and reasoning about events in multiagent settings. Notions of independence and causality are then introduced and it is shown how they can be used to determine the persistence of facts over time. Finally, it is shown how these notions, together with traditional predicate circumscription, make it possible to retain a simple model of action while avoiding most of the difficulties associated with the frame problem.

DTIC

Models; Calculus

20070011100 Naval Postgraduate School, Monterey, CA USA

Vibration Analysis Using a MEMS Accelerometer

Young, Jonathan C; Dec 2006; 61 pp.; In English; Original contains color illustrations

Report No.(s): AD-A462581; No Copyright; Avail.: CASI: [A04](#), Hardcopy

The primary objective of this thesis was to study the feasibility of using a MEMS accelerometer to monitor vibration signatures of a machine to determine if the machine is operating properly. The secondary objective was to investigate the self test features of the accelerometer used in the vibration monitoring. An Efector Octavis accelerometer sensor was used in this study. It was used to monitor a small air pump and an air conditioning (AC) system. The sensor provided the amplitude for the frequency spectrum of the motor vibration. A reference signal was calculated by taking an average of the spectrum over 30 seconds. Two methods (a ratio of crosscorrelation coefficients and a spectral distance) were used to compare the reference to the sensor data. The spectral distance method proved to be the better of the two. Using this method, the system could sense when the pump or the AC unit were malfunctioning. The self test feature involved exciting the Built in Self Test (BIST) pin of the accelerometer with a signal generator. Then the impulse response of the accelerometer was measured from the output pin using an oscilloscope.

DTIC

Accelerometers; Dynamic Structural Analysis; Microelectromechanical Systems

20070011231 Edgewood Chemical Biological Center, Aberdeen Proving Ground, MD USA

Development of the 5-cm Agent Fate Wind Tunnel

Weber, Daniel J; Scudder, Mary K; Moury, Clayton S; Shuely, Wendel J; Molnar, John W; Miller, Miles C; Dec 2006; 181 pp.; In English

Report No.(s): AD-A462884; ECBC-TR-327; No Copyright; Avail.: CASI: [A09](#), Hardcopy

This report describes development of a 5-cm wind tunnel designed to measure the release and retention of chemical warfare agents (CWA) from various materials under simulated environmental conditions. The wind tunnel, sized to fit within a standard chemical fume hood, provides a specified vertical velocity profile, temperature, and relative humidity (simulating the natural environment) for a sustained time period ranging from hours to weeks. The associated data acquisition instrumentation measures the time history of the vapor released during evaporation of the CWA from the material substrate whether the chemical is a sessile drop on the surface or a sorbed liquid within the substrate. The wind tunnel creates the full-scale, lower portion of the velocity profile produced by a wind-induced, atmospheric boundary layer, which passes over a full-scale drop of agent and a full-scale sample of the material substrate. This feature differentiates it from environmental type wind tunnels where scaling is required for the airflow and items being tested. The 5-cm wind tunnel has the capability to test single and multiple drops of agent. This report summarizes the design evolution, component details and operational functions. Representative data obtained in the tunnel are compared with results from other experimental sources.

DTIC

Absorption; Chemical Warfare; Environmental Tests; Evaporation; Wind Tunnels

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*.

20070009608 Army War Coll., Carlisle Barracks, PA USA

Global Command and Control System (GCCS) and Strategic Education at the U.S. Army War College

Mangam, David; Niedrauer, Bruce; Waddell, William; Chantelau, William; Jan 1999; 10 pp.; In English

Report No.(s): AD-A461123; No Copyright; Avail.: CASI: [A02](#), Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA461123>

No abstract available

Command and Control; Education; Universities; Warfare

20070009611 Joint C4ISR Battle Center, Suffolk , VA USA

Underpinning the RMA - Advancements in the Transformation of Information into Knowledge for Command and Control

Owen, Donald G; Saenz, Anthony; Sinclair, Mark R; Jan 1999; 15 pp.; In English

Report No.(s): AD-A461157; No Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA461157>

The exercise of Command and Control will be transformed in the future by advances in the ability of the commander to gain and act upon near-perfect situational knowledge which has been distilled from diverse information sources. The art of modern command and control has evolved over centuries of practice, modified as demanded by political and technological changes. With the near asymptotic pace of innovation in the past three decades and the geopolitical instability and realignment brought on by the decline of the former Soviet Union, evolutionary change in command and control is being replaced by major revolutionary advances. This paper outlines some of the elements of this transformation and discusses Department of Defense (DoD) and other organizations efforts to examine, quantify and implement these advances. This process is not being conducted in a fully comprehensive manner, especially within DoD; the Joint Experimentation Process mandated by Title XII of the Defense Authorization Act of 1999 has made only superficial progress in this regard. It is the intent of this paper to discuss several of the most promising initiatives to the end that they can be assimilated by DoD into the comprehensive process realignment that is the Revolution in Military Affairs (RMA). The main underlying theme of the RMA is that the Commander can attain near-perfect situational awareness, and will therefore be able to select precise and accurate courses of action to guarantee desired outcomes in any military situation. Near-perfect situational awareness has five distinguishing elements and is facilitated by four key enablers. Although the overall impact of current initiatives on the RMA are unclear, some major elements are becoming increasingly evident as a result of ongoing experimentation, demonstrations, and as fielding is implemented.

DTIC

Command and Control; Defense Program; Information Systems

20070009613 Army Research Inst. for the Behavioral and Social Sciences, Fort Knox, KY USA

Simulation-Based Training and Assessment of Digital Command Staff: Training and Assessment for Network-Centric Command and Control

Hess, Stephen M; Hutton, Rob; Sterling, Bruce; Campbell, Charlotte; Jan 2000; 8 pp.; In English; Original contains color illustrations

Report No.(s): AD-A461191; No Copyright; Avail.: CASI: A02, Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA461191>

Increasing digitization of the modern battlefield brings with it new demands on military command staffs for rapid, flexible decision making, execution of complex digital skills such as visualization and information management, and coordinated, communication-intensive teamwork. The Army's Battle-Command Reengineering III exercise (BCR III) simulated the demands of the future digital command environment by placing a command staff in the context of a soldier-in-the-loop simulation, with a suite of digital tools including email, shared whiteboard, and SA-enhancing common-operating views, to test concepts in future battle command. In this context, we developed an innovative approach to decision- skills training using short, focused vignettes that provided staff members with opportunities to utilize the same digital equipment to accomplish goals in each of several stages of the natural battle-preparation and execution cycle. To assess the degree to which the training approach was successful and to develop a picture of individual and team outcome/process, we developed a set of targeted performance measures. These measures fell into several categories ranging from measures of individual performance to measures of team-level perceptions of teammates roles and workload. We employed a mix of observation, participant survey and objective measurement to provide measures of both team outcome and team processes.

DTIC

Command and Control; Digital Systems; Education; Network Control; Simulation

20070009638 General Accounting Office, Washington, DC USA

Telecommunications: Direct Broadcast Satellite Subscribership Has Grown Rapidly, But Varies Across Different Types of Markets

Apr. 2005; 40 pp.; In English

Report No.(s): PB2007-105651; GAO-05-257; No Copyright; Avail.: CASI: A03, Hardcopy

Since its introduction in 1994, direct broadcast satellite (DBS) service has grown dramatically, and this service is now the principal competitor to cable television service. Although DBS service has traditionally been a rural service, passage of the

Satellite Home Viewer Improvement Act of 1999 enhanced the competitiveness of DBS service in suburban and urban markets. GAO agreed to examine (1) how DBS subscribership changed since 2001; (2) how DBS penetration rates differ across urban, suburban, and rural areas; (3) how DBS penetration rates differ across markets based on the degree and type of competition provided by cable operators; and (4) the factors that appear to influence DBS penetration rates across cable franchise areas. To complete this report, GAO prepared descriptive statistics and an econometric model using data from the Federal Communications Commissions annual Cable Price Survey and the Satellite Broadcasting and Communications Associations subscriber count database.

NTIS

Direct Broadcast Satellites; Market Research; Telecommunication

20070009680 University of Southern California, Marina del Rey, CA USA

Evaluation of a Spoken Dialogue System for Virtual Reality Call for Fire Training

Robinson, Susan M; Roque, Antonio; Vaswani, Ashish; Traum, David; Hernandez, Charles; Millsbaugh, Bill; Jan 2007; 9 pp.; In English; Original contains color illustrations

Report No.(s): AD-A461549; No Copyright; Avail.: CASI: [A02](#), Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA461549>

We present an evaluation of a spoken dialogue system that engages in dialogues with soldiers training in an immersive Call for Fire (CFF) simulation. We briefly describe aspects of the Joint Fires and Effects Trainer System, and the Radiobot-CFF dialogue system, which can engage in voice communications with a trainee in call for fire dialogues. An experiment is described to judge performance of the Radiobot CFF system compared with human radio operators. Results show that while the current version of the system is not quite at human-performance levels, it is already viable for training interaction and as an operator-controller aid.

DTIC

Education; Fires; Speech; Virtual Reality; Voice Communication

20070009719 Air Force Research Lab., Brooks AFB, TX USA

Agent-based Simulation and Support of C3 Decisionmaking Using a Command and Control Research Network

Barnes, Christopher; Petrov, Plamen V; Elliott, Linda R; Jan 2002; 12 pp.; In English; Original contains color illustrations

Report No.(s): AD-A462000; No Copyright; Avail.: CASI: [A03](#), Hardcopy

This paper describes approach, methodology, and potential application areas for agent technologies in C2 performance and primarily focuses on the development of agent-based constructed forces. The platform involved is the AWACS-AEDGE(TradeMark). This is a distributed, real-time team decision support environment comprised of simulators, entity framework, intelligent agents and user interfaces. The AEDGE is constructed as a federation of intelligent agent-based functions that enable user-friendly scenario construction, emulation of friendly and hostile entities, and dynamic scenario control. Its architecture and decision making algorithms are examined, as well as agent technology and utilization in the realms of constructive forces, synthetic team members, and decision support.

DTIC

AWACS Aircraft; Command and Control; Decision Making; Simulation

20070009723 NATO Supreme Allied Command Transformation, Norfolk, VA USA

'COM as Shooter' - Operational Planning using C2 for Confronting and Collaborating

Baan, Andy; Howard, Nigel; Tait, Andrew; Jan 2003; 23 pp.; In English; Original contains color illustrations

Report No.(s): AD-A462086; No Copyright; Avail.: CASI: [A03](#), Hardcopy

Confrontation and Collaboration Analysis (CCA) is a way of analyzing interactions between parties - especially in Peace or Post-Conflict Stabilization Operations. It concentrates on achieving a particular kind of psychological effect viz a change in the intentions and objectives of other parties - and directly supports emerging command concepts such as Effects-Based Operations and the Operational Net Assessment. This paper describes the use of CCA in the form of a cut-down system for Command and Control of Confronting and Collaborating (C2CC) within Allied Action 03 (a major NATO planning exercise).

DTIC

Command and Control; Maintainability; Operational Problems; Planning

20070009794 Naval Postgraduate School, Monterey, CA USA

The Command and Control - Emerging Effects Framework: An Overview

Jansen, Erik; Jones, Carl R; Sovereign, Michael G; Jan 2002; 17 pp.; In English

Report No.(s): AD-A461798; No Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA461798>

The Command and Control - Emerging Effects (C2E2) framework describes a military force in an ecology of conflict and cooperation. The force's actions impact others, generating effects in a co-evolutionary process of emergent behavior patterns. The military force uses problem-focused processes to identify, solve, and implement its chosen solutions. Its organizational logic is the force-wide logic of its domain-specific, problem-focused processes. Its organizational architecture comprises the organizational logic with specifications for each logical task, roles for performing both manpower and technical tasks, incentives and coordination mechanisms, and structuring of tasks and roles into organizational units. Assigning resources (personnel and technical systems) to these roles and adjusting for role maladaptations requires control-coordination processes. These control-coordination processes, the science of C2, provide an infrastructure, (a 'surface') on which the command process (the art of C2) operates. The command process involves a dialogue of deciding, leading, and interpreting among the commanders in the chain of command. The interactions engendered by the dialogue generate force-wide sense making processes and action capabilities that are the means for evolutionary adaptation to the ecology. The capability employs the adoption of a strategic posture and an operating point in the space of strategic fitness dimensions (edges).

DTIC

Command and Control; General Overviews

20070009798 TRADOC Analysis Command, Fort Leavenworth, KS USA

Command and Control Experimentation Lessons Learned From the US Army Division Advanced Warfighting Experiment (DAWE)

Kroening, Donald W; Leath, Lynn; Jun 2000; 16 pp.; In English

Report No.(s): AD-A461430; No Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA461430>

The purpose of this paper is to identify command and control (C2) experimentation lessons learned from the data collection and analysis processes of the US Army Division XXI Advanced Warfighting Experiment (DAWE). These lessons learned will assist the analytic and data collection communities in conducting future Advanced Warfighting Experiments (AWEs) and the Army Experimentation Campaign Plan (AECPP). This document provides a background of the DAWE, an overview of the data collection and analysis processes, and the C2 experimentation lessons learned during the planning, execution and post-event phases of the DAWE. The lessons learned section includes examples of the problems encountered and potential solutions. Lastly, this document highlights the general implications resulting from these lessons learned.

DTIC

Command and Control; Warfare; Armed Forces (United States)

20070009810 California Univ., Santa Cruz, CA USA

A Protocol for Scalable Loop-Free Multicast Routing

Parsa, M; Garcia-Luna-Aceves, J J; Jan 1997; 31 pp.; In English

Contract(s)/Grant(s): F19628-93-C-0175; F19628-96-C-0038

Report No.(s): AD-A461677; No Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA461677>

In network multimedia applications, such as multiparty teleconferencing, users often need to send the same information to several (but not necessarily all) other users. To manage such one-to-many or many-to-many communications efficiently in wide-area internetworks, it is imperative to support and perform multicast routing. Multicast routing sends a single copy of a message from a source to multiple receivers over a communication link that is shared by the paths to the receivers. Loop-freedom is a specially important consideration in multicasting. Because applications using multicasting tend to be multimedia and bandwidth intensive, and loops in multicast routing duplicate looping packets. We present and verify a new multicast routing protocol, called Multicast Internet Protocol (MIP), which offers a simple and flexible approach to constructing both group-shared and shortest-paths multicast trees. MIP can be sender-initiated or receiver-initiated or both; therefore, it can be tailored to the particular nature of an application's group dynamics and size. MIP is independent of the underlying unicast routing algorithms used.

DTIC

Protocol (Computers); Multimedia; Teleconferencing; Communication Networks; Internets

20070009818 Army Research Lab., Adelphi, MD USA

Future Army Tactical Operation Center Concept

Emmerman, Philip J; Rodriquez, Albert; Johnson, Joseph E; Grills, John P; Jan 1999; 9 pp.; In English; Original contains color illustrations

Report No.(s): AD-A461301; No Copyright; Avail.: CASI: [A02](#), Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA461301>

The inefficiency, high complexity, and lack of mobility of current army tactical operation centers (TOC) will limit their effectiveness in the highly dynamic non-linear future battlefield. The extensive hardware, software, and manpower resources needed to operate a current TOC severely restrict the mobility envisioned for the future battlefield. There are three major technical thrusts required to provide this drastic increase in automation; system architecture unification, integrating airborne, satellite, and terrestrial communications, and the development and maximum usage of software agent architectures and applications. The Army is working aggressively in each of these areas. A common client server and database architecture is being developed for the Army Battle Command System. Robust wide band radios and networks are being developed and experimented with. There is significant research, development and implementation of agent architectures and applications that apply to this battlefield automation. This paper focuses on both the challenges of this battlefield TOC automation and a proposed agent based solution.

DTIC

Telecommunication; Radio Equipment; Military Operations

20070009826 NASA Goddard Space Flight Center, Greenbelt, MD, USA

NASA Multi-Time-Code Mechanism

Rakow, Glenn Parker; September 25, 2006; 4 pp.; In English; SpaceWire 101 Seminar, 25 Sep. 2006, Washington, DC, USA;

No Copyright; Avail.: CASI: [A01](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20070009826>

A viewgraph presentation describing a time code function expansion is shown.

CASI

Time Functions; Computer Programs; Systems Engineering; Communication Networks

20070009831 NASA Ames Research Center, Moffett Field, CA, USA

Wireless Command-and-Control of UAV-Based Imaging LANs

Herwitz, Stanley; Dunagan, S. E.; Sullivan, D. V.; Slye, R. E.; Leung, J. G.; Johnson, L. F.; October 2006; 18 pp.; In English; Original contains color and black and white illustrations

Report No.(s): NASA/TM-2006-213479; Copyright; Avail.: CASI: [A03](#), Hardcopy

Dual airborne imaging system networks were operated using a wireless line-of-sight telemetry system developed as part of a 2002 unmanned aerial vehicle (UAV) imaging mission over the USA's largest coffee plantation on the Hawaiian island of Kauai. A primary mission objective was the evaluation of commercial-off-the-shelf (COTS) 802.11b wireless technology for reduction of payload telemetry costs associated with UAV remote sensing missions. Predeployment tests with a conventional aircraft demonstrated successful wireless broadband connectivity between a rapidly moving airborne imaging local area network (LAN) and a fixed ground station LAN. Subsequently, two separate LANs with imaging payloads, packaged in exterior-mounted pressure pods attached to the underwing of NASA's Pathfinder-Plus UAV, were operated wirelessly by ground-based LANs over independent Ethernet bridges. Digital images were downlinked from the solar-powered aircraft at data rates of 2-6 megabits per second (Mbps) over a range of 6.5-9.5 km. An integrated wide area network enabled payload monitoring and control through the Internet from a range of ca. 4000 km during parts of the mission. The recent advent of 802.11g technology is expected to boost the system data rate by about a factor of five.

Author

Command and Control; Imaging Techniques; Local Area Networks; Pilotless Aircraft; Wireless Communication; Solar Powered Aircraft; Remote Sensing

20070009869 Carnegie-Mellon Univ., Pittsburgh, PA USA

Enabling Secure High-Performance Wireless Ad Hoc Networking

Hu, Yih-Chun; May 29, 2003; 180 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): CCR-0209204; NAG3-2534

Report No.(s): AD-A461094; CMU-CS-03-144; No Copyright; Avail.: CASI: [A09](#), Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA461094>

A revolution has occurred in wireless communications over the last decade. Advances in processing power have enabled widespread deployment of radio networks as well as portable devices that can make use of such networks. Wireless networks have become more convenient and affordable and have spread to even fairly stationary applications such as home networking and community networking. Ad hoc networks can extend the range of such wireless networks: in an ad hoc network nodes cooperate to dynamically establish routing among themselves a packet sent by one node may be forwarded in turn by a sequence of other nodes allowing the packet to reach a destination beyond the sender wireless transmission range. This thesis discusses improvements to service in ad hoc network routing. Since different networks require different types of service, I propose several mechanisms to improve service in various network conditions. One example of service is Quality-of-Service (QoS) since certain networks may desire some flows to have priority over other flows. Many of the mechanisms presented here make no distinction between lower and higher priority traffic and in my evaluation I only examine performance metrics aggregated over all flows rather than the performance of a few select flows. Another area encompassed by service is security. In particular when an attacker is present in the network a protocol that provides security against such an attacker should provide better service than one that does not. For example a secure protocol should deliver more packets incur less overhead or conserve overall network power usage better than in insecure protocol when the network is under attack. As a network experiences attack a secure network routing protocol may continue to provide some level of service whereas a traditional network routing protocol may fail completely.

DTIC

Communication Networks; Protocol (Computers); Transmitters

20070009899 Strategic Consulting, Inc., Fairfax Station, VA USA

Rethinking Command & Control

Curts, Raymond J; Campbell, Douglas E; Mar 20, 2006; 26 pp.; In English; Original contains color illustrations

Report No.(s): AD-A461640; No Copyright; Avail.: CASI: [A03](#), Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA461640>

Established characteristics bounding the conduct of Command and Control going back to the days of Sun Tzu specifically describe the intended implementation of C2 operations. These can still be seen aboard a variety of warfighting assets and in training facilities both at home and deployed. Military posturing has changed with the advent of information systems and Moore's Law. This has naturally led to the need for 'information superiority' which in turn highlights the necessity for new policies, processes, procedures, strategies and tactics. At issue is that the term 'Command & Control' may need to be redefined, or that it is no longer applicable in this new age of agile organizations. The consequences of recent warfighting actions have led some to believe that the role of C2 is being eroded by the advent of huge databases and ubiquitous services. In short, traditional Command & Control works well in a military that is trained in a limited communications environment, experienced and semi-autonomous. Moving as we are, to a military that is becoming dependent upon automation will require it to replace training, experience, and autonomy with a more centralized control, and dependence upon automation. Otherwise, the authors suggest that 'Command and Control' is a relic in today's modern warfare environment.

DTIC

Command and Control; Data Bases; Tactics; Deployment

20070009906 National Defense Univ., Washington, DC USA

Lessons From Bosnia: The IFOR Experience

Wentz, Larry; Layton, Richard L; Landon, James J; Bair, Andrew; Dziedzic, Michael J; Combelles-Siegel, Pascale; Jacobson, Mark R; Allard, Kenneth; Jan 1998; 518 pp.; In English; Original contains color illustrations

Report No.(s): AD-A461623; No Copyright; Avail.: CASI: [A22](#), Hardcopy

This book tells the story of the challenges faced and innovative actions taken by NATO and U.S. personnel to ensure that IFOR and Operation Joint Endeavor were military successes. A coherent C4ISR lessons-learned story has been pieced together from firsthand experiences, interviews of key personnel, focused research, and analysis of lessons learned reports provided to the National Defense University team. The book provides numerous examples that support the observation that DoD's vision is working for the Bosnia operation. However, much work remains to be done to achieve information superiority. The success of the IFOR operation was a major step forward, but this step was not due to technology alone. It was due mainly to the efforts of the dedicated, professional, and innovative men and women of the military, government, and contractors who were there and those who supported them.

DTIC

Bosnia and Herzegovina; Defense Program; Personnel

20070009912 Mitre Corp., McLean, VA USA

Design and Performance of Code Tracking for the GPS M Code Signal

Betz, John W; Sep 2000; 12 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): F19628-00-C-001

Report No.(s): AD-A460257; No Copyright; Avail.: CASI: [A03](#), Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA460257>

The binary offset carrier (BOC) modulation of the new GPS military ranging signal, the M code signal, provides essential benefits in many respects. Because of this signal's differences from conventional ranging signals, M code receiver performance also benefits from some changes to conventional designs. Extensive analysis, simulation, and hardware experimentation have yielded useful insights in receiver design; some of the key insights are provided in this paper. A discriminator design approach is described based on theoretically developed S curves and predictions of code tracking accuracy, and used to configure the experimental hardware. It is seen that the design approach must be somewhat different from that used for receivers of C/A code and Y code signals, in order to take advantage of the unique characteristics of BOC modulations. Theoretical expressions are presented that describe performance of despreading and code tracking the M code signal's BOC modulation using a delay-locked loop with noncoherent early-late discriminator. Simple algebraic approximations are also provided. Theoretical predictions of signal-to-noise ratio and code tracking accuracy in white noise are compared with measured results, demonstrating the utility of the design approach and close comparison between theoretical predictions and measurements. Finally, the effect of front-end bandwidth on receiver performance is assessed.

DTIC

Global Positioning System; Signal Processing

20070009919 Carnegie-Mellon Univ., Pittsburgh, PA USA

Resource Management in Multi-hop Ad Hoc Networks

Maltz, David A; Nov 21, 1999; 28 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): NCR-9502725; F19628-96-C-0061

Report No.(s): AD-A461042; CMU-CS-00-150; No Copyright; Avail.: CASI: [A03](#), Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA461042>

An ad hoc network is a collection of wireless mobile nodes dynamically forming a temporary network without the use of any existing network infrastructure or centralized administration. Routing protocols have been developed that allow such nodes to communicate, but these protocols typically provide only best-effort service. In particular, they do not provide a way to control the consumption of resources in the network, such as the battery power or the carrying capacity of the nodes. This proposal describes a scheme of path-state and flow-state mechanisms that can be used to explicitly manage resources in an ad hoc network, explains how the scheme can be evaluated, and argues for its importance.

DTIC

Communication Networks; Resources Management

20070010456 NASA Glenn Research Center, Cleveland, OH, USA

High-Capacity Communications from Martian Distances Part 4: Assessment of Spacecraft Pointing Accuracy Capabilities Required For Large Ka-Band Reflector Antennas

Hodges, Richard E.; Sands, O. Scott; Huang, John; Bassily, Samir; [2006]; 7 pp.; In English; Ka Band Conference, 27-29 Sep. 2006, Genova, Italy

Contract(s)/Grant(s): WBS 439432.07.04.03.01; Copyright; Avail.: CASI: [A02](#), Hardcopy

Improved surface accuracy for deployable reflectors has brought with it the possibility of Ka-band reflector antennas with extents on the order of 1000 wavelengths. Such antennas are being considered for high-rate data delivery from planetary distances. To maintain losses at reasonable levels requires a sufficiently capable Attitude Determination and Control System (ADCS) onboard the spacecraft. This paper provides an assessment of currently available ADCS strategies and performance levels. In addition to other issues, specific factors considered include: (1) use of 'beaconless' or open loop tracking versus use of a beacon on the Earth side of the link, and (2) selection of fine pointing strategy (body-fixed/spacecraft pointing, reflector pointing or various forms of electronic beam steering). Capabilities of recent spacecraft are discussed.

Author

Reflector Antennas; Beacons; Attitude Control; Extremely High Frequencies; Accuracy

20070010479 NASA Goddard Space Flight Center, Greenbelt, MD, USA

A Lidar for Making Range Resolved CO₂ Measurements within the Planetary Boundary Layer

Burris, John; Riris, Haris; Andrews, Arlyn; Krainak, Mike; Sun, Xiaoli; Abshire, Jim; Colarco, Amelia; Heaps, William;

[2006]; 1 pp.; In English; 7th International Symposium on Tropospheric Profiling, 11-17 Jun. 2006, Denver, CO, USA; No Copyright; Avail.: Other Sources; Abstract Only

A ground based differential absorption lidar is under development at NASA's Goddard Space Flight Center to make range resolved measurements of CO₂ within the planetary boundary layer. This is a direct detection lidar designed for both photon counting and analog use. Technology being developed for this instrument will be discussed including efforts in fiber lasers, optical parametric amplifiers and both InGaAs and HgCdTe solid-state detectors. The capabilities of this system are investigated and preliminary results presented.

Author

Optical Radar; Differential Absorption Lidar; Carbon Dioxide; Planetary Boundary Layer; Rangefinding; Light Amplifiers; Parametric Amplifiers

20070010521 Float [Kenneth W], Braselton, GA, USA

Blind Selected Mapping Techniques for Crest Factor Reduction of Forward Link CDMA Signals

Chen, N.; Zhou, G.; 12 Dec 05; 15 pp.; In English

Contract(s)/Grant(s): NSF-CCR-0218778

Patent Info.: Filed Filed 12 Dec 05; US-Patent-Appl-SN-11-301-381

Report No.(s): PB2007-101459; No Copyright; Avail.: CASI: [A03](#), Hardcopy

Disclosed are apparatus that implement blind selected mapping techniques that provide for crest factor reduction of forward link CDMA signals. Communication signals are processed using a mathematical algorithm that selectively maps a summed communication signal in a frame to another summed communication signal which has a smaller peak-to-average power ratio. The reduced dynamic range communication signal is amplified and transmitted to a receiver. At the receiver, the reduced power communication signal is processed using a mathematical algorithm that detects the selected mapping index used in the transmitter and converts the received signals into the original communication signals.

NTIS

Code Division Multiple Access; Conformal Mapping

20070010524 Edell, Shapiro and Finnan, LLC, Rockville, MD, USA

Energy-Efficient Network Protocol and Node Device for Sensor Networks

Yoon, C. J.; 22 Mar 05; 22 pp.; In English

Patent Info.: Filed Filed 22 Mar 05; US-Patent-Appl-SN-11-085-655

Report No.(s): PB2007-101457; No Copyright; Avail.: CASI: [A03](#), Hardcopy

An 'on-demand' approach for a routing protocol for a wireless network that achieves balanced energy consumption among all participating nodes in the network. Synchronization messages transmitted by nodes associated with an upstream node include local node information (LNI) that a node can use to repair or bypass a lost upstream node in a real or virtual (temporary) manner depending upon the local node's battery level. Only if a repair process fails will a global re-organization (Re-Org) be initiated. The LNI also allows for nodes having lower power availability (battery level) not to transmit the LNI so that unaffiliated node(s) can select an upstream node having more power availability thereby extending network life.

NTIS

Protocol (Computers); Sensors; Wireless Communication

20070010525 Lucent Technologies, Murray Hill, NJ, USA

Method and Apparatus for Seamless Roaming For Wireless Networks

Lin, C. H.; Paul, S.; Rangarajan, S.; 25 Mar 05; 14 pp.; In English

Contract(s)/Grant(s): NSF-ANI-0335244

Patent Info.: Filed Filed 25 Mar 05; US-Patent-Appl-SN-11-089-736

Report No.(s): PB2007-101458; No Copyright; Avail.: CASI: [A03](#), Hardcopy

A method and apparatus for seamless roaming support for wireless networks is disclosed. The method includes broadcasting a request for a physical address of a default router related to a mobile unit; receiving the request at the default router; replying to the mobile unit; and creating an initial entry in a location table.

NTIS

Wireless Communication; Communication Networks

20070010534 NASA Glenn Research Center, Cleveland, OH, USA

A Review of Antenna Technologies for Future NASA Exploration Missions

Miranda, Felix A.; Nessel, James A.; Romanofsky, Robert R.; Acosta, J.; [2007]; 33 pp.; In English; 12th Ka and Broadband Communications Conference, 27-29 Sept. 2006, Naples, Italy; Original contains color illustrations

Contract(s)/Grant(s): WBS 732759.03.01.03.04; No Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: <http://hdl.handle.net/2060/20070010534>

NASA's plans for the manned exploration of the Moon and Mars will rely heavily on the development of a reliable communications infrastructure from planetary surface-to-surface, surface-to-orbit and back to Earth. Future missions will thus focus not only on gathering scientific data, but also on the formation of the communications network. In either case, unique requirements become imposed on the antenna technologies necessary to accomplish these tasks. For example, proximity (i.e., short distance) surface activity applications such as robotic rovers, human extravehicular activities (EVA), and probes will require small size, lightweight, low power, multi-functionality, and robustness for the antenna elements being considered. In contrast, trunk-line communications to a centralized habitat on the surface and back to Earth (e.g., relays, satellites, and landers) will necessitate high gain, low mass antennas such as novel inflatable/deployable antennas. Likewise, the plethora of low to high data rate services desired to guarantee the safety and quality of mission data for robotic and human exploration will place additional demands on the technology. Over the last few years, NASA Glenn Research Center has been heavily involved in the development and evaluation of candidate antenna technologies with the potential for meeting the aforementioned requirements. These technologies range from electrically small antennas to phased arrays and large inflatable antenna structures. A summary of these efforts will be discussed in this paper. NASA planned activities under the Exploration Vision as they pertain to the communications architecture for the Lunar and Martian scenarios will be discussed, with emphasis on the desirable qualities of potential antenna element designs for envisioned communications assets. Identified frequency allocations for the Lunar and Martian surfaces, as well as asset-specific data services will be described to develop a foundation for viable antenna technologies which might address these requirements and help guide future technology development decisions.

Author

Antenna Arrays; NASA Programs; Phased Arrays; Communication Networks; Antenna Components; Inflatable Structures; Large Space Structures

20070010536 NASA Glenn Research Center, Cleveland, OH, USA

Antenna Technologies for NASA Applications

Miranda, Felix; [2007]; 47 pp.; In English; IDGA's Military Antenna Systems Conference Westin Arlington Gateway, 19-20 Sept. 2006, Arlington, VA, USA; Original contains color illustrations

Contract(s)/Grant(s): WBS 732759.03.01.03.04; No Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: <http://hdl.handle.net/2060/20070010536>

This presentation addresses the efforts being performed at GRC to develop antenna technology in support of NASA's Exploration Vision. In particular, the presentation discusses the communications architecture asset-specific data services, as well as wide area coverage, high gain, low mass deployable antennas. Phased array antennas as well as electrically small, lightweight, low power, multifunctional antennas will be also discussed.

Author

Antenna Arrays; Antenna Components; Phased Arrays; High Gain

20070010538 NASA Glenn Research Center, Cleveland, OH, USA

Antenna Technology and other Radio Frequency (RF) Communications Activities at the Glenn Research Center in Support of NASA's Exploration Vision

Miranda, Felix A.; January 30, 2007; 53 pp.; In English; Invited Presentation as part of the Distinguished Lecture in Electrical Engineering, The Pennsylvania State University, 30 Jan. 2007, Pennsylvania State College, PA, USA; Original contains color illustrations

Contract(s)/Grant(s): WBS 305311.01.03.03; No Copyright; Avail.: CASI: A04, Hardcopy

ONLINE: <http://hdl.handle.net/2060/20070010538>

NASA's Vision for Space Exploration outlines a very ambitious program for the next several decades of the Space Agency endeavors. Ahead is the completion of the International Space Station (ISS); safely flight the shuttle (STS) until 2010; develop and fly the Crew Exploration Vehicle (Orion) by no later than 2014; return to the moon by no later than 2020; extend human presence across the solar system and beyond; implement a sustainable and affordable human and robotic program; develop supporting innovative technologies, knowledge and infrastructure; and promote international and commercial participation in

exploration. To achieve these goals, a series of enabling technologies must be developed or matured in a timely manner. Some of these technologies are: spacecraft RF technology (e.g., high power sources and large antennas which using surface receive arrays can get up to 1 Gbps from Mars), uplink arraying (reduce reliance on large ground-based antennas and high operation costs; single point of failure; enable greater data-rates or greater effective distance; scalable, evolvable, flexible scheduling), software define radio (i.e., reconfigurable, flexible interoperability allows for in flight updates open architecture; reduces mass, power, volume), and optical communications (high capacity communications with low mass/power required; significantly increases data rates for deep space). This presentation will discuss some of the work being performed at the NASA Glenn Research Center, Cleveland, Ohio, in antenna technology as well as other on-going RF communications efforts.

Author

Antennas; Communication Equipment; Space Exploration; Optical Communication; Radio Frequencies; Radio Communication

20070010539 NASA Glenn Research Center, Cleveland, OH, USA

Steerable Space Fed Lens Array for Low-Cost Adaptive Ground Station Applications

Lee, Richard Q.; Popovic, Zoya; Rondineau, Sebastien; Miranda, Felix A.; [2007]; 4 pp.; In English; IEEE International Symposium on Antennas and Propagation, 10-15 Jun. 2007, Honolulu, HI, USA; Original contains color illustrations

Contract(s)/Grant(s): NAG3-2920; WBS 732759.03.01.02.15; No Copyright; Avail.: CASI: [A01](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20070010539>

The Space Fed Lens Array (SFLA) is an alternative to a phased array antenna that replaces large numbers of expensive solid-state phase shifters with a single spatial feed network. SFLA can be used for multi-beam application where multiple independent beams can be generated simultaneously with a single antenna aperture. Unlike phased array antennas where feed loss increases with array size, feed loss in a lens array with more than 50 elements is nearly independent of the number of elements, a desirable feature for large apertures. In addition, SFLA has lower cost as compared to a phased array at the expense of total volume and complete beam continuity. For ground station applications, both of these tradeoff parameters are not important and can thus be exploited in order to lower the cost of the ground station. In this paper, we report the development and demonstration of a 952-element beam-steerable SFLA intended for use as a low cost ground station for communicating and tracking of a low Earth orbiting satellite. The dynamic beam steering is achieved through switching to different feed-positions of the SFLA via a beam controller.

Author

Antenna Arrays; Ground Stations; Low Cost; Communicating; Beam Steering; Phased Arrays

20070010619 Bruckner (Paul) P.C., Austin, TX, USA

Hybrid Spread Spectrum Radio System

Smith, S. F.; Dress, W. B.; 31 Dec 03; 29 pp.; In English

Contract(s)/Grant(s): DE-AC05-00 OR 22725

Patent Info.: Filed Filed 31 Dec 03; US-Patent-Appl-SN-10-750 432

Report No.(s): PB2007-103161; No Copyright; Avail.: CASI: [A03](#), Hardcopy

Systems and methods are described for hybrid spread spectrum radio systems. A method includes modulating a signal by utilizing a subset of bits from a pseudo-random code generator to control an amplification circuit that provides a gain to the signal. Another method includes: modulating a signal by utilizing a subset of bits from a pseudo-random code generator to control a fast hopping frequency synthesizer; and fast frequency hopping the signal with the fast hopping frequency synthesizer, wherein multiple frequency hops occur within a single data-bit time.

NTIS

Patent Applications; Spread Spectrum Transmission; Radio Transmission; Frequency Synthesizers; Circuits

20070010775 Civil Affairs Group (4th), Washington, DC USA

Multinational Force and Host-Nation Administration in Wartime Iraq, an Inter-ministerial Approach

Ballard, John R; Jan 2005; 21 pp.; In English; Original contains color illustrations

Report No.(s): AD-A462296; XA-4CAG; No Copyright; Avail.: CASI: [A03](#), Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA462296>

Problem or Issue: Modern multinational operations frequently require the integration of coalition, host nation and friendly forces and resources to achieve strategic objectives. Although multinational warfare is not new, some of the processes used during operation Iraqi Freedom were quite innovative particularly those focused on the rebuilding of Iraqi institutions and

cities. The focus of this study is the cooperative construct used by USA and Iraqi governments at the tactical, operational and strategic level to restore essential services and stability in Al Anbar province, Iraq. Relevance to Command and Control: During Iraqi Freedom the First Marine Expeditionary Force employed multinational command relations involving coalition partners and the host nation forces and created cooperative relationships with Iraqi political structures, creating some very complex but workable architectures. These working relationships were critical to success in the restive Al Anbar province and were exemplified during the battle for the city of Fallujah, operation AL FAJR. Approach to the Topic: Using first person interviews and units histories, this study will identify the strengths of the command relationships used during operations in Fallujah, and particularly after the termination of combat. In particular it will illustrate the political relationships formed at the local, provincial and national level to plan and execute the restoration of democracy to the city. Results: The arrangements developed during operation AL FAJR can serve as an example during future military operations where political coordination is particularly crucial.

DTIC

Interoperability; Iraq; Military Operations

20070010777 National Defence Headquarters, Ottawa, Ontario Canada

Command of Coalition Operations in a Multicultural Environment: A Canadian Naval Niche? The Case Study of Operation Apollo

Gimblett, Richard H; Jun 2006; 26 pp.; In English; Original contains color illustrations

Report No.(s): AD-A462300; No Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA462300>

For the better part of two years, from December 2001 until the end of October 2003, senior Canadian naval officers exercised the unique responsibility of commanding a multinational coalition fleet gathered in the Arabian Sea, culminating in command of Task Force 151 (CTF 151). This initial stage of Operation Enduring Freedom (OEF) was known in Canada as Operation Apollo. Key to mission success was effective employment of network-enabled operations (NEOps) technology, as well as attention to a variety of cultural factors. In analyzing the operational level command function, this paper employs the unifying framework of the 'environment-technology-culture' triad, where the three factors of environment (the sea), technology (a major control mechanism for exercising command), and culture (service, organizational, and national) are taken to be the most important factors that impact on naval command styles. It follows with a detailed discussion of each of these factors in the recent Canadian operational context, allowing for the fact that there is some iterative overlap amongst them. The paper concludes that the case study of Operation Apollo demonstrates that the Canadian Navy possesses significant attributes that make coalition naval command a 'niche' role for which it is ideally suited. Eleven briefing charts summarize the presentation.

DTIC

Canada; Command and Control; Military Operations; Military Personnel

20070010782 Naval Research Lab., Washington, DC USA

Algorithms for Energy-Efficient Multicasting in Static Ad Hoc Wireless Networks

Wieselthier, Jeffrey E; Nguyen, Gam D; Ephremides, Anthony; Jan 2001; 14 pp.; In English

Report No.(s): AD-A462310; No Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA462310>

In this paper we address the problem of multicasting in ad hoc wireless networks from the viewpoint of energy efficiency. We discuss the impact of the wireless medium on the multicasting problem and the fundamental trade-offs that arise. We propose and evaluate several algorithms for defining multicast trees for session (or connection-oriented) traffic when transceiver resources are limited. The algorithms select the relay nodes and the corresponding transmission power levels, and achieve different degrees of scalability and performance. We demonstrate that the incorporation of energy considerations into multicast algorithms can, indeed, result in improved energy efficiency.

DTIC

Algorithms; Communication Networks

20070010784 Naval Research Lab., Washington, DC USA

Energy-Efficient Broadcast and Multicast Trees in Wireless Networks

Wieselthier, Jeffrey E; Nguyen, Gam D; Ephremides, Anthony; Jan 2002; 13 pp.; In English

Report No.(s): AD-A462312; No Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA462312>

The wireless networking environment presents formidable challenges to the study of broadcasting and multicasting problems. In this paper we focus on the problem of multicast tree construction, and we introduce and evaluate algorithms for tree construction in infrastructureless, all-wireless applications. The performance metric used to evaluate broadcast and multicast trees is energy-efficiency. We develop the Broadcast Incremental Power (BIP) algorithm, and adapt it to multicast operation by introducing the Multicast Incremental Power (MIP) algorithm. These algorithms exploit the broadcast nature of the wireless communication environment, and address the need for energy-efficient operation. We demonstrate that our algorithms provide better performance than algorithms that have been developed for the link-based, wired environment.

DTIC

Broadcasting; Communication Networks

20070010787 Naval Postgraduate School, Monterey, CA USA

Autonomous vs. Interdependent Structures: Impact on Unpredicted Tasks in a Simulated Joint Task Force Mission

Hocevar, Susan P; Jan 2000; 18 pp.; In English

Report No.(s): AD-A462318; No Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA462318>

This simulation experiment is the latest in a series conducted by the Adaptive Architecture for Command and Control (A2C2) research team. The focus was to evaluate the relative performance to two organizational structures on tasks that varied in terms of complexity and predictability. One structure represented a more traditional, functional form with interdependent nodes. The second structure was derived from computer-modeling to reduce the need for coordination by creating fairly autonomous divisional units. Results from a previous A2C2 experiment suggested that the more autonomous, divisional structure, while outperforming the functional structure in planned mission tasks, could be less effective with complex unpredictable tasks. Organization theory argues that coordination capability is an important factor in an organization's ability to respond to an uncertain and complex environment. The question examined in this research was whether the different degrees of coordination capability developed by these two structures would influence the performance and process outcomes for both predictable and unpredictable tasks. The results show only limited differences in the results for the two structures, though these are in the direction predicted above. However, a more consistent finding suggests that training and improved teamwork processes override structural differences in influencing performance outcomes. Implications to future research and training implications are discussed.

DTIC

Autonomy; Command and Control; Organizations

20070010790 Naval Research Lab., Washington, DC USA

Energy-Efficient Multicasting of Session Traffic in Bandwidth- and Transceiver-Limited Wireless Networks

Wieselthier, Jeffrey E; Nguyen, Gam D; Ephremides, Anthony; Jan 2002; 15 pp.; In English

Report No.(s): AD-A462323; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA462323>

In this paper, we address the impact of resource limitations on the operation and performance of the broadcasting and multicasting schemes developed for infrastructureless wireless networks in our earlier studies. These schemes, which provide energy-efficient operation for source-initiated session traffic, were previously studied without fully accounting for such limitations. We discuss the node-based nature of the all-wireless medium, and demonstrate that improved performance can be obtained when such properties are exploited by networking algorithms. Our broadcast and multicast algorithms involve the joint choice of transmitter power and tree construction, and thus depart from the conventional approach that makes design choices at each layer separately. We indicate how the impact of limited frequency resources can be addressed. Alternative schemes are developed for frequency assignment, and their performance is compared under different levels of traffic load, while also incorporating the impact of limited transceiver resources. The performance results include the comparison of our algorithms to alternative link-based algorithms for broadcasting and multicasting.

DTIC

Bandwidth; Communication Networks; Traffic; Transmitter Receivers

20070010799 Stanford Univ., CA USA

Knowledge as Inventory: Near-Optimizing Knowledge and Power Flows in Edge Organizations (Phase One)

MacKinnon, Douglas J; Jan 2005; 21 pp.; In English; Original contains color illustrations

Report No.(s): AD-A462332; No Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA462332>

This paper reports on Phase I of a two-phase research project to model, simulate and ultimately optimize knowledge flows in Edge organizations. We begin by describing knowledge as a set of discrete yet perishable skills, and consider how these perishable skills flow through organizations in response to demand triggered by environmental changes. We hypothesize that analyzing the stocks and flows of perishable knowledge inventory' in organizations, analogous to analyzing those of perishable physical goods inventory in a supply chain, uncovers useful insights to clarify current understanding and permits initial quantification of knowledge management impacts on organizational performance. We examine differences between knowledge and physical goods, and explore how we can adapt methods for costs of knowledge inventory additions, subtractions, reordering as well as EOQ, holding times, inventory doctrines of Just-In-Case, Just-In-Time, and make vs. buy decisions. The discussion leads to the concept of Knowledge Chain Management (KCM). KCM can provide military and business practitioners with a useful framework for maintaining knowledge (and therefore power) levels; and KCM provides a new theoretical lens to frame future research (including our Phase II research) in terms of knowledge and power flows.

DTIC

Command and Control; Information Management; Optimization; Organizations

20070010812 RAND Corp., Santa Monica, CA USA

Impact of Network Performance on Warfighter Effectiveness Using MANA (Briefing Charts)

Porche, Isaac; Wilson, Brad; Witty, Susan; Jun 15, 2004; 78 pp.; In English; Original contains color illustrations

Report No.(s): AD-A462352; No Copyright; Avail.: CASI: [A05](#), Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA462352>

No abstract available

Charts; Command and Control; Communication Networks; Military Operations; System Effectiveness

20070010873 Naval Research Lab., Washington, DC USA

Progress in Laser Propagation in a Maritime Environment at the Naval Research Laboratory

Gilbreath, G C; Rabinovich, W S; Moore, C I; Burris, H R; Mahon, R; Grant, K J; Goetz, P G; Murphy, J L; Suite, M R; Stell, M F; Swingen, M L; Jan 2005; 10 pp.; In English; Original contains color illustrations

Report No.(s): AD-A462445; No Copyright; Avail.: CASI: [A02](#), Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA462445>

In this paper, we summarize progress in free space laser propagation research at the U.S. Naval Research Laboratory, specifically in the context of propagating and detecting signals through the atmosphere in a maritime environment. Transmission through the atmosphere over large bodies of water presents different challenges than transmission through the atmosphere over land. Our paper reports some of these findings as well as progress in our collaborative efforts to mitigate turbulence to enhance our data links.

DTIC

Lasers; Optical Communication; Progress

20070010875 Naval Research Lab., Washington, DC USA

Steering Compensation for Strong Vertical Refraction Gradients in a Long-Distance Free-Space Optical Communication Link Over Water

Suite, M R; Moore, C I; Burris, H R; Wasiczko, L; Stell, M F; Rabinovich, W S; Scharpf, W J; Gilbreath, G C; Jan 2005; 11 pp.; In English

Report No.(s): AD-A462448; No Copyright; Avail.: CASI: [A03](#), Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA462448>

No abstract available

Communication Networks; Free-Space Optical Communication; Optical Communication; Refraction; Steering; Water

20070010879 Naval Postgraduate School, Monterey, CA USA

Adapting the Vehicle Mounted Tactical Loudspeaker System to Today's Operational Environment

Keiser, Jonathan B; Engen, Mark C; Dec 1, 2006; 71 pp.; In English; Original contains color illustrations

Report No.(s): AD-A462455; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA462455>

From the time they were first used by the USA Army during World War II, loudspeakers have proven to be an effective means for tactical psychological operations (PSYOP) teams to disseminate messages to their intended target audiences. The

vehicle mounted family of loudspeakers (FOL) is the loudspeaker system currently being utilized by tactical psychological operations forces as the primary mobile means of disseminating messages or sound effects to their target audiences. In its current configuration, the vehicle mounted loudspeaker system is not meeting the needs of the tactical PSYOP teams (TPTs) conducting operations in today's operational environment. The objective of our project is to determine why the current loudspeaker system is not meeting the requirements of the TPTs, and provide recommended changes to the current FOL system.

DTIC

Combat; Loudspeakers

20070010939 Naval Research Lab., Washington, DC USA

Techniques and Issues in Multicast Security

Kruus, Peter S; Macker, Joseph P; Jan 1998; 21 pp.; In English; Original contains color illustrations

Report No.(s): AD-A462619; No Copyright; Avail.: CASI: [A03](#), Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA462619>

Multicast networking support is becoming an increasingly important future technology area for both commercial and military distributed and group-based applications. Integrating a multicast security solution involves numerous engineering tradeoffs. The end goal of effective operational performance and scalability over a heterogeneous internetwork is of primary interest for widescale adoption and application of such a capability. Various techniques that have been proposed to support multicast security are discussed and their relative merits are explored.

DTIC

Communication Networks; Security

20070010942 Naval Research Lab., Washington, DC USA

A Survey of Multicast Security Issues and Architectures

Kruus, Peter S; Jan 1998; 14 pp.; In English

Report No.(s): AD-A462625; No Copyright; Avail.: CASI: [A03](#), Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA462625>

This paper addresses issues relevant to implementing security for IP multicast networks. These issues are of importance to application developers wishing to implement security services for their multicast applications. The paper investigates the steps required to create a secure multicast session including issues of group membership and key distribution. A common simple criteria is established that can be used to evaluate multicast keying architectures. The criteria focuses on the efficiency and scalability of the keying solution. Using this criteria, several keying architectures are evaluated and compared to determine their strengths and weaknesses.

DTIC

Communication Networks; Security; Surveys

20070011099 Naval Postgraduate School, Monterey, CA USA

Communication Aspects in Urban Terrain

Pfeiffer, Volker; Dec 2006; 99 pp.; In English; Original contains color illustrations

Report No.(s): AD-A462580; No Copyright; Avail.: CASI: [A05](#), Hardcopy

The nature of warfare has changed dramatically during the last decade. Western armies are increasingly required to conduct complex operations in urban terrain against asymmetric threats. These opponents use cities and their inhabitants for cover and concealment. In such situations, modern equipped armies often cannot fully utilize many of their most powerful weapons. To overcome this situation, modern communication systems are being acquired and deployed to provide real-time reconnaissance; thereby, attempting to neutralize the threat through enhanced situational awareness. This research addresses the potential impacts of communication from airborne sensors on assisting a convoy in finding its way through a hostile city quarter (based on Mazar-E-Sharif, Afghanistan) in which militia forces try to interdict them via street blockades and ambushes. The implementation is done in the agent-based simulation Map Aware Non-Uniform Automata (MANA). The results show that the current MANA version is not sufficiently capable to handle routing problems in urban terrain. Specifically, the movement algorithm is locally greedy and not flexible enough to project into the future as real human decision makers do. Many workarounds were developed to mitigate this limitation. The analysis shows that the number of blockades is the single most important factor in determining the convoy's success. Of the communication factors, network latency has the most

impact. For the convoy to effectively use the information, it needs to get from the sensor to the convoy in 11 seconds.
DTIC

Cities; Telecommunication; Terrain; Warfare

20070011102 Naval Postgraduate School, Monterey, CA USA

Performance Analysis of IEEE 802.11g Receivers With Erasure Decoding to Mitigate the Effects of Pulse-Noise Interference

Zouros, Georgios; Dec 2006; 125 pp.; In English; Original contains color illustrations

Report No.(s): AD-A462584; No Copyright; Avail.: CASI: [A06](#), Hardcopy

The performance of IEEE 802.11g wireless local area network (WLAN) standard receivers when the signal is transmitted over a frequency-selective, slowly fading Nakagami channel in a pulse-noise interference environment when errors-and-erasures Viterbi decoding is used is examined. The different combinations of modulation (both binary and non-binary) and convolutional code rate specified by the WLAN standard are examined. The performance obtained with errors-and-erasures decoding (EED) is compared with the performance obtained with errors-only hard decision Viterbi decoding (HDD) as well as that obtained with soft decision Viterbi decoding (SDD) for binary modulation, while for non-binary modulation, EED performance is compared with HDD performance. It was found that EED can significantly improve performance under some conditions when pulse-noise interference is present.

DTIC

Decoding; Receivers; Reliability Analysis; Wireless Communication

33

ELECTRONICS AND ELECTRICAL ENGINEERING

Includes development, performance, and maintainability of electrical/electronic devices and components; related test equipment; and microelectronics and integrated circuitry. for related information see also *60 Computer Operations and Hardware*; and *76 Solid-State Physics*. For communications equipment and devices see *32 Communications and Radar*.

20070009693 Ladas and Parry, Los Angeles, CA, USA

Reprogrammable Distributed Reference Ladder for Analog-to-Digital Converters

Mokhtari, M.; 3 Feb 04; 12 pp.; In English

Contract(s)/Grant(s): AFRL-F3060-99-C-0022

Patent Info.: Filed Filed 3 Feb 04; US-Patent-Appl-SN-10-772 113

Report No.(s): PB2007-102950; No Copyright; Avail.: CASI: [A03](#), Hardcopy

An analog to digital converter comprises a plurality of comparators, each comparator for comparing an input electrical signal with a respective, pre-selected reference electrical signal, an encoder coupled to the comparators to receive a detection signal from each comparator indicative of the input signal, and a plurality of reference circuits, each reference circuit coupled to a respective one of the plurality of comparators to supply the respective reference electrical signal to the respective comparator.

NTIS

Analog to Digital Converters; Circuits

20070009698 Ladas and Parry, Los Angeles, CA, USA

Apparatus and Method of Interconnecting Nanoscale Programmable Logic Array Clusters

DeHon, A.; 28 Jul 05; 49 pp.; In English

Contract(s)/Grant(s): ONR-N0014-01-0651; ONR-N0014-01-0591

Patent Info.: Filed Filed 28 Jul 05; US-Patent-Appl-SN-11-193-408

Report No.(s): PB2007-101450; No Copyright; Avail.: CASI: [A03](#), Hardcopy

An apparatus and methods for interconnecting a plurality of nanoscale programmable logic array (PLA) clusters are disclosed. The apparatus allows PLA clusters to be built at nanoscale dimensions, signal restoration to occur at the nanoscale, and interconnection between PLA clusters to be performed with nanoscale wiring. The nanoscale PLA, restoration, and interconnect arrangements can be constructed without using lithographic patterning to produce the nanoscale feature sizes and wire pitches. The nanoscale interconnection of the plurality of nanoscale PLA clusters can implement any logic function or any finite state machine. The nanoscale interconnect allows Manhattan (X,Y grid) routing between arbitrary nanoscale PLA

clusters. The methods teach how to interconnect nanoscale PLAs with nanoscale interconnect and how to build arbitrary logic with nanoscale feature sizes without using lithography to pattern the nanoscale features.

NTIS

Logic Circuits; Nanoclusters

20070009701 Honeywell International, Inc., Morristown, NJ, USA

ESD Foam Ground Clip

Sundstrom, L. L.; 24 Mar 05; 14 pp.; In English

Contract(s)/Grant(s): N00030-04-C-0010

Patent Info.: Filed Filed 24 Mar 05; US-Patent-Appl-SN-11-089-184

Report No.(s): PB2007-101452; No Copyright; Avail.: CASI: [A03](#), Hardcopy

Methods and systems are provided for protecting an electronic device from electrostatic discharge when inserting and removing the electronic device from ESD foam. In one embodiment, an ESD foam ground clip is presented. The clip comprises a low-impedance contact and a ground connector adapted to electrically connect the low-impedance contact to an electrical ground.

NTIS

Clips; Electrostatics; Foams

20070009707 Reinhart Boerner Van Deuren S.C., Milwaukee, WI, USA

Organic Light-Emitting Diodes and Methods for Assembly and Enhanced Charge Injection

Marks, T. J.; Huang, Q.; Cui, J.; Veinot, J.; Yan, H.; 14 Mar 03; 38 pp.; In English

Patent Info.: Filed Filed 14 Mar 03; US-Patent-Appl-SN-10-507 751

Report No.(s): PB2007-102786; No Copyright; Avail.: CASI: [A03](#), Hardcopy

New organic light-emitting diodes and related electroluminescent devices and methods for fabrication, using siloxane self-assembly techniques.

NTIS

Diodes; Electroluminescence; Injection; Light Emitting Diodes

20070009709 Sandia National Labs., Livermore, CA, USA

Silicon Micro-Mold

Morales, A. M.; 15 Dec 04; 10 pp.; In English

Contract(s)/Grant(s): DE-AC04-94AL85000

Patent Info.: Filed Filed 15 Dec 04; US-Patent-Appl-SN-11-015 084

Report No.(s): PB2007-102787; No Copyright; Avail.: CASI: [A02](#), Hardcopy

The present invention describes a method for fabricating an x-ray mask tool which can achieve pattern features having lateral dimension of less than 1 micron. The process begins by depositing a conductive metal layer onto one surface of a silicon wafer. A thin photoresist and a standard lithographic mask are then used to transfer an trace image pattern onto the opposite surface of the wafer by exposing and developing the resist. The exposed portion of the silicon substrate is anisotropically etched through the wafer thickness down to conductive metal layer to provide an etched pattern consisting of a series of rectilinear channels and recesses in the silicon which serve as the silicon micro-mold. Microcomponents are prepared with this mold by first filling the mold channels and recesses with a metal deposit, typically by electroplating, and then removing the silicon micro-mold by chemical etching.

NTIS

Fabrication; Fractures (Materials); Masks; Silicon; X Rays

20070009711 Hein (William E.), Loveland, CO, USA

Apparatus and Processes for the Mass Production of Photovoltaic Modules

Barth, K. L.; Enzenroth, R. A.; Sampath, W. S.; 24 Mar 04; 27 pp.; In English

Patent Info.: Filed Filed 24 Mar 04; US-Patent-Appl-SN-10-808 050

Report No.(s): PB2007-102805; No Copyright; Avail.: CASI: [A03](#), Hardcopy

An apparatus and processes for large scale inline manufacturing of CdTe photovoltaic modules in which all steps, including rapid substrate heating, deposition of CdS, deposition of CdTe, CdCl₂ treatment, and ohmic contact formation, are performed within a single vacuum boundary at modest vacuum pressures. A p+ ohmic contact region is formed by

subliming a metal salt onto the CdTe layer. A back electrode is formed by way of a low cost spray process, and module scribing is performed by means of abrasive blasting or mechanical brushing through a mask. The vacuum process apparatus facilitates selective heating of substrates and films, exposure of substrates and films to vapor with minimal vapor leakage, deposition of thin films onto a substrate, and stripping thin films from a substrate. A substrate transport apparatus permits the movement of substrates into and out of vacuum during the thin film deposition processes, while preventing the collection of coatings on the substrate transport apparatus itself.

NTIS

Photovoltaic Cells; Manufacturing; Modules; Equipment

20070009715 Stafford (Thomas P.), Palm Harbor, FL, USA

Optical Digital-to-Analog Converter

Chen, Y. K.; Leven, A.; Tu, K. Y.; 3 Feb 04; 9 pp.; In English

Contract(s)/Grant(s): DARPA-MDA972-03-C-0046

Patent Info.: Filed Filed 3 Feb 04; US-Patent-Appl-SN-10-771 089

Report No.(s): PB2007-102949; No Copyright; Avail.: CASI: [A02](#), Hardcopy

An optical digital-to-analog conversion is realized by employing either a continuous wave or pulsed laser optical signal. The laser optical signal is split into a plurality of mutually coherent optical beams, which are phase shift modulated by bits of a digital data sequence to be converted to an analog signal. The phase shift modulated optical beams are recombined to realize the desired digital-to-analog converted optical signal.

NTIS

Digital to Analog Converters; Waveforms

20070009720 Britt (Trask), Salt Lake City, UT, USA

Electrode Structures, Display Devices Containing the Same

Moradi, B.; Xia, Z. Y.; Zhang, T.; 28 Mar 05; 14 pp.; In English

Contract(s)/Grant(s): ARPA-DABT63-93-C-0025

Patent Info.: Filed Filed 28 Mar 05; US-Patent-Appl-SN-11-091 610

Report No.(s): PB2007-102947; No Copyright; Avail.: CASI: [A03](#), Hardcopy

An electrode structure for a display device comprising a gate electrode proximate to an emitter and a focusing electrode separated from the gate electrode by an insulating layer containing a ridge are provided. When the focusing electrode is an aperture-type electrode, the ridge protrudes closer to the emitter than the sidewall of the gate electrode or the sidewall of the focusing electrode. When the focusing electrode is a concentric-type electrode, the ridge protrudes above the upper surface of the gate electrode or the upper surface of the focusing electrode. A method for making the aperture-type and concentric-type electrode structures is described. A display device containing such electrode structures is also described. By forming an insulating ridge between the gate and focusing electrodes, shorting between the two electrodes is reduced and yield enhancement increased.

NTIS

Display Devices; Electrodes; Gates (Circuits)

20070009721 IsothermalSystems Research, Liberty Lake, WA, USA

Spindle-Motor Driven Pump System

Wos, G. W.; 30 Jan 04; 12 pp.; In English

Contract(s)/Grant(s): DMA-N68335-00-D-0451

Patent Info.: Filed Filed 30 Jan 04; US-Patent-Appl-SN-10-769 037

Report No.(s): PB2007-102944; No Copyright; Avail.: CASI: [A03](#), Hardcopy

The present invention is a compact pump that is powered by a brushless DC spindle-motor, as used in disk drives and CD-ROM drives. A hard drive type spindle-motor is a brushless DC motor that is highly balanced, very reliable, available at low cost, and is capable of significant rotational speeds. According to the present invention, a spindle-motor is mounted to a pump housing and to an impeller within the housing. The spindle-motor rotates the impeller causing movement of a fluid. Preferably for spray cooling, the pump is a turbine pump.

NTIS

Pumps; Spindles

20070009729 Lowenstein Sandler PC, Roseland, NJ, USA

Pattern-Free Method of Making Line Gratings

Russel, W. B.; Chou, S. Y.; Pease, L. F.; Deshpande, P. A.; 29 Sep 04; 19 pp.; In English

Contract(s)/Grant(s): DOD-NDSEG-F46920-99-C-0054; NSF-DMR-0213706

Patent Info.: Filed Filed 29 Sep 04; US-Patent-Appl-SN-10-953 906

Report No.(s): PB2007-102933; No Copyright; Avail.: CASI: [A03](#), Hardcopy

In accordance with the invention, substrate-supported linear arrays are formed by the steps of adhering a thin layer of polymer between a pair of substrates and separating the substrates perpendicular to the layer. The polymer layer separates to form substrate-supported polymer gratings on both substrates, each grating having a period proportional to the thickness of the layer. The process has been used to make gratings with periods in the sub-micron range or larger over areas covering square centimeters.

NTIS

Fabrication; Linear Arrays; Gratings (Spectra)

20070009860 Mitre Corp., McLean, VA USA

DirAc: An Integrated Circuit for Direct Acquisition of the M-Code Signal

Betz, John W; Fite, John D; Capozza, Paul T; Oct 2004; 11 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): FA8721-04-C-0001

Report No.(s): AD-A460256; MITRE-04-0963; No Copyright; Avail.: CASI: [A03](#), Hardcopy

This paper describes the first integrated circuit (IC) designed, fabricated, and tested to perform direct acquisition of the M code signal. This DirAc IC prototype provides direct acquisition capability for test receivers and also demonstrates the feasibility of performing direct acquisition over extended regions of time and frequency uncertainty. The IC is designed and fabricated using 180 nm technology, and has been tested to demonstrate complete functionality and full performance. It uses parallel code matched filters, with FFT-based backend processing to search over 800 Hz of frequency uncertainty and 10 msec of time uncertainty in parallel, using off-chip memory for noncoherent integration. Multiple such timefrequency tiles are searched serially. Inputs are sampled at 2 bits each inphase and quadrature. The DirAc IC supports a maximum integration time (combined coherent and noncoherent integration) of 1.28 seconds, and includes compensation for code Doppler. Coherent integration time up to 10 msec can be used. The DirAc IC's architecture takes advantage of the M-code signal's binary offset carrier (BOC) modulation to reduce acquisition processing complexity. DirAc supports different modes and features of the M-code signal. Hardware is time-shared between inphase and quadrature processing and also between upper and lower sidebands of the BOC modulation. The architecture uses a pipelined design to provide the equivalent processing capability of 3.2 million parallel correlators, performing 2 tera operations per second. Average power consumption in a typical application is less than 1 mW. The IC design and layout process are also described, identifying techniques used to efficiently design and layout the IC. Theoretical predictions are provided for search speed and for the ability to work at different levels of carrier-to-noise density ratio.

DTIC

Integrated Circuits; Fabrication; Signal Processing

20070010441 NASA Glenn Research Center, Cleveland, OH, USA

High-Temperature Characterization of Alumina Substrates and Folded Slot Antenna

Scardelletti, Maximilian C.; Jordan, Jennifer L.; Stalker, Amy R.; Ponchak, George E.; [2007]; 5 pp.; In English; IEEE Antennas and Propagation Symposium, 9-15 Jun. 2007, Honolulu, HI, USA; Original contains color illustrations

Contract(s)/Grant(s): WBS 645846.02.07.03.03.02; No Copyright; Avail.: CASI: [A01](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20070010441>

The characterization of 99.6% polycrystalline alumina substrates and folded slot antennas is presented in this paper. Coplanar Waveguide (CPW) calibration standards were fabricated on 99.6% polycrystalline alumina substrates. Thru-Reflect-Line (TRL) calibrations were performed at temperatures of 25 to 400 C over a frequency range from 0.5 to 50 GHz. The effective dielectric constant of the alumina substrates was determined to be relatively constant at 5.4 from 25 to 200 C and then increased steadily to approximately 6 at 400 C. The loss of the CPW lines increased as temperature and frequency increased as well noting that the increase in loss is even more profound as both the temperature and frequency increased simultaneously. A CPW fed folded slot antenna fabricated on the alumina substrates is also presented. The Return Loss (RL) of a CPW fed folded slot antenna exhibits a self impedance matching technique. The RL of the folded slot antenna at 25 C displays a resonance at 3.5 GHz and is approximately 16 dB in magnitude. At 300 C the resonance shifts down in frequency to approximately 3.3 GHz and has roughly the same magnitude. However the loss of the antenna response also increases at this

elevated temperature. This work is part of the initial stages of an effort at NASA Glenn research Center to develop wireless sensors for harsh environments. This work can reduce cost, space to house all the hard wired connections, and reduce the weight of the overall units such as aerospace engines and allow for the placement of the wireless sensors in the engine which are not possible with hard wired sensors.

Author

Slot Antennas; Polycrystals; Aluminum Oxides; Waveguides; Calibrating; Frequency Ranges; High Temperature; Planar Structures

20070010511 Stanford Linear Accelerator Center, Stanford, CA, USA

Experimental Work with Photonic Band Gap Fiber. Building a Laser Electron Accelerator

Lincoln, M.; Ischebeck, R.; Noble, R.; Siemann, R.; Aug. 01, 2006; 7 pp.; In English

Report No.(s): DE2006-892578; SLAC-PUB-12087; No Copyright; Avail.: National Technical Information Service (NTIS)

In the laser acceleration project E-163 at the Stanford Linear Accelerator Center, work is being done toward building a traveling wave accelerator that uses as its accelerating structure a length of photonic band gap fiber. The small scale of the optical fiber allows radiation at optical wavelengths to be used to provide the necessary accelerating energy. Optical wavelength driving energy in a small structure yields higher accelerating fields. The existence of a speed-of-light accelerating mode in a photonic band gap fiber has been calculated previously (1). This paper presents an overview of several of the experimental challenges posed in the development of the proposed photonic band gap fiber accelerator system.

NTIS

Electron Accelerators; Energy Gaps (Solid State); Lasers; Photonics

20070010512 Stanford Univ., CA, USA, Stanford Univ., CA, USA

Photoelectron Emission Studies in CsBr at 257 nm

Maldonado, J. R.; Liu, Z.; Sun, Y.; Pianetta, P. A.; Pease, F. W.; Sep. 01, 2006; 18 pp.; In English

Report No.(s): DE2006-892595; SLAC-PUB-12109; No Copyright; Avail.: National Technical Information Service (NTIS)

CsBr/Cr photocathodes were found (1,2) to meet the requirements of a multi-electron beam lithography system operating with a light energy of 4.8 eV (257nm). The fact that photoemission was observed with a light energy below the reported 7.3 eV band gap for CsBr was not understood. This paper presents experimental results on the presence of intra-band gap absorption sites (IBAS) in CsBr thin film photo electron emitters, and presents a model based on IBAS to explain the observed photoelectron emission behavior at energies below band gap. A fluorescence band centered at 330 nm with a FWHM of about 0.34 eV was observed in CsBr/Cr samples under 257 nm laser illumination which can be attributed to IBAS and agrees well with previously obtained synchrotron photoelectron spectra(1) from the valence band of CsBr films.

NTIS

Photoelectric Emission; Photoelectrons

20070010523 Schwegman, Lundberg, Woessner and Kluth, P.A., Minneapolis, MN, USA

Electro-Optic Modulation

Lipson, M.; Schmidt, B.; Prahara, S.; Xu, Q.; 3 Mar 06; 28 pp.; In English

Contract(s)/Grant(s): NSF-ECS-0300387; DARPA-2003-IT-674

Patent Info.: Filed Filed 3 Mar 06; US-Patent-Appl-SN-11-367-756

Report No.(s): PB2007-101462; No Copyright; Avail.: CASI: [A03](#), Hardcopy

A silicon electro-optic waveguide modulator is formed using a metal-oxide-semiconductor (MOS) configuration. Various embodiments are described using different modes of operation of the MOS diode and gate oxide thicknesses. In one example, a high-speed submicron waveguide active device is formed using silicon-on-insulator. A micro-ring resonator intensity-modulator exhibits switching times on the order of tens of pS with modulation depth of 73% with a bias voltage of 5 volts.

NTIS

Electro-Optics; Modulation; Modulators; Silicon; Waveguides

20070010526 Humphreys Engineer Center Support Activity, Alexandria, VA, USA

System and Method for Extending the Range of Hard-Wired Electrical Systems

Yankelun, N. E.; 23 Mar 05; 18 pp.; In English

Patent Info.: Filed Filed 23 Mar 05; US-Patent-Appl-SN-11-086-292

Report No.(s): PB2007-101463; No Copyright; Avail.: CASI: [A03](#), Hardcopy

A modification to designs of existing hard-wired electrical and electronic systems that extends the operating reach of these systems or improves signal quality, or both. Conventional hard-wired systems have communicated narrow broadband electrical signals only over electrically conductive media such as copper coaxial cable. A modification to the design using an embodiment of the present invention adds electrical-to-optical and optical-to-electrical transceivers, optical fiber, signal conditions and circulators to existing hard-wired systems to permit transmittal of narrow broadband pulses and FM-CW steps signals over a much longer landline than available for conventional systems. Embodiments of the present invention include sensor systems using RF pulses or FM-CW step signals and time domain reflectometry.

NTIS

Electrical Engineering; Wiring; Systems Engineering; Methodology

20070010555 Delphi Technology Corp., Springfield, NJ, USA

Hybrid Interconnect for a Solid-Oxide Fuel Cell Stack

England, D. M.; Wilson, L.; Mukerjee, S.; Vavonese, C.; 23 Mar 05; 6 pp.; In English

Contract(s)/Grant(s): DE-FC26-02NT41022

Patent Info.: Filed Filed 23 Mar 05; US-Patent-Appl-SN-11-087 904

Report No.(s): PB2007-101486; No Copyright; Avail.: CASI: [A02](#), Hardcopy

An electrical interconnect for a fuel cell assembly comprising a peripheral frame formed of one or more materials having a coefficient of thermal expansion similar to that of adjacent elements to which the interconnect must be bonded and a central portion formed of a corrosion-resistant material for conducting electric current between adjacent fuel cells. Preferably, the central portion is attached to the peripheral frame via a brazed corrugated lap joint for relieving thermal expansion differences between the frame and the central portion. Preferably, the joint includes an interlayer of a ductile material, for example, a nickel, copper, silver or gold layer, which helps to relieve thermal stress between the frame and the central portion.

NTIS

Fuel Cells; Patent Applications; Solid Oxide Fuel Cells

20070010614 Ratnerprestia, Valley Forge, PA, USA

Image Sensor with Deep Well Region and Method of Fabrication the Image Sensor

Janesick, J. R.; Dines, E. L.; Muzilla, M. S.; Staplebrock, M. G.; 28 Oct 04; 18 pp.; In English

Patent Info.: Filed Filed 28 Oct 04; US-Patent-Appl-SN-10-975 299

Report No.(s): PB2007-103156; No Copyright; Avail.: CASI: [A03](#), Hardcopy

An imager, an image sensor included in the imager and a method of fabricating the image sensor are provided. The image sensor having a substrate with front and back sides to produce image data, includes a transparent conductive coating arranged on the back side of the substrate, a first well region of a first conductive type having first and second opposite sides, the first side being arranged adjacent with the front side of the image sensor; and a second well region of a second conductive type, different from the first conductive type and having a deep well region provided adjacent with the second side of the first well region, the transparent conductive coating configured to develop or to receive a first potential and the first well region configured to receive a second potential to substantially deplete a region between the transparent conductive coating and the first well region.

NTIS

Fabrication; Patent Applications

20070010615 Department of the Army, Fort Belvoir, VA, USA

Infrared Device Having and Optical Power Limiter with Improved Optical Gain

Colandene, T. M.; 10 Oct 05; 5 pp.; In English

Patent Info.: Filed Filed 10 Oct 05; US-Patent-Appl-SN-11-031 000

Report No.(s): PB2007-103155; No Copyright; Avail.: CASI: [A01](#), Hardcopy

An infrared device in accordance with the present invention includes an optical train for receiving incident radiation into the device, a focal plane array for receiving the incident radiation from the optical train, and an optical power limiter (OPL) that is positioned therebetween. To improve the overall optical gain for the device, the optical train initially focuses the incident radiation into an intermediate focal plane that is located within the OPL. With this configuration, however, the incident radiation begins to lose focus once it passes through the intermediate focal plane and exits the OPL. To prevent this, the infrared device includes a plurality of microlenses on the OPL surface that is facing the focal plane array. The plurality

of microlenses re-focuses the incident radiation onto a final focal plane that is coincident with the focal plane array.
NTIS

Infrared Radiation; Patent Applications; Power Limiters

20070010616 Hamilton, Brook, Smith and Reynolds, Concord, MA, USA, Kopin Corp., Taunton, MA, USA

Bipolar Transistor with Graded Base Layer

Welser, R. E.; DeLuca, P. M.; Lutz, C. R.; Stevns, K. S.; Pan, N.; 20 Oct 04; 37 pp.; In English

Contract(s)/Grant(s): F33615-99-C-1510

Patent Info.: Filed Filed 20 Oct 04; US-Patent-Appl-SN-10-969 804

Report No.(s): PB2007-103157; No Copyright; Avail.: CASI: [A03](#), Hardcopy

A semiconductor material which has a high carbon dopant concentration includes gallium, indium, arsenic and nitrogen. The disclosed semiconductor materials have a low sheet resistivity because of the high carbon dopant concentrations obtained. The material can be the base layer of gallium arsenide-based heterojunction bipolar transistors and can be lattice-matched to gallium arsenide emitter and/or collector layers by controlling concentrations of indium and nitrogen in the base layer. The base layer can have a graded band gap that is formed by changing the flow rates during deposition of III and V additive elements employed to reduce band gap relative to different III-V elements that represent the bulk of the layer. The flow rates of the III and V additive elements maintain an essentially constant doping-mobility product value during deposition and can be regulated to obtain pre-selected base-emitter voltages at junctions within a resulting transistor.

NTIS

Bipolar Transistors; Carbon; Patent Applications

20070010617 Chicoine (Caroline), Saint Louis, MO, USA

System and Method of Command Signal Conditioning in High Response Systems

Roach, J. M.; Degroote, S. H.; 29 Dec 03; 12 pp.; In English

Contract(s)/Grant(s): MDA 972-99-990003

Patent Info.: Filed Filed 29 Dec 03; US-Patent-Appl-SN-10-748 001

Report No.(s): PB2007-103159; No Copyright; Avail.: CASI: [A03](#), Hardcopy

A system and method of command signal conditioning in high response systems is disclosed. The system includes a central digital controller having a digital controller frame rate, a motor, a motor controller in communication with the digital controller and the motor, the motor controller having a motor controller frame rate higher than the digital controller frame rate, and a signal conditioner adapted to condition the command signal to produce a modified command signal at the motor controller frame rate. The signal conditioner is preferably implemented in software. In one embodiment, the signal conditioner is adapted to calculate a moving average at the frame rate of the motor controller. In another embodiment, the signal conditioner comprises a first order hold and a filter in communication therewith. A method of command signal conditioning in accordance with the foregoing is also disclosed.

NTIS

Patent Applications; Signal Processing; Digital Systems

20070010620 Reinhart, Boerner, Van Deuren S.C., Milwaukee, MI, USA

Coherent States Based Quantum Data Encryption Through Optically Amplified WDM Communication Networks

Kumar, P.; Corndorf, E.; Kanter, G. S.; Liang, C.; 5 Nov 04; 22 pp.; In English

Contract(s)/Grant(s): F30602-01-2-0528

Patent Info.: Filed Filed 5 Nov 04; US-Patent-Appl-SN-10-982 196

Report No.(s): PB2007-103162; No Copyright; Avail.: CASI: [A03](#), Hardcopy

A quantum cryptographic protocol uses two-mode coherent states that is optically amplifiable, resulting in a polarization independent system that is compatible with the existing WDM infrastructure and which provides secure data encryption suitable for wavelength division multiplexing networks through an in-line amplified line.

NTIS

Communication Networks; Cryptography; Patent Applications; Wavelength Division Multiplexing

20070010621 Conte (Francis L.), Swampscott, MA, USA

Deflector Embedded Impingement Baffle

Sayegh, S. D.; Royal, G. W.; Rufo, M.; 26 Dec 03; 10 pp.; In English

Contract(s)/Grant(s): DAAE07-00-C-N086

Patent Info.: Filed Filed 26 Dec 03; US-Patent-Appl-SN-10-746 092

Report No.(s): PB2007-103163; No Copyright; Avail.: CASI: [A02](#), Hardcopy

An impingement baffle includes a perforate plate having a pattern of impingement holes. An imperforate deflector is spaced from the plate and is smaller than the plate for deflecting inlet air around the deflector to the holes. The baffle is disposed between a turbine shroud and supporting hanger, and the deflector is disposed between the hanger and the baffle.

NTIS

Baffles; Deflectors; Embedding; Impingement; Patent Applications

20070010666 California Univ., Lawrence Berkeley National Lab., Berkeley, CA, USA

Quantum Efficiency Characterization of Back-Illuminated CCDs Part 2: Reflectivity Measurements

Fabricius, M. H.; Bebek, C. J.; Groom, D. E.; Karcher, A.; Roe, N. A.; Jan. 19, 2006; 11 pp.; In English

Report No.(s): DE2006-893744; LBNL-59378; No Copyright; Avail.: National Technical Information Service (NTIS)

The usual quantum efficiency (QE) measurement heavily relies on a calibrated photodiode (PD) and the knowledge of the CCDs gain. Either can introduce significant systematic errors. But reflectivity can also be used to verify QE measurements. $1 - R \approx QE$, where R is the reflectivity, and over a significant wavelength range, $1 - R = QE$. An unconventional reflectometer has been developed to make this measurement. R is measured in two steps, using light from the lateral monochromator port via an optical fiber. The beam intensity is measured directly with aPD, then both the PD and CCD are moved so that the optical path length is unchanged and the light reflects once from the CCD; the PD current ratio gives R. Unlike traditional schemes this approach makes only one reflection from the CCD surface. Since the reflectivity of the LBNL CCDs might be as low as 2 percent this increases the signal to noise ratio dramatically. The goal is a 1 percent accuracy. We obtain good agreement between $1 - R$ and the direct QE results.

NTIS

Charge Coupled Devices; Illuminating; Monochromators; Photodiodes; Reflectance

20070010679 Lawrence Livermore National Lab., Livermore, CA, USA, California Univ., Berkeley, CA, USA, Stanford Linear Accelerator Center, Stanford, CA, USA

Proposal for a High-Brightness Pulsed Electron Source

Zolotarev, M.; Commins, E. D.; Heifets, S.; Sannibale, F.; January 2006; 7 pp.; In English

Report No.(s): DE2006-893770; SLAC-PUB-12160; No Copyright; Avail.: National Technical Information Service (NTIS)

We propose a novel scheme for a high-brightness pulsed electron source, which has the potential for many useful applications in electron microscopy, inverse photo-emission, low energy electron scattering experiments, and electron holography. A description of the proposed scheme is presented.

NTIS

Brightness; Electron Sources

20070010712 National Renewable Energy Lab., Golden, CO USA

Battery Thermal Management System Design Modeling

Kim, G. H.; Pesaran, A.; Oct. 28, 2006; 19 pp.; In English

Report No.(s): DE2006-894990; No Copyright; Avail.: National Technical Information Service (NTIS)

Looks at the impact of cooling strategies with air and both direct and indirect liquid cooling for battery thermal management.

NTIS

Electric Batteries; Electric Motor Vehicles; Management Systems; Systems Engineering; Temperature Control

20070010727 Lawrence Livermore National Lab., Livermore, CA USA

Controller Strategy for a 6 DOF Piezoelectric Translation Stage

Buice, E. S.; Yang, H.; Smith, S. T.; Hocken, R. J.; Trumper, D. L.; Mar. 24, 2006; 6 pp.; In English

Report No.(s): DE2006-894344; UCRL-PROC-220093; No Copyright; Avail.: National Technical Information Service (NTIS)

A controller for the third generation, 6 degree-of-freedom (DOF) piezoelectric translation stage shown in this document is presented. This was tested by monitoring all six coordinate motions using an orthogonal array of six, high-resolution capacitance gages. The full 6 DOF matrix transformations and controller block diagrams for this system have been measured and the system operated under closed loop control. Results of early experiments to determine the 21 open loop response functions as well as preliminary results showing the closed loop response for the 3 linear translations are presented in this abstract. The ultimate goal of this project is to incorporate this 6 DOF stage within a long range X-Y scanning system for nanometer pick-and-place capability over an area of 50 x 50 mm. The control strategy and early results from this system will be presented.

NTIS

Controllers; Piezoelectricity; Translating

20070010745 NASA Glenn Research Center, Cleveland, OH, USA

New 5 Kilowatt Free-Piston Stirling Space Convertor Developments

Brandhorst, Henry W.; [2007]; 6 pp.; In English; Space Technology and Applications International Forum (STAIF-2007), University of New Mexico's Institute for Space and Nuclear Power Studies (UNM-ISNPS), 11-14 Feb. 2007, Albuquerque, Mexico; Original contains color illustrations

Contract(s)/Grant(s): WBS 850661.02.99.01.03; No Copyright; Avail.: CASI: [A02](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20070010745>

NASA has recently funded development of a 5 kW (or greater) free-piston Stirling conversion system for reactor power systems. A nominal 5 kW convertor allows two of these units to be dynamically balanced. A group of three dual-convertor combinations would yield the desired 30 kW. The status of this program will be presented. Goals include a specific power in excess of 140 W/kg at the convertor level, lifetime in excess of five years and AC output. The initial step is the design and development of a nominal 5 kW per cylinder Stirling convertor assembly (SCA) which will serve as a prototype of one or more SCAs that will make up the final 30 kW Stirling Convertor Power System. Assumed requirements for this new convertor for lunar fission power systems will be presented. The primary objective of this development effort will be to demonstrate a 5 kW SCA that can be tested to validate the viability of Stirling technology for space fission surface power systems.

Author

Piston Engines; Stirling Cycle; Converters; Electric Power

20070010756 NASA Glenn Research Center, Cleveland, OH, USA

High Power Alternator Test Unit (ATU) Electrical System Test

Birchough, Arthur; Hervol, David; [2007]; 20 pp.; In English; Space Technology and Applications International Forum (STAIF), 11-15 Feb. 2007, USA; Original contains color illustrations

Contract(s)/Grant(s): WBS 463169.04.03; No Copyright; Avail.: CASI: [A03](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20070010756>

The Alternator Test Unit (ATU) in the Lunar Power System Facility (LPSF) located at the NASA Glenn Research Center (GRC) in Cleveland, OH was used to simulate the operating conditions and evaluate the performance of the ATU and its interaction with various LPSF components in accordance with the JIMO AC Power System Requirements. The testing was carried out at the breadboard development level. Results of these tests will be used for the development and validation of analytical models for performance and lifetime prediction.

Author

Electric Power Supplies; AC Generators; Breadboard Models; Performance Prediction

20070010781 Texas Univ., Austin, TX USA

Evaluating Mima-Mac For Dense Urban Environments

Nettles, Scott; Jan 2007; 9 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): FA8750-05-1-0246; DARPA ORDER-U724; Proj-U724

Report No.(s): AD-A462309; No Copyright; Avail.: CASI: [A02](#), Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA462309>

This report focuses on a technique, the mitigating interference using multiple antennas MAC (MIMA-MAC), which uses MIMO to solve a critical problem that occurs in multihop wireless networks. We show that applying MIMO to network level

problems may result in novel uses of the basic technology. The end result is improved communication, especially in dense urban environments.

DTIC

Cities; Communication Networks; Multibeam Antennas; Wireless Communication

20070010794 Naval Research Lab., Washington, DC USA

Circuit-Switched 'Network Capacity' under QoS Constraints

Wieselthier, Jeffrey E; Nguyen, Gam D; Ephremides, Anthony; Sep 2002; 17 pp.; In English; Original contains color illustrations

Report No.(s): AD-A462327; No Copyright; Avail.: CASI: [A03](#), Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA462327>

Usually the network-throughput maximization problem for constant-bit-rate (CBR) circuit-switched traffic is posed for a fixed offered load profile. Then choices of routes and of admission control policies are sought to achieve maximum throughput (usually under QoS constraints). However, similarly to the notion of channel capacity, it is also of interest to determine the network capacity; i.e., for a given network we would like to know the maximum throughput it can deliver (again subject to specified QoS constraints) if the appropriate traffic load is supplied. Thus, in addition to determining routes and admission controls, we would like to specify the vector of offered loads between each source/destination pair that achieves capacity. Since the combined problem of choosing all three parameters (i.e., offered load, admission control, and routing) is too complex to address, we consider here only the optimal determination of offered load for given routing and admission control policies. We provide an off-line algorithm, which is based on Lagrangian techniques that perform robustly in this rigorously formulated nonlinear optimization problem with nonlinear constraints. We demonstrate that significant improvement is obtained, as compared with simple uniform loading schemes, and that fairness mechanisms can be incorporated with little loss in overall throughput.

DTIC

Circuits; Communication Networks; Switching; Switching Circuits

20070010898 Link Simulation and Training, Mesz, AZ USA

The Variability of Spatial Resolution Estimates Obtained Using a CCD Camera

Geri, George A; Caufield, Kristin J; Winterbottom, Marc D; Dec 2006; 11 pp.; In English

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

Report No.(s): AD-A462516; No Copyright; Avail.: CASI: [A03](#), Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA462516>

We have previously developed techniques for measuring the spatial resolution of flight simulator displays. In the present experiment, we estimate the relative variability of the measurement technique and the display projectors they were designed to assess. We use the ratio of the standard deviation and mean of the resolution estimates as a measure of variability. Variability was found to be about 1.3% for grating transparencies illuminated by a stable light source. This value may be taken as the inherent variability of our measurement hardware and analysis procedures. Analogous measurements made on cathode ray tube (CRT) projectors resulted in a mean variability of about 4.3%. The difference between the two estimates, 3.0%, may be taken as a measure of the variability of the CRT projectors alone.

DTIC

Cameras; CCD Cameras; Charge Coupled Devices; Display Devices; Estimates; Resolution; Spatial Resolution; Variability

20070010920 Naval Postgraduate School, Monterey, CA USA

Wirelessly Networked Opportunistic Digital Phased Array: System Analysis and Development of a 2.4 GHz Demonstrator

Yeo, Eng C; Dec 2006; 92 pp.; In English; Original contains color illustrations

Report No.(s): AD-A462570; No Copyright; Avail.: CASI: [A05](#), Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA462570>

The concept of a wirelessly networked opportunistic digital phased array radar brings about the added advantages of stealth, enhanced survivability, and maximum maneuverability. The array elements are spread over a wide range of locations on the ship's hull and superstructure, and the Local Oscillator (LO) and data/control signals are wirelessly transmitted to and from a central computer processor, which also performs as the digital beamformer. As part of the ongoing research effort, this thesis focused on the hardware and software development of a 2.4 GHz two element array demonstrator. A system analysis

of a generic distributed array radar was done and some key parameters pertaining to the Transmit/Receive (T/R) module and an eight-element array radar were calculated. In addition, the research analyzed the radar waveform properties, sampling and data rates, the digital beamformer concept and requirements, and assessed their impacts on the radar performance. Two Transmit/Receive (T/R) modules were built and a two-element array test bench developed using the various National Instruments Compact Reconfigurable Input and Output (cRIO) and Field Programmable Gate Array (FPGA) modules. The main software, written in LabVIEW, allowed the test bench to demonstrate the proper functionalities of transmission and reception of the T/R modules. The hardware and software code could be extended easily for an eight-element array radar. Lastly, a number of measurements to characterize the T/R module were done. No significant interference between the modulator and demodulator boards inside of the compact T/R module chassis was observed.

DTIC

Digital Systems; Phased Arrays; Proving; Systems Analysis

20070010926 Naval Postgraduate School, Monterey, CA USA

Object Oriented Programmable Integrated Circuit (OOPic) Upgrade and Evaluation for Autonomous Ground Vehicle (AGV)

Hoffman, Andrew J; Dec 2006; 61 pp.; In English; Original contains color illustrations

Report No.(s): AD-A462596; No Copyright; Avail.: CASI: [A04](#), Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA462596>

A small, low-power Object-Oriented Programmable integrated circuit microcontroller, was integrated and tested with the architecture for an autonomous ground vehicle (AGV). Sensors with the OOPic, and the XBee Wireless Suite were included in the integration. Tests were conducted, including range and time operation analysis for wireless communications for comparison with the legacy BL2000 microcontroller. Results demonstrated long battery life for the electronics of the robot, as well as communication ranges exceeding high power modems. The OOPic was limited by processing power and an ability to interpret some incoming form data. Consequently its use as a one for one replacement for the BL2000 is limited. However combined use with the BL2000 shows promise as a replacement for sensor monitoring and a hardware substitute for the

DTIC

Autonomous Navigation; Autonomy; Integrated Circuits

20070010941 Clemson Univ., SC USA

Robust Tracking Control for a Piezoelectric Actuator

Salah, M; McIntyre, M; Dawson, D; Wagner, J; Jan 2006; 13 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): CU/CRB/9/14/06/; 1

Report No.(s): AD-A462622; No Copyright; Avail.: CASI: [A03](#), Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA462622>

In this paper, a hysteresis model-based nonlinear robust controller is developed for a piezoelectric actuator, utilizing a Lyapunov-based stability analysis, which ensures that a desired displacement trajectory is accurately tracked. Simulation results are presented and discussed to demonstrate the proof of concept for the proposed robust control strategy.

DTIC

Actuators; Piezoelectric Actuators; Piezoelectric Transducers; Piezoelectricity

20070011129 Delaware Univ., Newark, DE USA

All Electrical Spin Detection in III-V Semiconductors

Appelbaum, Ian R; May 2, 2007; 3 pp.; In English

Contract(s)/Grant(s): N00014-06-1-0039

Report No.(s): AD-A462737; No Copyright; Avail.: CASI: [A01](#), Hardcopy

The project goal, to demonstrate electrical detection of electron spin transport in a semiconductor, has been met. We have achieved a clear spin-valve effect in an in-plane magnetic field and coherent precession and Hanle effect in a perpendicular magnetic field using a silicon spin transport device.

DTIC

Electron Transfer; Semiconductors (Materials)

20070011136 Defence Science and Technology Organisation, Edinburgh, Australia

Parametric Adaptive Matched Filter and its Modified Version

Dong, Yunhan; May 2006; 62 pp.; In English; Original contains color illustrations

Report No.(s): AD-A462747; DSTO-RR-0313; No Copyright; Avail.: CASI: [A04](#), Hardcopy

The parametric adaptive matched filter (PAMF) for space-time adaptive processing (STAP) has been an interesting research area in the airborne radar data processing community over the last decade. Starting from providing a complete formulation of PAMF, this report assesses the performance of PAMF using simulated data as well as real airborne data collected by the Multi-channel Airborne Radar Measurements (MCARM) system with use of results from the conventional STAP as a benchmark. A modified PAMF approach using both forward and backward predictions is proposed to eliminate the dimensionality loss of the method. Finally the operational counts and computational savings of PAMF are also estimated.

DTIC

Adaptive Filters; Matched Filters

20070011192 Naval Research Lab., Washington, DC USA

Multiple Access Covert Channels

Moskowitz, Ira S; Newman, Richard E; Jan 2005; 11 pp.; In English; Original contains color illustrations

Report No.(s): AD-A462824; No Copyright; Avail.: CASI: [A03](#), Hardcopy

In this paper we consider the situation of multiple malicious transmitters attempting to covertly communicate with a single receiver. We show how the situation of non-collaborating transmitters can be modeled by multiple access channels. The simpler situation of collaborating transmitters is used as a bounding result. We also discuss the surprising results of Gaarder and Wolf that feedback can increase capacity unlike the situation for standard covert channel analysis. This is of importance when dealing with the network scenario.

DTIC

Multiple Access; Receivers; Transmitters

20070011217 Pennsylvania State Univ., University Park, PA USA

MEMS Shear Stress Sensor

Jonson, Michael; Haque, Aman; Desai, Amit; Benedict, Samuel; Ziegler, Todd; Dec 21, 2005; 29 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): N00014-05-1-0535; Proj-13069

Report No.(s): AD-A462857; No Copyright; Avail.: CASI: [A03](#), Hardcopy

A micro electro mechanical system (MEMS) was designed, manufactured, and vibrationally tested. The system consisted of a multitude of nearly identical shear stress sensors. The resonant frequency was measured to 57 sensors with a mean frequency of 90.037 KHZ and a standard deviation of 0.297 KHZ. Although attempted in water, only the air measurements were conducted.

DTIC

Microelectromechanical Systems; Sensors; Shear Stress

20070011230 Vista Research, Inc., Sunnyvale, CA USA

Technology Development for a Multi-Mission Passive EO/IR Turret Applied to Maritime Search and Rescue

Moe, George; Jan 22, 2007; 22 pp.; In English

Contract(s)/Grant(s): N68335-06-C-0284; Proj-F132

Report No.(s): AD-A462883; No Copyright; Avail.: CASI: [A03](#), Hardcopy

The objective of this project is to develop polarization and sea foam mitigation techniques and camera components to improve the performance and reduce the form factor of turreted passive multi-spectral imaging systems, with specific application to an existing sensor system known as EPAS, for electro-optic passive ASW system. The work under this contract was focused on the application of this sensor system to Maritime Search and Rescue. The relative merits of the various sensors in the turret for this application were assessed, including the potential for mitigation of sea foam and the potential use of polarization, and a concept of operations that was developed that provides a day-night capability by means of the use of thermal imaging sensors in an optimal geometry coupled with algorithms suitable for real time processing. A plan was developed and proposed to collect data to evaluate target and clutter characteristics and to demonstrate detection performance. Subsequently the existence of data collected in another program was discovered that can be obtained and analyzed under the option tasks. This would obviate the special data collection.

DTIC

Electro-Optics; Rescue Operations

20070011394 NASA Glenn Research Center, Cleveland, OH, USA

Characteristics of a Linearly Tapered Slot Antenna (LTSA) Conformed Longitudinally Around a Cylinder

Jordan, Jennifer L.; Ponchak, George E.; Tavassolian, Negar; Tentzeris, Manos M.; [2007]; 4 pp.; In English; IEEE AP-S International Symposium on Antennas and Propagation, 10-15 Jun. 2006, Honolulu, HI, USA; Original contains color illustrations

Contract(s)/Grant(s): WBS 387625.02.05.03.01; Copyright; Avail.: CASI: [A01](#), Hardcopy

The family of tapered slot antennas (TSA s) is suitable for numerous applications. Their ease of fabrication, wide bandwidth, and high gain make them desirable for military and commercial systems. Fabrication on thin, flexible substrates allows the TSA to be conformed over a given body, such as an aircraft wing or a piece of clothing for wearable networks. Previously, a Double Exponentially Tapered Slot Antenna (DE TSA) was conformed around an exponential curvature, which showed that the main beam skewed towards the direction of curvature. This paper presents a Linearly Tapered Slot Antenna (LTSA) conformed longitudinally around a cylinder. Measured and simulated radiation patterns and the direction of maximum H co-polarization (Hco) as a function of the cylinder radius are presented.

Author

Antenna Radiation Patterns; Curvature; Slot Antennas; Bandwidth; Fabrication; High Gain

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FLUID MECHANICS AND THERMODYNAMICS

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

20070009704 Army Research Development and Engineering Command, Warren, MI USA

Corrosion Preventing Characteristics of Military Hydraulic Fluids

Tebbe, Jill M; Villahermosa, Luis A; Mowery, Ralph B; Jan 2004; 6 pp.; In English; Original contains color illustrations

Report No.(s): AD-A461046; No Copyright; Avail.: CASI: [A02](#), Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA461046>

Hydraulic systems are widely used in a variety of military applications such as aircraft, ground vehicles, and weapon systems. The impact of corrosion on hydraulic systems and its components has been identified but is often not recognized. Project collaboration between the U.S. Army Research Lab, U.S. Army Corrosion Office, and Concurrent Technologies Corporation identified the most critical corrosion issues found in hydraulic systems to be hoses, hose end fittings, actuator arms, pistons, cylinders, and rams.

DTIC

Corrosion; Corrosion Resistance; Hydraulic Fluids; Military Technology

20070009722 California Univ., San Francisco, CA, USA, Lawrence Livermore National Lab., Livermore, CA USA

Boattail Plates with Non-Rectangular Geometries for Reducing Aerodynamic Base Drag of a Bluff Body in Ground Effect

Oretega, J. M.; Salari, K.; 22 Sep 03; 9 pp.; In English

Contract(s)/Grant(s): DE-W-7405-ENG-48

Patent Info.: Filed 22 Sep 03; US-Patent-Appl-SN-10-668 820

Report No.(s): PB2007-102943; No Copyright; Avail.: CASI: [A02](#), Hardcopy

An apparatus for reducing the aerodynamic base drag of a bluff body having a leading end, a trailing end, a top surface, opposing left and right side surfaces, and a base surface at the trailing end substantially normal to a longitudinal centerline of the bluff body, with the base surface joined (1) to the left side surface at a left trailing edge, (2) to the right side surface at a right trailing edge, and (3) to the top surface at a top trailing edge. The apparatus includes left and right vertical boattail plates which are orthogonally attached to the base surface of the bluff body and inwardly offset from the left and right trailing edges, respectively. This produces left and right vertical channels which generate, in a flowstream substantially parallel to the longitudinal centerline, respective left and right vertically-aligned vortical structures, with the left and right vertical boattail plates each having a plate width defined by a rear edge of the plate spaced from the base surface. Each plate also has a peak plate width at a location between top and bottom ends of the plate corresponding to a peak vortex of the respective vertically-aligned vortical structures.

NTIS

Aerodynamic Drag; Base Flow; Bluff Bodies; Boattails; Drag Reduction; Ground Effect (Aerodynamics)

20070009978 National Nuclear Security Administration, Las Vegas, NV, USA

Well Installation Report for Corrective Action Unit 443, Central Nevada Test Area NYE County, Nevada

Jan. 2006; 141 pp.; In English

Report No.(s): DE2006-892463; DOE/NV-1102; No Copyright; Avail.: National Technical Information Service (NTIS)

A Corrective Action Investigation (CAI) was performed in several stages from 1999 to 2003, as set forth in the 'Corrective Action Investigation Plan for the Central Nevada Test Area Subsurface Sites, Corrective Action Unit 443' (DOE/NV, 1999). Groundwater modeling was the primary activity of the CAI. Three phases of modeling were conducted for the Faultless underground nuclear test. The first phase involved the gathering and interpretation of geologic and hydrogeologic data, and inputting the data into a three-dimensional numerical model to depict groundwater flow. The output from the groundwater flow model was used in a transport model to simulate the migration of a radionuclide release (Pohlmann et al., 2000). The second phase of modeling (known as a Data Decision Analysis (DDA)) occurred after NDEP reviewed the first model. This phase was designed to respond to concerns regarding model uncertainty (Pohl and Mihevc, 2000). The third phase of modeling updated the original flow and transport model to incorporate the uncertainty identified in the DDA, and focused the model domain on the region of interest to the transport predictions. This third phase culminated in the calculation of contaminant boundaries for the site (Pohl et al., 2003). Corrective action alternatives were evaluated and an alternative was submitted in the 'Corrective Action Decision Document/Corrective Action Plan for Corrective Action Unit 443: Central Nevada Test Area-Subsurface' (NNSA/NSO, 2004). Based on the results of this evaluation, the preferred alternative for CAU 443 is Proof-of-Concept and Monitoring with Institutional Controls. This alternative was judged to meet all requirements for the technical components evaluated and will control inadvertent exposure to contaminated groundwater at CAU 443.

NTIS

Fluid Flow; Ground Water; Installing; Mathematical Models; Nevada

20070010016 Clarkson Univ., Potsdam, NY, USA

Motion of a Drop on a Solid Surface Due to a Wettability Gradient

Subramanian, R.; Moumen, Nadjoua; McLaughlin, John B.; Langmuir; 2005; Volume 21, pp. 11844-11849; In English

Contract(s)/Grant(s): NAG3-2703; Copyright; Avail.: Other Sources

ONLINE: <http://dx.doi.org/10.1021/la051943i>

The hydrodynamic force experienced by a spherical-cap drop moving on a solid surface is obtained from two approximate analytical solutions and used to predict the quasi-steady speed of the drop in a wettability gradient. One solution is based on approximation of the shape of the drop as a collection of wedges, and the other is based on lubrication theory. Also, asymptotic results from both approximations for small contact angles, as well as an asymptotic result from lubrication theory that is good when the length scale of the drop is large compared with the slip length, are given. The results for the hydrodynamic force also can be used to predict the quasi-steady speed of a drop sliding down an incline.

Author

Gradients; Solid Surfaces; Wettability; Hydrodynamics; Motion; Force Distribution; Drops (Liquids)

20070010027 NASA Glenn Research Center, Cleveland, OH, USA

Thermal Analysis on Cryogenic Liquid Hydrogen Tank on an Unmanned Aerial Vehicle System

Wang, Xiao-Yen; Harpster, George; Hunter, James; January 2007; 19 pp.; In English; 45th Aerospace Sciences Meeting and Exhibit, 8-11 Jan. 2007, Reno, NV, USA; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 931164.03.01.02.01

Report No.(s): NASA/TM-2007-214675; AIAA Paper 2007-1218; E-15811; No Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: <http://hdl.handle.net/2060/20070010027>

Thermal analyses are performed on the liquid hydrogen (LH2) tank designed for an unmanned aerial vehicle (UAV) powered by solar arrays and a regenerative proton-exchange membrane (PEM) fuel cell. A 14-day cruise mission at a 65,000 ft altitude is considered. Thermal analysis provides the thermal loads on the tank system and the boiling-off rates of LH2. Different approaches are being considered to minimize the boiling-off rates of the LH2. It includes an evacuated multilayer insulation (MLI) versus aerogel insulation on the LH2 tank and aluminum versus stainless steel spacer rings between the inner and outer tank. The resulting boil-off rates of LH2 provided by the one-dimensional model and three-dimensional finite element analysis (FEA) on the tank system are presented and compared to validate the results of the three-dimensional FEA. It concludes that heat flux through penetrations by conduction is as significant as that through insulation around the tank. The tank system with MLI insulation and stainless steel spacer rings result in the lowest boiling-off rate of LH2.

Author

Thermal Analysis; Liquid Hydrogen; Cryogenics; Protons; Fuel Cells; Solar Arrays; Multilayer Insulation

20070010437 NASA Glenn Research Center, Cleveland, OH, USA

Modeling of Heat and Mass Transfer in a TEC-Driven Lyophilizer

Yuan, Zeng-Guang; Hegde, Uday; Litwiller, Eric; Flynn, Michael; Fisher, John; July 17, 2006; 6 pp.; In English; 36th International Conference on Environmental Systems, 17-20 Jul. 2006, Norfolk, VA, USA; Original contains color illustrations
Contract(s)/Grant(s): NCC3-975; WBS 516672.04.02.05

Report No.(s): Paper-2006-01-2185; Copyright; Avail.: CASI: [A02](#), Hardcopy

Dewatering of wet waste during space exploration missions is important for crew safety as it stabilizes the waste. It may also be used to recover water and serve as a preconditioning step for waste compaction. A thermoelectric cooler (TEC)-driven lyophilizer is under development at NASA Ames Research Center for this purpose. It has three major components: (i) an evaporator section where water vapor sublimates from the frozen waste, (ii) a condenser section where this water vapor deposits as ice, and (iii) a TEC section which serves as a heat pump to transfer heat from the condenser to the evaporator. This paper analyses the heat and mass transfer processes in the lyophilizer in an effort to understand the ice formation behavior in the condenser. The analysis is supported by experimental observations of ice formation patterns in two different condenser units.

Author

Ice Formation; Dewatering; Thermoelectricity; Water Vapor; Space Exploration; Heat Pumps; Evaporators; Mass Transfer

20070010440 NASA Glenn Research Center, Cleveland, OH, USA

Diffusion Flame Stabilization

Takahashi, Fumiaki; Katta, Viswanath R.; [2007]; 1 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): IH1011219; WBS 519205.02.02.02.02; Copyright; Avail.: CASI: [A01](#), Hardcopy

Diffusion flames are commonly used for industrial burners in furnaces and flares. Oxygen/fuel burners are usually diffusion burners, primarily for safety reasons, to prevent flashback and explosion in a potentially dangerous system. Furthermore, in most fires, condensed materials pyrolyze, vaporize, and burn in air as diffusion flames. As a result of the interaction of a diffusion flame with burner or condensed-fuel surfaces, a quenched space is formed, thus leaving a diffusion flame edge, which plays an important role in flame holding in combustion systems and fire spread through condensed fuels. Despite a long history of jet diffusion flame studies, lifting/blowoff mechanisms have not yet been fully understood, compared to those of premixed flames. In this study, the structure and stability of diffusion flames of gaseous hydrocarbon fuels in coflowing air at normal earth gravity have been investigated experimentally and computationally. Measurements of the critical mean jet velocity (U_{jc}) of methane, ethane, or propane at lifting or blowoff were made as a function of the coflowing air velocity (U_a) using a tube burner (i.d.: 2.87 mm) (Fig. 1, left). By using a computational fluid dynamics code with 33 species and 112 elementary reaction steps, the internal chemical-kinetic structures of the stabilizing region of methane and propane flames were investigated (Fig. 1, right). A peak reactivity spot, i.e., reaction kernel, is formed in the flame stabilizing region due to back-diffusion of heat and radical species against an oxygen-rich incoming flow, thus holding the trailing diffusion flame. The simulated flame base moved downstream under flow conditions close to the measured stability limit.

Author

Diffusion Flames; Computational Fluid Dynamics; Hydrocarbon Fuels; Jet Flow; Methane; Propane; Reaction Kinetics; Stabilization; Ethane

20070010443 NASA Glenn Research Center, Cleveland, OH, USA

Effects of Lewis Number on Temperatures of Spherical Diffusion Flames

Santa, K. J.; Sun, Z.; Chao, B. H.; Sunderland, P. B.; Axelbaum, R. I.; Urban, D. L.; Stocker, D. P.; [2007]; 9 pp.; In English; AIAA 45th Aerospace Sciences Meeting, 8-11 Jan. 2007, Reno, NV, USA

Contract(s)/Grant(s): NCC3-696; NCC3-1912; NAG3-697; NAG3-1910; NNC05AA46A

Report No.(s): AIAA Paper 2007-736; Copyright; Avail.: CASI: [A02](#), Hardcopy

Spherical diffusion flames supported on a porous sphere were studied numerically and experimentally. Experiments were performed in 2.2 s and 5.2 s microgravity facilities. Numerical results were obtained from a Chemkin-based program. The program simulates flow from a porous sphere into a quiescent environment, yields both steady-state and transient results, and accounts for optically thick gas-phase radiation. The low flow velocities and long residence times in these diffusion flames lead to enhanced radiative and diffusive effects. Despite similar adiabatic flame temperatures, the measured and predicted temperatures varied by as much as 700 K. The temperature reduction correlates with flame size but characteristic flow times and, importantly, Lewis number also influence temperature. The numerical results show that the ambient gas Lewis number would have a strong effect on flame temperature if the flames were steady and nonradiating. For example, a 10% decrease in Lewis number would increase the steady-state flame temperature by 200 K. However, for these transient, radiating flames the effect of Lewis number is small. Transient predictions of flame sizes are larger than those observed in microgravity

experiments. Close agreement could not be obtained without either increasing the model's thermal and mass diffusion properties by 30% or reducing mass flow rate by 25%.

Author

Diffusion Flames; Flame Temperature; Lewis Numbers; Mass Flow Rate; Thermal Diffusion; Vapor Phases; Porosity; Flow Velocity

20070010473 Los Alamos National Lab., NM USA

Hydrodynamic and Thermodynamic Models, and Numerical Techniques

Dartevelle, S.; Mar. 2005; 63 pp.; In English

Report No.(s): DE2006-894813; No Copyright; Avail.: Department of Energy Information Bridge

Since the multiphase system is made up of a large number of particles, it is impractical to solve the motion of each individual particle; hence GMFIX v1.61 is based upon the Implicit Multi-Field formalism (IMF) which treats all phases in the system as interpenetrating continua. Each instantaneous local point variable (mass, velocity, temperature, pressure, so forth) must be treated to acknowledge the fact that any given arbitrary volume can be shared by different phases at the same time. This treatment may involve, for instance, an averaging or a smoothing process. The process of deriving a single-phase Navier-Stokes system of equations into a multiphase system is a critical task, particularly when multiphase turbulence must be accounted for. The process upon which GMFIX is built upon is entirely described in Dartevelle (2005a). In a nutshell, Dartevelle (2005a) shows that the most self-consistent, efficient, and practical method to derive a multiphase set of Navier-Stokes Partial Differential Equations (PDEs) which would be fully compatible with different approach of multiphase turbulence is the single-step technique.

NTIS

Hydrodynamics; Thermodynamics

20070010637 Lawrence Livermore National Lab., Livermore, CA USA

Comparison of Dispersion Calculations in Bluff Body Wakes Using LES and Unsteady Rans

Paschkewitz, J. S.; Feb. 01, 2006; 16 pp.; In English

Report No.(s): DE2006-895088; UCRL-TR-218576; No Copyright; Avail.: National Technical Information Service (NTIS)

Accurate modeling of the dispersion behavior of sprays or particles is critical for a variety of problems including combustion, urban pollution or release events, and splash and spray transport around heavy vehicles. Bluff body wakes are particularly challenging since these flows are both highly separated and strongly unsteady. Attempting to model the dispersion of droplets or particles interacting with bluff body wakes is even more difficult since small differences in the flow field encountered by particles can lead to large differences in the dispersion behavior. Particles with finite inertia can exhibit additional complicating effects such as preferential concentration. In this preliminary study, we consider the dispersion of solid particles in the wake of a rectangular plane at a Reynolds number (Re) of 10000 and that of droplets in the wake of a simplified tractor-trailer geometry at $Re = 2 \times 10^6$ using both the Large Eddy Simulation (LES) and Unsteady Reynolds-Averaged Navier-Stokes (URANS) turbulence modeling approaches. The calculations were performed using identical meshes for both the LES and URANS models. Particle stresses are not backcoupled to the carrier fluid velocity solution. In the case of the rectangular plane wake, the LES calculation predicts a finer-scale and more persistent wake structure than the URANS one; the resulting particle dispersion is considerably ((approx) 40%) underpredicted for low inertia particles. For the case of the simplified tractor-trailer geometry, although the LES is underresolved, similar trends are observed with strong differences in the vertical and horizontal dispersion of the smallest particles. These results suggest that it may be necessary to use LES to accurately capture the dispersion behavior of small, low inertia particles or droplets, but that URANS may be sufficient for problems in which only large particles with substantial inertia are of primary concern.

NTIS

Bluff Bodies; Wakes; Large Eddy Simulation; Reynolds Averaging; Unsteady Flow

20070010646 Lawrence Livermore National Lab., Livermore, CA USA

Incorporating Electrokinetic Phenomena Into EBNavierStokes

Trebotich, C. D.; Jan. 11, 2006; 12 pp.; In English

Report No.(s): DE2006-895090; UCRL-TR-218083; No Copyright; Avail.: National Technical Information Service (NTIS)

Motivated by the recent interest in using electrokinetic effects within microfluidic devices, they have extended the EBNavierStokes code to be able to handle electrokinetic effects. With this added functionality, the code becomes more useful for understanding and designing microfluidic devices that take advantage of electrokinetic effects (e.g. pumping and mixing).

Supporting the simulation of electrokinetic effects required three main extensions to the existing code: (1) addition of an electric field solver, (2) development of a module for accurately computing the Smulochowski slip-velocity at fluid-solid boundaries, and (3) extension of the fluid solver to handle nonuniform inhomogeneous Dirichlet boundary conditions. The first and second extensions were needed to compute the electrokinetically generated slip-velocity at fluid-solid boundaries. The third extension made it possible for the fluid flow to be driven by a slip-velocity boundary condition (rather than by a pressure difference between inflow and outflow). In addition, several small changes were made throughout the code to make it compatible with these extensions. This report documents the changes to the EBNavierStokes code required to support the simulation of electrokinetic effects. They begin with a brief overview of the problem of electrokinetically driven flow. Next, they present a detailed description of the changes to the EBNavierStokes code. Finally, they present some preliminary results and discuss future directions and improvements to the code.

NTIS

Electrokinetics; Fluid Flow; Navier-Stokes Equation

20070010682 Japan Aerospace Exploration Agency, Tokyo, Japan

Standard Form of Finite Difference Approximation for Incompressible Navier-Stokes Equations

Kishi, T.; Takahashi, T.; Mar. 2006; 18 pp.; In Japanese

Report No.(s): PB2007-105557; JAXA-RR-05-032; Copyright; Avail.: National Technical Information Service (NTIS)

The purpose of this paper is to formulate the consistency criteria for finite difference approximations for partial differential operators and to determine the standard form of finite difference approximation for incompressible Navier-Stokes equations. If the standard difference approximation is employed as the discrete Laplace operator, then difference approximations for divergence operator $\text{div}(\text{sub } h)$ and gradient operator $\text{grad}(\text{sub } h)$, which are consistent with well-known properties of partial differential operators, are necessarily given by one-sided differencing. It is shown that the standard form of difference approximation for Navier-Stokes equations is reduced to finite differencing of nonlinear terms.

NTIS

Approximation; Differential Equations; Finite Difference Theory; Incompressible Flow; Navier-Stokes Equation; Operators (Mathematics)

20070010765 Sest, Inc., OH, USA

Thermal Performance of High Temperature Titanium -- Water Heat Pipes by Multiple Heat Pipe Manufacturers

Sanzi, James L.; [2007]; 22 pp.; In English; STAIF Conference, 12-15 Feb. 2007, Albuquerque, NM, USA; Original contains color and black and white illustrations

Contract(s)/Grant(s): NNC05BA2B; WBS 463169.04.03; No Copyright; Avail.: CASI: [A03](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20070010765>

Titanium - water heat pipes are being investigated for use in heat rejection systems for lunar and Mars fission surface power systems. Heat pipes provide an efficient and reliable means to transfer heat to a radiator heat rejection system. NASA Glenn Research Center requisitioned nine titanium water heat pipes from three vendors. Each vendor supplied three heat pipes 1.25 cm diameter by 1.1 meter long with each vendor selecting a different wick design. Each of the three heat pipes is slightly different in construction. Additional specifications for the heat pipes included 500 K nominal operating temperature, light weight, and freeze tolerance. The heat pipes were performance tested gravity-aided, in the horizontal position and at elevations against gravity at 450 K and 500 K. Performance of the three heat pipes is compared. The heat pipe data will be used to verify models of heat pipe radiators that will be used in future space exploration missions.

Author

Temperature Effects; Heat Pipes; Titanium; Water; Lunar Surface; Mars Surface; High Temperature; Heat Radiators

20070010848 Cincinnati Univ., OH USA

Independent Stage Control of a Cascade Injector (Postprint)

Meicenheimer, Heidi L; Gutmark, Ephraim J; Carter, Campbell D; Eklund, Dean R; Gruber, Mark R; Hsu, Kuang-Yu; Jul 2005; 17 pp.; In English

Contract(s)/Grant(s): Proj-3012

Report No.(s): AD-A462411; No Copyright; Avail.: CASI: [A03](#), Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA462411>

An experimental investigation of a cascade injector was completed. The objective of this investigation was to determine whether the number of active stages in the cascade injector could be used to control penetration and mixing characteristics.

The injector was tested at two overexpanded injection conditions in a Mach 3 crossflow. Shadowgraph and schlieren imaging, Mie scattering, Planar Laser Induced Fluorescence, and pressure profiling were the diagnostic techniques used to reveal various features of the injectant plume and its interaction with the supersonic crossflow. Results suggest that penetration can be controlled by the number of active stages in the cascade injector. Additional analysis and experiments are planned to better quantify the effects of injector stages revealed in this initial work.

DTIC

Fuel Injection; Injectors; Supersonic Combustion Ramjet Engines

20070011133 Zagreb Univ., Zagreb, Croatia

Internal Tidal Hydrodynamics and Ambient Characteristics of the Adriatic (ITHACA)

Orlic, Mirko; Beg Paklar, Gordana; Dacic, Vlado; Leder, Nenad; Dec 31, 2006; 107 pp.; In English

Contract(s)/Grant(s): N00014-05-1-0698; Proj-05PR08927-00

Report No.(s): AD-A462744; No Copyright; Avail.: CASI: [A06](#), Hardcopy

Field phase of the ITHACA project has been carried out between February and September 2006. During the experiment (1) meteorological conditions were documented by permanent stations in the area (Split-Marjan, Dubrovnik, Komiza, Hvar and Palagruza); (2) optical surveys were performed twice at stations Bisevo, Susac and Lastovo; (3) shipboard CTD surveys were carried out on four occasions at an along-basin transect comprising 13 closely spaced stations; (4) thermistor data were collected on the islands of Bisevo, Susac and Lastovo utilizing 3 x 10 sensors deployed on steep cliffs opened to the southeast; (5) ADCP measurements were performed at three stations using trawl-resistant bottom mounts (called barnys); and (6) surface tides were monitored at the permanent Split and Dubrovnik stations and at one of the ADCP stations. The project was successful, as all the instruments were recovered except one of the thermistors. Preliminary analysis of the data collected has shown that diurnal temperature oscillations were particularly strong at one of the islands (Lastovo) and that corresponding baroclinic current variability was largest at a nearby ADCP station. Apparently, the diurnal signal was related not only to internal tides but also to periodic upwelling and downwelling events that were especially pronounced in July 2006. Inertial oscillations were also well visible in both the temperature and ADCP time series. Lower frequencies were dominated by the east-coast inflow to the Adriatic, which, however, underwent a summertime change recorded in July 2006 at two of the ADCP stations, between May and July 2006 at one station.

DTIC

Adriatic Sea; Hydrodynamics; Internal Waves; Meteorological Parameters; Oceans; Tides

20070011239 Michigan Univ., Ann Arbor, MI USA

Velocity Slip and Temperature Jump in Hypersonic Aerothermodynamics

Lofthouse, Andrew J; Jan 11, 2007; 25 pp.; In English

Contract(s)/Grant(s): FA9550-05-1-0115

Report No.(s): AD-A462892; CI07-0013; No Copyright; Avail.: CASI: [A03](#), Hardcopy

Hypersonic vehicles experience different flow regimes during flight due to changes in atmospheric density. Computational Fluid Dynamics (CFD), while relatively computationally inexpensive, are not physically accurate in areas of highly non-equilibrium flows. The direct simulation Monte Carlo (DSMC) method, while physically accurate for all flow regimes, is relatively computationally expensive. A breakdown parameter can be used to determine where in the flow domain the CFD methods are valid. The current study investigates the effect of continuum breakdown on surface aerothermodynamic properties (pressure, shear stress and heat transfer rate) of a cylinder in Mach 10 and Mach 25 flows of argon gas for several different flow regimes, from the continuum to a rarefied gas. Several different velocity slip and temperature jump boundary conditions are examined for use with the CFD method. CFD and DSMC solutions are obtained at each condition. Total drag and peak heat transfer rate predictions by CFD remains within about 6% of the DSMC predictions for all regimes considered, with the generalized slip condition proposed by Gokcen giving the best results.

DTIC

Aerothermodynamics; Computational Fluid Dynamics; Hypersonics

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*.

20070009640 Air Force Research Lab., Wright-Patterson AFB, OH USA

The Dual-Radar Software Development Facility as a Case Study of Interoperability

Satterthwaite, Charles P; Miyahara, Gary K; Jan 2000; 13 pp.; In English; Original contains color illustrations

Report No.(s): AD-A461121; No Copyright; Avail.: CASI: [A03](#), Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA461121>

The Dual-radar Software Development Facility Project is an example of the collaborative efforts required between an Air Force System Program Office, a Air Force Logistics Center, the Air Force Research Laboratory, the Air Force Special Operations Command, The Contractor Raytheon, and the Contractor Boeing to provide a common (interoperable) embedded information support environment for multiple weapon systems. This paper will provide a case study of the multiple programs (along with their associated histories) leading up to the realization of the Dual-radar Software Development Facility. The Dual-radar Software Development Facility supports the radar software for both F-15 APG-70 and AC-130U Gunship APQ-180 Radars. The provision of a common support environment was proven feasible because the APQ-180 radar is a derivative radar of the APG-70, with several common components. The DrSDF program followed the Advanced Avionics Multi-Radar Software Support System (I & II) that first provided a feasibility study, and then provided the preliminary engineering designs for the DrSDF.

DTIC

Computer Programming; Interoperability; Radar; Software Engineering

20070009656 Optical Sciences Corp., Huntsville, AL USA

Cold Background, Flight Motion Simulator Mounted, Infrared Scene Projectors Developed for use in AMRDEC Hardware-in-the-Loop

Beasley, D B; Bender, Matt; Cantey, Thomas M; Messer, Tim; Saylor, Daniel A; Buford, Jim; Jan 2004; 12 pp.; In English; Original contains color illustrations

Report No.(s): AD-A461382; No Copyright; Avail.: CASI: [A03](#), Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA461382>

This paper will present the results and progress of AMRDEC's development of two cold background flight motion simulator (FMS) mountable, emitter array based infrared scene projectors for use in hardware-in-the-loop systems simulation. The goal for this development is the ability to simulate realistic low temperature backgrounds for windowed/domed seekers operating in tactical and exo-atmospheric simulations. Two projectors have been simultaneously developed; the first represents a streamlined pathfinder version consisting of a Honeywell emitter array and refractive optical system contained within an FMS-mountable environmental chamber cooled to -55 degrees Celsius. The second system is the full-capability version including a cryogenically operated BRITE II emitter array, zoom optics, integrated steerable point source and high-frequency jitter mirror contained within a similar FMS- mountable environmental chamber. This system provides a full-FOV cold background. two-dimensional dynamic IR scene projection, a high dynamic range independently steerable point source and combined optical path high frequency jitter control. Both projectors are designed to be compatible with operation on a 5 axis electric motor driven Carco flight motion simulator. Results presented will include design specifications, optical performance, sample imagery, apparent temperature and proposed future improvements.

DTIC

Flight Simulators; Infrared Instruments; Infrared Radiation; Motion Simulators; Photographs; Projectors

20070009775 Indigo Systems Corp., Santa Barbara, CA USA

Use of a Miniature Infrared COTS Sensor in Several Military Applications

Kostrzewa, Joseph; Meyer, William; Terre, William; Laband, Stan; Newsome, Gwendolyn; Jan 2002; 10 pp.; In English; Original contains color illustrations

Report No.(s): AD-A461317; No Copyright; Avail.: CASI: [A02](#), Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA461317>

The proliferation of small infrared cameras in high-volume commercial applications (e.g. fire fighting, law-enforcement, and automotive) presents a tremendous opportunity for truly low-cost military micro-sensors. Indigo Systems Corporation's

UL3 Omega(trademark) camera is a commercial off-the-shelf (COTS) thermal imager that offers ultra-small size (3.5 cubic inch), light weight (102g), and low power (1.3 W). It employs a 164x120 microbolometer focal plane array (FPA) and is currently entering full-scale production. Furthermore, a 324x240 upgrade is in development. While aimed primarily at the commercial market, small size and low-power consumption make UL3 well-suited for other applications, including miniature unmanned aerial vehicles (UAVs) weapon-sights, and unattended ground sensors (UGS). This paper focuses on the key features of the UL3 family of miniature IR cameras and their utility in soldier systems.

DTIC

Cameras; Electric Equipment; Infrared Detectors; Infrared Radiation; Military Technology; Miniaturization

20070009776 Indigo Systems Corp., Santa Barbara, CA USA

Overview of the UL3 Omega(Trademark) Uncooled Camera and its Applications

Kostrzewa, Joseph; Meyer, William; Terre, William; Kraemer, Doug; Poe, George; Nguyen, Vu; Brown, Mark; Newsome, Gwendolyn; Jan 2002; 8 pp.; In English; Original contains color illustrations

Report No.(s): AD-A461318; No Copyright; Avail.: CASI: [A02](#), Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA461318>

When it was first introduced two years ago, Indigo Systems Corporation's UL3 Alpha(trademark), a miniature uncooled infrared camera, set new standards for ultra-low size, weight and power within the thermal imaging industry. Now Omega(trademark), the next generation in Indigo's UL3 product line, takes advantage of novel algorithms and packaging concepts to further reduce size, weight, and power while still improving performance. These qualities make Omega(tm) an ideal candidate for many commercial and military applications, including fire-fighting, law enforcement, industrial inspection, remote surveillance, miniature unmanned aerial vehicles (UAVs), unmanned ground vehicles (UGV), and numerous other possibilities. This paper describes the design, performance and salient features of the Omega(tm) camera. Current and future applications of the UL3 product line are also discussed.

DTIC

Cameras; Electric Equipment; Infrared Radiation; Miniaturization

20070010494 NASA Stennis Space Center, Stennis Space Center, MS, USA, Science Systems and Applications, Inc., Bay Saint Louis, MS, USA

System Characterization Results for the QuickBird Sensor

Holekamp, Kara; Ross, Kenton; Blonski, Slawomir; [2007]; 1 pp.; In English

Contract(s)/Grant(s): NNS04AB54T

Report No.(s): SSTI-2220-0097; No Copyright; Avail.: Other Sources; Abstract Only

An overall system characterization was performed on several DigitalGlobe# QuickBird image products by the NASA Applied Research & Technology Project Office (formerly the Applied Sciences Directorate) at the John C. Stennis Space Center. This system characterization incorporated geospatial accuracy assessments, a spatial resolution assessment, and a radiometric calibration assessment. Geospatial assessments of standard georeferenced multispectral products were obtained using an array of accurately surveyed geodetic targets evenly spaced throughout a scene. Geospatial accuracy was calculated in terms of circular error. Spatial resolution of QuickBird panchromatic imagery was characterized based on edge response measurements using edge targets and the tilted-edge technique. Relative edge response was estimated as a geometric mean of normalized edge response differences measured in two directions of image pixels at points distanced from the edge by -0.5 and 0.5 of ground sample distance. A reflectance-based vicarious calibration approach, based on ground-based measurements and radiative transfer calculations, was used to estimate at-sensor radiance. These values were compared to those measured by the sensor to determine the sensor's radiometric accuracy. All imagery analyzed was acquired between fall 2005 and spring 2006. These characterization results were compared to previous years' results to identify any temporal drifts or trends.

Author

Spatial Resolution; Accuracy; Radiometric Resolution; Calibrating; Geodesy; Targets

20070010648 NASA Stennis Space Center, Stennis Space Center, MS, USA, Science Systems and Applications, Inc., Bay Saint Louis, MS, USA

SSC Geospatial Assessment of an AWiFS Image Orthorectified Product

Kenton, Ross; Stubbs, Ruby; [2007]; 29 pp.; In English

Contract(s)/Grant(s): NNS04AB54T

Report No.(s): SSTI-2220-0098; No Copyright; Avail.: CASI: [A03](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20070010648>

The geositional accuracy of an AWiFS (Advanced Wide Field Sensor) orthorectified product was evaluated. Specifically, the image products were acquired by the Indian Remote Sensing Resourcesat-1 satellite, then orthorectified by GeoEye . Analysis was performed using DOQs (digital orthophoto quadrangles) and other reference sources of similar accuracy. A total of six AWiFS images were characterized. These images were acquired over the continental USA from June through September 2005. The images were equally divided between the two AWiFS cameras. Forty to fifty check points were collected manually per scene and analyzed to determine overall circular error, estimates of horizontal bias, and other systematic errors.

Author

Remote Sensing; Cameras; Systematic Errors; Error Analysis

20070010770 Naval Research Lab., Washington, DC USA

Spatial Resolution and Imaging of Gamma-Rays with Germanium Strip Detectors

Kroeger, R A; Johnson, W N; Kinzer, R L; Kurfess, J D; Inderhees, S E; Phlips, B; Gehrels, N; Graham, B; Jan 1995; 9 pp.; In English

Report No.(s): AD-A462288; No Copyright; Avail.: CASI: [A02](#), Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA462288>

No abstract available

Detectors; Gamma Rays; Germanium; Imaging Techniques; Spatial Resolution

20070010822 Naval Postgraduate School, Monterey, CA USA

Doppler-Only Synthetic Aperture Radar

Chua, Cheng Lock C; Dec 2006; 87 pp.; In English; Original contains color illustrations

Report No.(s): AD-A462367; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA462367>

SAR has traditionally been performed using high-range resolution data. This thesis is a proof-of-concept that the imaging process can be performed using high-doppler resolution data. The system requires a simple continuous wave transmitter, and the signal returns are confined to a narrow band. High-doppler resolution data is collected along an isodoppler line for different perspectives of the target. This data, a sinogram, is equivalent to taking the Radon transform of the target. The Fourier transform of the sinogram from each perspective (at an angle) gives a slice of the two-dimensional transform subtending an angle with the axis, with equally distributed points along the line. This results in a higher density of points near the centre. Some form of weighting is necessary. This weighting is part of the Filtered Backprojection algorithm to determine the Inverse Radon transform of the sinogram. The backprojection portion is a simple redistribution of data back along the original projection line. Images were modeled by delta functions to test the above algorithm. The main points noted were that the reconstructed image was a scaled version of the original image, and that the quality of the image improved when more perspectives of the target were taken.

DTIC

Doppler Radar; High Resolution; Imaging Techniques; Synthetic Aperture Radar

20070010907 Massachusetts Univ., Lowell, MA USA

VHF/UHF Imagery of Targets, Decoys, and Trees

Gatesman, A J; Beaudoin, C; Giles, R; Waldman, J; Poirier, J L; Ding, K H; Franchi, P; Tichovolsky, E J; Weijer, B; Nixon, W; Oct 2002; 20 pp.; In English; Original contains color illustrations

Report No.(s): AD-A462543; No Copyright; Avail.: CASI: [A03](#), Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA462543>

No abstract available

Continuous Wave Radar; Decoys; Detection; High Frequencies; Image Processing; Imagery; Radar Imagery; Synthetic Aperture Radar; Target Acquisition; Targets; Ultrahigh Frequencies; Very High Frequencies

20070010946 Naval Postgraduate School, Monterey, CA USA

Fusion of Night Vision and Thermal Images

Neo, Tiong T; Dec 2006; 133 pp.; In English; Original contains color illustrations

Report No.(s): AD-A462662; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA462662>

Night vision and thermal images are extensively used in military operations, as they help in mission planning and executions tasks. Image fusion effectively combines information present in each type of image. This research explored two wavelet-based image fusion approaches for night vision and thermal images; namely wavelet transform fusion and region-based fusion. Morphological methods designed to improve the image segmentation step were considered to improve image contrast and a global image quality index was applied to investigate the information content improvement resulting from the fusion process. Finally, a MATLAB-based graphical user interface was designed to assist the user in evaluating the benefits of the fusion process. Results showed the selection process is able to narrow to the best fused image with a satisfactory accuracy.

DTIC

Multisensor Fusion; Night Vision; Thermal Mapping

20070011114 Massachusetts Univ., Lowell, MA USA

VHF/UHF Radar Signatures of Foliage-Obscured Threat Military Vehicles

Gatesman, A J; Testorf, M; Beaudoin, C; Fiddy, M; Giles, R; Waldman, J; Ding, K; Poirier, J; Nixon, W; Nov 2001; 15 pp.; In English; Original contains color illustrations

Report No.(s): AD-A462711; No Copyright; Avail.: CASI: [A03](#), Hardcopy

No abstract available

Foliage; High Frequencies; Image Processing; Radar Imagery; Radar Signatures; Ultrahigh Frequencies; Very High Frequencies

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*.

20070010699 NASA Glenn Research Center, Cleveland, OH, USA

A Small Angle Scattering Sensor System for the Characterization of Combustion Generated Particulate

Feikema, Douglas A.; Kim, W.; Sivathanu, Yudaya; [2007]; 14 pp.; In English; 45th Aerospace Sciences Meeting and Exhibit, 8-11 Jan. 2007, Reno, NV, USA

Contract(s)/Grant(s): NNC04AA40A; 732759.03.01.02.21; Copyright; Avail.: CASI: [A03](#), Hardcopy

One of the critical issues for the US space program is fire safety of the space station and future launch vehicles. A detailed understanding of the scattering signatures of particulate is essential for the development of a false alarm free fire detection system. This paper describes advanced optical instrumentation developed and applied for fire detection. The system is being designed to determine four important physical properties of disperse fractal aggregates and particulates including size distribution, number density, refractive indices, and fractal dimension. Combustion generated particulate are the primary detection target; however, in order to discriminate from other particulate, non-combustion generated particles should also be characterized. The angular scattering signature is measured and analyzed using two photon optical laser scattering. The Rayleigh-Debye-Gans (R-D-G) scattering theory for disperse fractal aggregates is utilized. The system consists of a pulsed laser module, detection module and data acquisition system and software to analyze the signals. The theory and applications are described.

Author

Combustion; Particulates; Sensors; Characterization; Lasers; Light Scattering

20070010793 Photonic Systems, Inc., Billerica, MA USA

Low-Cost, High-Performance Analog Optical Links

Prince, Joelle; Burns, William; Ackerman, Edward; Cox, Charles; Roussell, Harold; Makrides, Frank; Regan, Michael; Dec 2006; 120 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): F30602-00-C-0128; Proj-J811

Report No.(s): AD-A462326; No Copyright; Avail.: CASI: [A06](#), Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA462326>

Photonic Systems, Inc. pursued the goal stated in the RF Lightwave Integrate Circuits' (RFLIC's) BAA ('...achieving a Vpi in the range of 0.1 to 0.5 Volts [to enable a link having] zero RF insertion loss with 1 - 10 mW of optical power available

from conventional laser diode sources') on two parallel development paths. Collaborating with Sarnoff Corporation, Photonic Systems developed a Bipolar Cascade Laser that achieved a slope efficiency of 0.5 W/A by forcing the link's input RF signal to feed a series-connected succession of multiple laser junctions whose optical outputs are collected in parallel to illuminate the link's single photodetector. Additionally, Photonic Systems developed a Broad Bandwidth Resonant Modulator, in which two low-loss optical resonators act as a lever to reduce the effective V_{pi} by 25% for a $V_{pi}=2.7V$ of the interferometric optical intensity modulator process relative to the V_{pi} of the optical phase modulator embedded within the two resonators.

DTIC

Analog Data; Fiber Optics; Low Cost; Semiconductor Lasers; Systems Engineering

20070010889 Link Simulation and Training, Mesz, AZ USA

Brightness and Spatial Resolution of a Prototype, Green-Laser Projector Measured for Various Display Screens and Image Sizes

Geri, George A; Winterbottom, Marc D; Dec 2006; 11 pp.; In English

Contract(s)/Grant(s): F-41624-97-D-5000; Proj-1123

Report No.(s): AD-A462491; No Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA462491>

Laser light has many unique characteristics, such as coherence and speckle, and in addition, the individual pixels formed by the raster structure of a laser projector have very little persistence. As a result, there is some question as to whether the luminance of laser-projector imagery can be measured accurately, and whether that imagery will appear the same as more conventional imagery of the same luminance. In a preliminary attempt to address these questions, we have measured the luminance of a cathode ray tube (CRT) and a laser projector and have directly compared their measured luminance and perceived brightness. There were no apparent difficulties or complications in measuring the luminance of the laser projector using a standard spotmeter. However, a laser-projector image judged to have the same brightness as a CRT image had a measured luminance that was about 14% less. Thus, the limited and preliminary data reported here indicate that a laser image of the same luminance appears slightly brighter than that of a CRT. There were some differences between the CRT and laser measurements made with a spotmeter and with a CCD photometer. Although the differences were relatively small for display luminances less than about 5 fL, this issue should be addressed further with future versions of the laser projector. There appears to be a real difference in the spatial resolution measured at the center and edge of imagery projected onto the three screen tested. However, given the variability of the measurements, there is no clear evidence of significant differences among the three screens tested in center-to-edge spatial resolution. The relatively small (5.5% overall) reduction in spatial resolution as projected image size was reduced represents an apparent advantage of the laser projector over other displays. Further data are needed, however, to determine if this reduction in spatial resolution is significantly greater at the edge of the image.

DTIC

Brightness; Laser Applications; Lasers; Projectors; Prototypes; Spatial Resolution

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*.

20070009644 Army Night Vision and Electronic Sensors Directorate, Fort Belvoir, VA USA

Tractor Accessorized Zerriest Series II (TAZ II) Capabilities Demonstration September 10-11 and October 2-3, 2001

Jan 2002; 18 pp.; In English; Original contains color illustrations

Report No.(s): AD-A461838; No Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA461838>

The USA Department of State estimates that 80-110 million mines litter the world, the majority of which were deployed during the last 15 years. Several efforts are underway that address the current land mine problem. The USA established the Demining Assistance Program to initiate research and development into cost-effective demining techniques. The Department of Defense Humanitarian Demining Research and Development Program at Night Vision and Electronic Sensors Directorate (NVESD), Fort Belvoir, VA is tasked with executing this program. In one response to this tasking, commercial companies were invited to provide a capabilities demonstration of their mechanical equipment that can suitably address either one or both of the mine and/or the vegetation problems in Humanitarian demining operations. The purpose of this system capabilities

demonstration was to obtain information on non-developmental Mechanical Mine and/or Vegetation Clearing Systems that can demonstrate some or all of the following capabilities. 1) Support a variety of interchangeable tools capable of performing the diverse tasks involved with working in landmine suspect areas, i.e., mulchers, sifters, grinders, rakes, etc. 2) Clear a minimum of 200m²/hour of light to medium vegetation and cut 10cm diameter trees and brush. 3) Be capable of on-road and off-road operations in all types of weather and terrain. 4) Be capable of self-transport (less attachment) for distances less than 30km without destroying roads or bridges. 5) Be capable of destroying or removing landmines by grinding, sifting, raking, flailing, etc. 6) The system must be transportable, reliable, maintainable, and logistically supportable in third world mine affected countries. 7) Demonstrate the feasibility of protecting the system and operator, if applicable, with applique armor to withstand a blast equivalent to a .56kg (TNT) bounding fragmentation mine at 2 meters.

DTIC

Cutting; Tracked Vehicles; Tractors; Vegetation

20070009646 Army Night Vision and Electronic Sensors Directorate, Fort Belvoir, VA USA

Development and Test of the Humanitarian Demining Sifting Excavator

Wanner, Christopher; Oct 2003; 62 pp.; In English; Original contains color illustrations

Report No.(s): AD-A461839; No Copyright; Avail.: CASI: A04, Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA461839>

The Humanitarian Demining Sifting Excavator has been developed to address the problem of finding and clearing deeply buried, mixed minefields. The motivation for the development came from a 2002 site assessment by the team of an existing mine problem in Honduras. Areas were identified containing both antipersonnel and antitank land mines buried up to 0.5 meters in mineralized soils. Conventional mine clearing techniques employed in the areas of interest had uncovered widespread evidence of these deeply buried mines, however, these techniques were unreliable for consistently finding mines buried at these depths. The Sifting Excavator was proposed and chosen as the best equipment and approach for addressing these mines. It is a multi-tooled, excavator based system for safely excavating and sifting land mines from soil. A compressed, two phase field test program was designed to run concurrently with the equipment development in order to allow the development of operational techniques and provide proof of principle testing even as the equipment was being fabricated. The equipment development and test program were conducted between June and September of 2003.

DTIC

Clearances; Excavation

20070009648 Army Night Vision and Electronic Sensors Directorate, Fort Belvoir, VA USA

All-Purpose Remote Transport System (ARTS). Capabilities Demonstration, 24-26 September 2001

Feb 2002; 20 pp.; In English; Original contains color illustrations

Report No.(s): AD-A461841; No Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA461841>

The Department of State estimates that 80-110 million mines litter the world, the majority of which were deployed during the last 15 years. Several efforts are underway that address the current land mine problem. The USA established the Demining Assistance Program to initiate research and development into cost effective demining techniques. The Department of Defense Humanitarian Demining Research and Development Program at Night Vision and Electronic Sensors Directorate (NVESD), Fort Belvoir, VA is tasked with executing this program. In one response to this tasking, commercial companies were invited to provide a capabilities demonstration of their mechanical equipment that can suitably address either one or both of the mine and/or the vegetation problems in humanitarian demining operations. The purpose of this system capabilities demonstration was to obtain information on non-developmental Mechanical Mine and/or Vegetation Clearing Systems that can demonstrate some or all of the following capabilities. 1) Support a variety of interchangeable tools capable of performing the diverse tasks involved with working in landmine suspect areas, i.e., mulchers, sifters, grinders, rakes, etc. 2) Clear a minimum of 200m²/hour of light to medium vegetation and cut 10cm diameter trees and brush. 3) Be capable of on-road and off-road operations in all types of weather and terrain. 4) Be capable of self-transport (less attachment) for distances less than 30km without destroying roads or bridges. 5) Be capable of destroying or removing landmines by grinding, sifting, raking, flailing, etc. 6) The system must be transportable, reliable, maintainable, and logistically supportable in third world mine affected countries. 7) Demonstrate the feasibility of protecting the system and operator, if applicable, with applique armor to withstand a blast equivalent to a .56kg (TNT) bounding fragmentation mine at 2 meters.

DTIC

Cutting; Remote Control; Tractors; Vegetation

20070009650 Army Night Vision and Electronic Sensors Directorate, Fort Belvoir, VA USA

Aardvark Mark IV Joint Services Flail Unit (MKIV) Capabilities Demonstration 1-10 October 2001

Jan 2002; 20 pp.; In English; Original contains color illustrations

Report No.(s): AD-A461843; No Copyright; Avail.: CASI: **A03**, Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA461843>

The USA Department of State estimates that 80-110 million mines litter the world, the majority of which were deployed during the last 15 years. Several efforts are underway that address the current land mine problem. The USA established the Demining Assistance Program to initiate research and development into cost effective demining techniques. The Department of Defense (DoD) Humanitarian Demining Research and Development Program at Night Vision and Electronic Sensors Directorate (NVESD), Fort Belvoir, VA is tasked with executing this program. In one response to this tasking, commercial companies were invited to provide a capabilities demonstration of their mechanical equipment that can suitably address either one or both of the mine and/or the vegetation problems in Humanitarian demining operations. The purpose of this system capabilities demonstration was to obtain information on non-developmental Mechanical Mine and/or Vegetation Clearing Systems that can demonstrate some or all of the following capabilities. 1) Support a variety of interchangeable tools capable of performing the diverse tasks involved with working in landmine suspect areas, i.e., mulchers, sifters, grinders, rakes, etc. 2) Clear a minimum of 200m²/hour of light to medium vegetation and cut 10cm diameter trees and brush. 3) Be capable of on-road and off-road operations in all types of weather and terrain. 4) Be capable of self-transport (less attachment) for distances less than 30km without destroying roads or bridges. 5) Be capable of destroying or removing landmines by grinding, sifting, raking, flailing, etc. 6) The system must be transportable, reliable, maintainable, and logistically supportable in third world mine affected countries. 7) Demonstrate the feasibility of protecting the system and operator, if applicable, with applique armor to withstand a blast equivalent to a .56kg (TNT) bounding fragmentation mine at 2 meters.

DTIC

Cutting; Tractors; Vegetation

20070009730 DeWitt Ross and Stevens, S.C., Madison, WI, USA

Piston/Combustion Chamber Configurations for Enhanced CI Engine Performance

Wickman, D. D.; Reitz, R. D.; 16 May 03; 9 pp.; In English

Contract(s)/Grant(s): DE-FG04-99AL66269

Patent Info.: Filed 16 May 03; US-Patent-Appl-SN-10-514 001

Report No.(s): PB2007-102931; No Copyright; Avail.: CASI: **A02**, Hardcopy

Piston face (104, 204, 304) and combustion chamber (18) designs for use particularly in HSDI (high speed direct injection) diesel engines include an open bowl (108, 208, 308) characterized by a large face perimeter region (106, 206, 306) on the piston face (104, 204, 304), and a bowl (18) defined by a first depressed region (112, 212, 312) gently sloping radially inwardly from the face perimeter region (106, 206, 306) and a second depressed region (116, 216, 316) sharply sloping radially inwardly from the first depressed region (112, 212, 312) to the bowl floor (120, 220, 320). Injection is preferably directed towards an intermediate edge which is well-defined between the first and second depressed regions, resulting in portions of the injected fuel plume being directed to both the squish regions and the portion of the bowl situated below the intermediate edge. The designs promote premixed or MK (Modulated Kinetics) combustion, with a concomitant reduction in soot and nitrous oxides (NO_x) emissions while maintaining or enhancing brake specific fuel consumption.

NTIS

Combustion Chambers; Diesel Engines; Pistons

20070010565 National Renewable Energy Lab., Golden, CO USA

Effects of Biodiesel Blends on Vehicle Emissions. Fiscal Year 2006 Annual Operation Plan Milestone 10.4

McCormick, R. L.; Williams, A.; Ireland, J.; Brimhall, M.; Hayes, R. R.; Oct. 01, 2006; 69 pp.; In English

Report No.(s): DE2006-894987; NREL/MP-540-40554; No Copyright; Avail.: National Technical Information Service (NTIS)

The objective was to determine if testing entire vehicles, vs. just the engines, on a heavy-duty chassis dynamometer provides a better, measurement of the impact of B20 on emissions.

NTIS

Air Pollution; Biomass; Combustion Products; Dynamometers; Exhaust Emission; Exhaust Gases; Fuels; Mixtures

20070010629 National Renewable Energy Lab., Golden, CO USA, John Deere Product Engineering Center, Waterloo, IA, USA

Natural Gas Engine Development July 2003 - July 2005

Lekar, T. C.; Martin, T. J.; Nov. 2006; 43 pp.; In English

Report No.(s): DE2006-895247; NREL/SR-54040816; No Copyright; Avail.: National Technical Information Service (NTIS)

Discusses project to develop heavy-duty, 8.1L natural gas vehicle engines that would be certifiable below the 2004 federal emissions standards and commercially viable.

NTIS

Engine Design; Internal Combustion Engines; Natural Gas

20070010744 NASA Glenn Research Center, Cleveland, OH, USA

Forming a Turbomachinery Seals Working Group - An Overview and Discussion

Proctor, Margaret P.; [2007]; 19 pp.; In English; 2006 NASA Seal/Secondary Air System Workshop, 14-15 Nov. 2006, Cleveland, OH, USA

Contract(s)/Grant(s): WBS 561581.02.08.03.15.03; No Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: <http://hdl.handle.net/2060/20070010744>

A proposal to form a Turbomachinery Seals Working Group is discussed. Survey responses regarding the purpose, membership, and meeting frequency are presented as well as the areas of expertise and experience of the respondents. The types of seals used, designed, or sold, current work, and technical challenges of turbomachinery seals, their materials, analysis, geometry, manufacturing, maintenance, testing, and incorporation into engine systems are also presented.

Author

Turbomachinery; Seals (Stoppers); Mechanical Engineering; Technologies

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*.

20070009811 Civil Engineer Squadron (00319th), Grand Forks AFB, ND USA

Environmental Assessment - Demolish 934 of Grand Forks Air Force Base

Strom, Diane; Mar 2006; 102 pp.; In English

Report No.(s): AD-A461276; 319 CES/ND-2005-050; XC-319 CES/ND; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA461276>

The purpose of the proposed action is to demolish 608 square feet of excess facility space in building 934, known as the booster station, by CES contract in FY 06. Work includes removal of all plumbing, pumps and equipment, removal of the water lines from the water main into the building, replacement of the 14 tees on the water main with a straight piece of pipe, maintain the existing check valve and control valve on the water main with an accessible manhole; mercury, asbestos and lead-based paint abatement and removal; building demolition, excavation, slab removal, backfill, grading, removal of debris, and site restoration. The Grand Forks AFB Facilities Board agenda includes the demolition of 934, and demolition of 934 is proposed as a CES project. Project number JFSD200192 has been assigned. A new booster station was installed at the Grand Forks airport in 1999. The old booster station in Grand Forks, building 935, was demolished in 2000. The airport booster station does not need building 934 to function. Building 934 will not work without the airport booster station since building 935 was demolished. The city has installed a new clear well pumping station that has the ability to pump water to the base if the airport booster station fails. Building 934 presents a potential security risk because of the access to the base water supply at that point.

DTIC

Buildings; Environmental Tests; Environmental Monitoring

20070010605 Sandia National Labs., Albuquerque, NM USA

Modeling Brittle Fracture, Slip Weakening, and Variable Friction in Geomaterials with an Embedded Strong Discontinuity Finite Element

Foster, C. D.; Regueiro, R. A.; Borja, R. I.; Oct. 2006; 88 pp.; In English

Report No.(s): DE2006-895072; SAND-2006-5920; No Copyright; Avail.: National Technical Information Service (NTIS)

Localized shear deformation plays an important role in a number of geotechnical and geological processes. Slope failures, the formation and propagation of faults, cracking in concrete dams, and shear fractures in subsiding hydrocarbon reservoirs are examples of important effects of shear localization. Traditional engineering analyses of these phenomena, such as limit equilibrium techniques, make certain assumptions on the shape of the failure surface as well as other simplifications. While these methods may be adequate for the applications for which they were designed, it is difficult to extrapolate the results to more general scenarios. An alternative approach is to use a numerical modeling technique, such as the finite element method, to predict localization. While standard finite elements can model a wide variety of loading situations and geometries quite well, for numerical reasons they have difficulty capturing the softening and anisotropic damage that accompanies localization. By introducing an enhancement to the element in the form of a fracture surface at an arbitrary position and orientation in the element, we can regularize the solution, model the weakening response, and track the relative motion of the surfaces. To properly model the slip along these surfaces, the traction-displacement response must be properly captured. This report focuses on the development of a constitutive model appropriate to localizing geomaterials, and the embedding of this model into the enhanced finite element framework. This modeling covers two distinct phases. The first, usually brief, phase is the weakening response as the material transitions from intact continuum to a body with a cohesionless fractured surface. Once the cohesion has been eliminated, the response along the surface is completely frictional. We have focused on a rate- and state-dependent frictional model that captures stable and unstable slip along the surface. This model is embedded numerically into the element using a generalized trapezoidal formulation. While the focus is on the constitutive model of interest, the framework is also developed for a general surface response. This report summarizes the major research and development accomplishments for the LDRD project titled 'Cohesive Zone Modeling of Failure in Geomaterials: Formulation and Implementation of a Strong Discontinuity Model Incorporating the Effect of Slip Speed on Frictional Resistance'. This project supported a strategic partnership between Sandia National Laboratories and Stanford University by providing funding for the lead author, Craig Foster, during his doctoral research.

NTIS

Brittleness; Concretes; Discontinuity; Embedding; Finite Element Method; Fracture Mechanics; Friction

20070010665 Copperrsmith Consulting, Walnut Creek, CA, USA, Geomatrix Consultants, Oakland, CA, USA

Lessons Learned - The Use of Formal Expert Elicitation in Probabilistic Seismic Hazard Analysis

Copperrsmith, K. J.; Perman, R. C.; Youngs, R. R.; May 10, 2006; 10 pp.; In English

Report No.(s): DE2006-893709; No Copyright; Avail.: National Technical Information Service (NTIS)

Probabilistic seismic hazard analyses provide the opportunity, indeed the requirement, to quantify the uncertainties in important inputs to the analysis. The locations of future earthquakes, their recurrence rates and maximum size, and the ground motions that will result at a site of interest are all quantities that require careful consideration because they are uncertain. The earliest PSHA models (Cornell, 1968) provided solely for the randomness or aleatory variability in these quantities. The most sophisticated seismic hazard models today, which include quantified uncertainties, are merely more realistic representations of this basic aleatory model. All attempts to quantify uncertainties require expert judgment. Further, all uncertainty models should endeavor to consider the range of views of the larger technical community at the time the hazard analysis is conducted. In some cases, especially for large projects under regulatory review, formal structured methods for eliciting expert judgments have been employed. Experience has shown that certain key elements are required for these assessments to be successful, including: (1) experts should be trained in probability theory, uncertainty quantification, and ways to avoid common cognitive biases; (2) comprehensive and user-friendly databases should be provided to the experts; (3) experts should be required to evaluate all potentially credible hypotheses; (4) workshops and other interactions among the experts and proponents of published viewpoints should be encouraged; (5) elicitation are best conducted in individual interview sessions; (6) feedback should be provided to the experts to give them insight into the significance of alternative assessments to the hazard results; and (7) complete documentation should include the technical basis for all assessments. Case histories are given from seismic hazard analyses in Europe, western North America, and the stable continental region of the USA.

NTIS

Earthquakes; Hazards; Seismology

20070010750 Analytical Services and Materials, Inc., Hampton, VA, USA
A Procedure for Modeling Structural Component/Attachment Failure Using Transient Finite Element Analysis
Lovejoy, Andrew E.; Jegley, Dawn C., Technical Monitor; January 2007; 41 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): NNL04AA10B; WBS 561581.02.08.07
Report No.(s): NASA/CR-2007-214540; No Copyright; Avail.: CASI: **A03**, Hardcopy
ONLINE: <http://hdl.handle.net/2060/20070010750>

Structures often comprise smaller substructures that are connected to each other or attached to the ground by a set of finite connections. Under static loading one or more of these connections may exceed allowable limits and be deemed to fail. Of particular interest is the structural response when a connection is severed (failed) while the structure is under static load. A transient failure analysis procedure was developed by which it is possible to examine the dynamic effects that result from introducing a discrete failure while a structure is under static load. The failure is introduced by replacing a connection load history by a time-dependent load set that removes the connection load at the time of failure. The subsequent transient response is examined to determine the importance of the dynamic effects by comparing the structural response with the appropriate allowables. Additionally, this procedure utilizes a standard finite element transient analysis that is readily available in most commercial software, permitting the study of dynamic failures without the need to purchase software specifically for this purpose. The procedure is developed and explained, demonstrated on a simple cantilever box example, and finally demonstrated on a real-world example, the American Airlines Flight 587 (AA587) vertical tail plane (VTP).

Author

Transient Response; Static Loads; Failure Analysis; Structural Failure

42

GEOSCIENCES (GENERAL)

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

20070009994 NASA Johnson Space Center, Houston, TX, USA
Calcium Sulfate in Atacama Desert Basalt: A Possible Analog for Bright Material in Adirondack Basalt, Gusev Crater
Sutter, B.; Golden, D. C.; Amundson, R.; Chong-Diaz, G.; Ming, D. W.; [2007]; 2 pp.; In English; Lunar and Planetary Science Conference, 12-16 Mar. 2007, Houston, TX, USA; Original contains black and white illustrations; Copyright; Avail.: CASI: **A01**, Hardcopy

The Atacama Desert in northern Chile is one of the driest deserts on Earth ($\sim 2\text{mm/y}$). The hyper-arid conditions allow extraordinary accumulations of sulfates, chlorides, and nitrates in Atacama soils. Examining salt accumulations in the Atacama may assist understanding salt accumulations on Mars. Recent work examining sulfate soils on basalt parent material observed white material in the interior vesicles of surface basalt. This is strikingly similar to the bright-white material present in veins and vesicles of the Adirondack basalt rocks at Gusev Crater which are presumed to consist of S, Cl, and/or Br. The abundance of soil gypsum/anhydrite in the area of the Atacama basalt suggested that the white material consisted of calcium sulfate (Ca-SO_4) which was later confirmed by SEM/EDS analysis. This work examines the Ca-SO_4 of Atacama basalt in an effort to provide insight into the possible nature of the bright material in the Adirondack basalt of Gusev Crater. The objectives of this work are to (i) discuss variations in Ca-SO_4 crystal morphology in the vesicles and (ii) examine the Ca-SO_4 interaction(s) with the basalt interior.

Derived from text

Calcium; Sulfates; Mars Craters; Arid Lands; Basalt; Crystal Morphology; Mars Landing Sites

20070009998 NASA Johnson Space Center, Houston, TX, USA
Os-186 and Os-187 Enrichments and High-He-3/He-4 sources in the Earth's Mantle: Evidence from Icelandic Picrites
Brandon, Alan D.; Graham, David W.; Waight, Tod; Gautason, Bjarni; [2007]; 53 pp.; In English
Contract(s)/Grant(s): NSF EAR-00-00908; NSF OCE-02-41915; Copyright; Avail.: CASI: **A04**, Hardcopy

Picrites from the neovolcanic zones in Iceland display a range in Os-187/Os-188 from 0.1297 to 0.1381 ($(\gamma)\text{Os} = 0.0$ to 6.5) and uniform Os-186/Os-188 of 0.1198375 ± 32 (2 (σ)). The value for Os-186/Os-188 is within uncertainty of the present-day value for the primitive upper mantle of 0.1198398 ± 16 . These Os isotope systematics are best explained by ancient recycled crust or melt enrichment in the mantle source region. If so, then the coupled enrichments displayed in Os-186/Os-188 and Os-187/Os-188 from lavas of other plume systems must result from an independent process, the most

viable candidate at present remains core-mantle interaction. While some plumes with high He-3/He-4, such as Hawaii, appear to have been subjected to detectable addition of Os (and possibly He) from the outer core, others such as Iceland do not. A positive correlation between Os-187/Os-188 and He-3/He-4 from 9.6 to 19 RA in Iceland picrites is best modeled as mixtures of 500 Ma or older ancient recycled crust mixed with primitive mantle, creating a hybrid source region that subsequently mixes with the convecting MORB mantle during ascent and melting. This multistage mechanism to explain these isotope systematics is consistent with ancient recycled crust juxtaposed with more primitive, relatively He-rich mantle, in convective isolation from the upper mantle, most likely in the lowermost mantle. This is inconsistent with models that propose random mixing between heterogeneities in the convecting upper mantle as a mechanism to explain the observed isotopic variation in oceanic lavas or models that produce a high He-3/He-4 signature in melt depleted and strongly outgassed, He-poor mantle. Instead these systematics require a deep mantle source to explain the 3He/4He signature in Iceland lavas. The He-3/He-4 of lavas derived from the Iceland plume changed over time, from a maximum of 50 RA at 60 Ma, to approximately 25-27 RA at present. The changes are coupled with distinct compositional gaps between the different aged lavas when H-3/He-4 is plotted versus various geochemical parameters such as Nd-143/Nd-144 and La/Sm. These relationships can be interpreted as an increase in the proportion of ancient recycled crust in the upwelling plume over this time period.

Author

Helium Isotopes; Osmium Isotopes; Geochemistry; Enrichment; Lava; Earth Mantle; Crusts

43

EARTH RESOURCES AND REMOTE SENSING

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

20070009615 Engineer Detachment (64th) (Terrain), Fort Hood, TX USA

Fort Irwin, California, Terrain Analysis

Apr 1984; 77 pp.; In English; Original contains color illustrations

Report No.(s): AD-A461249; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA461249>

The requirement for this terrain analysis was stated in message P241854Z October 1975 from Commander, FORSCOM to the Office of Chief of Engineers (OCE), Department of the Army subject, 'Terrain Analysis of Selected FORSCOM Installations.' The message identified several installations, including Fort Irwin, and cited the topical coverage desired in the study. Headquarters, Department of the Army message A 012042Z Mar 1976, assigned to the 64th Engineer Detachment (Terrain) the task of Fort Irwin terrain analysis to be completed by December 1978. The Terrain Analysis Center (TAC) of the Engineer Topographic Laboratories (ETL), Fort Belvoir, Virginia was tasked by OCE with management and supervision of the overall project. FORSCOM message R051328Z June 1978, stated the initial reassignment of cartographic and reproduction support from the 524th Engineer Company (Topo), Fort Hood, TX to the 30th Engineer Battalion (Topo), Fort Belvoir, VA. The scope and content of the topical coverage of FORSCOM requirement were developed jointly between TAC and FORSCOM representatives. Analytical and cartographic specifications were developed by TAC, coordinated with OCE, and concurred in by FORSCOM headquarters.

DTIC

Cities; Terrain; Terrain Analysis

20070009642 Greenhorne and O'Mara, Inc., Greenbelt, MD USA

Fort Leonard Wood, Missouri, Terrain Analysis

Jan 1982; 51 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DACA87-81-C-0079

Report No.(s): AD-A461352; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA461352>

The major purpose of the program is to assist military planners in future stationing decisions. To achieve this purpose, planners must obtain an appreciation of the on-post terrain that includes, among other things, knowledge of the suitability for conducting field training exercises involving maneuverability of troops and military vehicles. The degree of maneuverability that can be achieved is a function of several terrain factors including slope, surface configuration, soils, vegetative cover, and surface drainage, all of which are treated in the studies. Planners concerned with troop stationing also need certain off-post

information such as statistics on housing, schools, hospitals, and public utilities in urban areas near installations, as well as pertinent data on airfields and ports in the vicinity. These items are also treated in the studies. Because the program under which this study was prepared is intended to serve troop stationing requirements, the support provided by the program to environmental requirements is only incidental. Some of the information contained in the studies may be useful as environmental baseline data, but the studies are by no means complete environmental inventories of the kind required in support of the environmental impact assessments.

DTIC

Cities; Geology; Terrain; Terrain Analysis; Water Resources; Wood

20070009662 Army Construction Engineering Research Lab., Champaign, IL USA

Characterizing Land Use Change Trends Around the Perimeter of Military Installations

Lozar, Robert C; Meyer, William D; Schlagel, Joel D; Melton, Robert H; MacAllister, Bruce A; Rank, Joseph S; MacDonald, Daniel P; Cedfeldt, Paul T; Kirby, Pat M; Goran, William D; Apr 2005; 105 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): MIPR-4CTABG4026

Report No.(s): AD-A461426; ERDC-TR-05-4; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA461426>

The Total Army Basing Study (TABS) office, as one aspect of their stationing study, wished to determine the rate of development near the boundaries of nearly 100 military installations throughout the USA. The Engineer Research and Development Center proposed that this could be done by comparing the urbanization as derived from Ikonos images (taken around 2003 and acquired for all Services through the National Geospatial-Intelligence Agency) to a digital land use data set developed by the USA Geological Survey in about 1992. This decade difference could then be used to determine not only the amount of development, but also the trend. For the military, increasing development near installation boundaries can limit the ability to carry out their primary responsibilities of military training readiness and material testing activities. A team of 10 professionals was able to carry out the analysis for all the installations in about 4 months. This document describes the standard procedure used and the generalized results for the trends in increased development near the installation boundaries. It also summarizes the urbanization trends from the statistics generated to provide a snapshot of encroachment characteristics near a sample of nearly 100 military installations.

DTIC

Cities; Land Use; Satellite Imagery; Trends

20070010585 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Realistic Covariance Prediction For the Earth Science Constellations

Duncan, Matthew; Long, Anne; [2006]; 1 pp.; In English; AAS/AIAA Astronomical Specialist Conference, 21-24 Aug. 2006, Keystone, CO, USA; Copyright; Avail.: Other Sources; Abstract Only

Routine satellite operations for the Earth Science Constellations (ESC) include collision risk assessment between members of the constellations and other orbiting space objects. One component of the risk assessment process is computing the collision probability between two space objects. The collision probability is computed via Monte Carlo techniques as well as numerically integrating relative probability density functions. Each algorithm takes as inputs state vector and state vector uncertainty information for both objects. The state vector uncertainty information is expressed in terms of a covariance matrix. The collision probability computation is only as good as the inputs. Therefore, to obtain a collision calculation that is a useful decision-making metric, realistic covariance matrices must be used as inputs to the calculation. This paper describes the process used by NASA Goddard's Earth Science Mission Operations Project to generate realistic covariance predictions for three of the ESC satellites: Aqua, Aura, and Terra

Author

Earth Sciences; Covariance; NASA Programs; Matrices (Mathematics); Satellite Constellations; Algorithms

20070011401 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Meeting Report: Long Term Monitoring of Global Vegetation using Moderate Resolution Satellites

Morissette, Jeffrey; Heinsch, Fath Ann; Running, Steven W.; October 10, 2006; 5 pp.; In English; Workshop Report to the AGU publication 'EOS Transactions', 7-10 Aug. 2006, Missoula, MT, USA; Copyright; Avail.: CASI: A01, Hardcopy

The international community has long recognized the need to coordinate observations of Earth from space. In 1984, this situation provided the impetus for creating the Committee on Earth Observation Satellites (CEOS), an international

coordinating mechanism charged with coordinating international civil spaceborne missions designed to observe and study planet Earth. Within CEOS, its Working Group on Calibration and Validation (WGCV) is tasked with coordinating satellite-based global observations of vegetation. Currently, several international organizations are focusing on the requirements for Earth observation from space to address key science questions and societal benefits related to our terrestrial environment. The Global Vegetation Workshop, sponsored by the WGCV and held in Missoula, Montana, 7-10 August, 2006, was organized to establish a framework to understand the inter-relationships among multiple, global vegetation products and identify opportunities for: 1) Increasing knowledge through combined products, 2) Realizing efficiency by avoiding redundancy, and 3) Developing near- and long-term plans to avoid gaps in our understanding of critical global vegetation information. The Global Vegetation Workshop brought together 135 researchers from 25 states and 14 countries to advance these themes and formulate recommendations for CEOS members and the Global Earth Observation System of Systems (GEOSS). The eighteen oral presentations and most of the 74 posters presented at the meeting can be downloaded from the meeting website (www.ntsg.umt.edu/VEGMTG/). Meeting attendees were given a copy of the July 2006 IEEE Transactions on Geoscience and Remote Sensing Special Issue on Global Land Product Validation, coordinated by the CEOS Working Group on Calibration and Validation (WGCV). This issue contains 29 articles focusing on validation products from several of the sensors discussed during the workshop.

Author

Geophysics; Remote Sensing; Vegetation; Artificial Satellites

44

ENERGY PRODUCTION AND CONVERSION

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

20070009658 National Renewable Energy Lab., Golden, CO USA

Laying the Foundation for a Solar America: The Million Solar Roofs Initiative Final Report October 2006. Million Solar Roofs

Strahs, G.; Tombari, C.; January 2006; 43 pp.; In English

Report No.(s): DE2006-893443; No Copyright; Avail.: National Technical Information Service (NTIS)

As the U.S. Department of Energy's Solar Energy Technology Program embarks on the next phase of its technology acceptance efforts under the Solar America Initiative, there is merit to examining the program's previous market transformation effort, the Million Solar Roofs Initiative. Its goal was to transform markets for distributed solar technologies by facilitating the installation of solar systems.

NTIS

Roofs; Solar Energy

20070009669 National Renewable Energy Lab., Golden, CO USA

Lessons Learned from the Photovoltaic Manufacturing Technology/PV Manufacturing R&D and Thin-Film PV Partnership Projects

Margolis, R.; Mitchell, R.; Zweibel, K.; Sep. 2006; 26 pp.; In English

Report No.(s): DE2006-893640; NREL/TP-520-39780; No Copyright; Avail.: Department of Energy Information Bridge

As the U.S. Department of Energy's (DOE's) Solar Energy Technologies Program initiates new cost-shared solar energy R&D under the Solar America Initiative (SAI), it is useful to analyze the experience gained from cost-shared R&D projects that have been funded through the program to date. This report summarizes lessons learned from two DOE-sponsored photovoltaic (PV) projects: the Photovoltaic Manufacturing Technology/PV Manufacturing R&D (PVMaT/PVMR&D) project and the Thin-Film PV Partnership project. During the past 10-15 years, these two projects have invested roughly \$330 million of government resources in cost-shared R&D and leveraged another \$190 million in private-sector PV R&D investments. Following a description of key findings and brief descriptions of the PVMaT/PVMR&D and Thin-Film PV Partnership projects, this report presents lessons learned from the projects.

NTIS

Energy Technology; Manufacturing; Photovoltaic Conversion; Solar Energy; Thin Films

20070009671 National Renewable Energy Lab., Golden, CO USA

Nontechnical Barriers to Solar Energy Use: Review of Recent Literature

Margolis, R.; Zuboy, J.; Sep. 2006; 30 pp.; In English

Report No.(s): DE2006-893639; NREL/TP-40116; No Copyright; Avail.: Department of Energy Information Bridge

In this paper, we review the nontechnical barriers to solar energy use. Specifically, we draw on recent literature to help identify key barriers that must be addressed as part of the Technology Acceptance efforts under the U.S. Department of Energy (DOE) Solar America Initiative. A broad literature search yielded more than 400 references, which we narrowed to 19 recent documents on nontechnical barriers to the use of solar energy and other energy efficiency and renewable energy (EE/RE) technologies. The following were the most frequently identified barriers: Lack of government policy supporting EE/RE, Lack of information dissemination and consumer awareness about energy and EE/RE, High cost of solar and other EE/RE technologies compared with conventional energy, Difficulty overcoming established energy systems Inadequate financing options for EE/RE projects, Failure to account for all costs and benefits of energy choices, Inadequate workforce skills and training, Lack of adequate codes, standards, and interconnection and net-metering guidelines, Poor perception by public of renewable energy system aesthetics, Lack of stakeholder/community participation in energy choices and EE/RE projects. Below we describe our methodology, the documents reviewed, and the barriers most frequently identified. In addition, annotated references include detailed information for each of the key documents, including the technologies considered, the method of barrier identification, the geographic focus, a summary of the document, and the barriers identified.

NTIS

Solar Energy; Energy Technology

20070009940 Illinois Univ., Chicago, IL, USA

Combined Synthetic Spectroscopic and Theoretical Approach to the Rational Design of Photophysical and Photochemical Properties of Dendrimers. Final Technical Report

Bareen, C. J.; Martinez, T. J.; Moore, J. M.; Oct. 2006; 13 pp.; In English

Contract(s)/Grant(s): DE-FG02-01ER15270

Report No.(s): DE2006-892903; No Copyright; Avail.: Department of Energy Information Bridge

We summarize progress in the DOE project, 'A Combined Synthetic, Spectroscopic, and Theoretical Approach to the Rational Design of Photophysical and Photochemical Properties of Dendrimers'.

NTIS

Dendrimers; Photochemical Reactions; Photovoltaic Cells; Spectroscopy

20070010453 NASA Glenn Research Center, Cleveland, OH, USA

Summary of Stirling Converter Testing at GRC

Schreiber, Jeffrey G.; [2006]; 15 pp.; In English; 4th International Energy Conversion Engineering Conference (IECEC-2006), 26-29 Jun. 2006, San Diego, CA, USA; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 138494.04.01.01; No Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: <http://hdl.handle.net/2060/20070010453>

The NASA Glenn Research Center (GRC) has been testing free-piston Stirling converters for potential use in radioisotope power systems. These converters tend to be in the 35 to 80 watt electric power output range. Tests at GRC have accumulated over 80,000 hours of operation. Test articles have been received from Infinia Corporation of Kennewick, WA and from Sunpower of Athens, OH. Infinia designed and built the developmental Stirling Technology Demonstration Convertors (TDC) in addition to the more advanced Test Bed and Engineering Unit convertors. GRC has eight of the TDC's under test including two that operate in a thermal vacuum environment. Sunpower designed and developed the EE-35 and the Advanced Stirling Converter (ASC). GRC has six of the EE-35's and is preparing for testing multiple ASC's. Free-piston Stirling converters for radioisotope power systems make use of non-contacting operation that eliminates wear and is suited for longterm operation. Space missions with radioisotope power systems are often considered that extend from three to 14 years. One of the key capabilities of the GRC test facility is the ability to support continuous, unattended operation. Hardware, software, and procedures for preparing the test articles were developed to support these tests. These included the processing of the convertors for minimizing the contaminants in the working fluid, developing a helium charging system for filling and for gas sample analysis, and the development of new control software and a high-speed protection circuit to insure safe, round-the-clock operation. Performance data of Stirling converters over time is required to demonstrate that a radioisotope power system is capable of providing reliable power for multi-year missions. This paper will discuss the status of Stirling converter testing at GRC.

Author

Stirling Cycle; Working Fluids; Thermal Environments; Test Facilities; Gas Analysis; Test Stands

20070010458 NASA Glenn Research Center, Cleveland, OH, USA

Stirling Isotope Power Systems for Stationary and Mobile Lunar Applications

Schmitz, Paul C.; Penswick, L. Barry; Shaltens, Richard K.; March 27, 2007; 19 pp.; In English; 4th International Energy Conversion Engineering Conference (IECEC-2006), 26-29 Jun. 2006, San Diego, CA, USA; Original contains color illustrations

Contract(s)/Grant(s): WBS 138494.04.01.01; Copyright; Avail.: CASI: [A03](#), Hardcopy

The NASA Exploration Systems Architecture Study (ESAS) places a significant emphasis on the development of a wide range of capabilities on the lunar surface as a stepping-stone to further space exploration. An important aspect of developing these capabilities will be the availability of reliable, efficient, and low-mass power systems to support both stationary and mobile applications. One candidate system to provide electrical power is made by coupling the General Purpose Heat Source (GPHS) with a high-performance Stirling convertor. In this paper we explore the practical power range of GPHS/Stirling convertor systems all with conductively coupled hot-end designs for use on the lunar surface. Design and off-design operations during the life of the convertor are studied in addition to considering these varying conditions on system. Unique issues concerning Stirling convertor configurations, integration of the GPHS with the Stirling convertor, controller operation, waste heat rejection, and thermal protection are explored. Of particular importance in the evaluation process is a thorough understanding of the interactions between the wide range of unique lunar environments and the selection of key systems operating characteristics and the power systems design. Additionally, as power levels rise the interface between the GPHS and Stirling and the Stirling and the radiator begins to dominate system mass and material selection becomes more important.

Author

Stirling Cycle; Thermal Protection; Radioisotope Heat Sources; Lunar Exploration; Space Exploration; Controllers

20070010510 National Renewable Energy Lab., Golden, CO USA, Department of Energy, Golden, CO, USA

Kenaitze Indian Tribe Wind and Solar Feasibility Study

Smagge, R.; Trefon, B.; Wirz, C.; Hirsch, B.; Mogar, D.; Sep. 29, 2006; 22 pp.; In English

Report No.(s): DE2006-892574; DE-FG36-04GO14020; No Copyright; Avail.: National Technical Information Service (NTIS)

The Kenaitze Indian Tribe completed this Renewable Energy Resource Development Feasibility Study in June, 2006. The study focused on wind and solar energy resources for the tribe, for future tribal operations and housing, and the possibility of energy development for sale to local energy providers. With the assistance of several technical advisors, including engineers and electricians, we collected wind and solar data at a 30-meter meteorological tower constructed on tribal land from January of 2004, until June, 2006. Our wind resource summary showed this site had a poor rating for wind power. We were surprised by that, as is usually feels windy in our area. The solar study showed somewhat better results; we had more solar energy available than other areas in Alaska, but not a high amount compared to the rest of the world. The benefits of this project to our community were, however, outstanding. This project gave us an opportunity to demonstrate the possibilities of local renewable energy resources. We had access to technical advisors for long term planning and education about renewable energy specific to our area. The project also increased the awareness of renewable energy resources in our community, as several energy meetings were held, educational demonstrations were done with tribal families and the Headstart students and staff, and we produced a short video on why the tribe wanted to do this project, and many people became involved in the process of this wind and solar energy feasibility study.

NTIS

Feasibility; Windpower Utilization; Solar Energy

20070010529 Los Alamos National Lab., NM USA

Aerogel Monolith with Improved Strength

DeFriend, K. A.; Loy, D. A.; 20 Mar 06; 7 pp.; In English

Contract(s)/Grant(s): W-7405-ENG-36

Patent Info.: Filed Filed 20 Mar 06; US-Patent-Appl-SN-11-385 141

Report No.(s): PB2007-101467; No Copyright; Avail.: CASI: [A02](#), Hardcopy

Aerogel monoliths are treated with silanes or transition metal-containing reagents by chemical vapor deposition. This treatment improves the mechanical strength of the aerogel while maintaining their high surface area, low density, and porosity. When silane containing reagents are used, the transparency is generally maintained.

NTIS

Aerogels; Vapor Deposition

20070010912 Naval Postgraduate School, Monterey, CA USA

Direct Imaging of Minority Charge Carrier Transport in Triple Junction Solar Cell Layers

Mills, Ted J; Dec 2006; 81 pp.; In English; Original contains color illustrations

Report No.(s): AD-A462555; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA462555>

An optical, contact-free method for measuring minority carrier diffusion lengths is developed and demonstrated for a range of semiconductor materials used in high efficiency triple junction solar cells. This method uses a Scanning Electron Microscope (SEM) coupled with an optical microscope. The diffusion lengths, combined with minority carrier lifetime measured via time-resolved photoluminescence, allow for the computation of minority charge carrier mobility. The technique uses images to extract diffusion length measurements from GaAs, InGaAs, and InGaP heterostructures at different SEM beam energies and probe currents. Excellent correlation between measurements shows the reproducibility of this technique. Diffusion lengths from 2-63 microns have been measured in a variety of GaAs, InGaAs, and InGaP samples. Effects of alloy ordering, doping, and lattice matching have been investigated. Several areas for further research are offered, including detailed radiation-damage mapping of solar cell layers. Further anisotropic studies of the solar cell layers are suggested to investigate the directional dependence of diffusion length within the InGaP heterostructures. Finally, new and emerging solar cell materials would benefit from this technique, allowing for the complete characterization of minority charge transport properties before growing an entire solar cell.

DTIC

Charge Carriers; Imaging Techniques; Minority Carriers; Solar Cells

45

ENVIRONMENT POLLUTION

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

20070009603 Stetina Brunda Garred and Brucker, Aliso Viejo, CA, USA

Unattended Ground Sensor Assembly

Kolarczyk, J. C.; Wisniewski, J. J.; 28 Dec 05; 7 pp.; In English

Contract(s)/Grant(s): N66001-98-C-8518

Patent Info.: Filed Filed 28 Dec 05; US-Patent-Appl-SN-11-320-190

Report No.(s): PB2007-101427; No Copyright; Avail.: CASI: [A02](#), Hardcopy

There is provided a ground sensor assembly adapted for deployment from air to a selected ground location. The ground sensor assembly comprises an aeriably deployable sensor housing which has upper and lower housing ends defining a longitudinally elongated aperture therebetween. A plurality of connected sensor modules are longitudinally inserted into the aperture between the upper and lower housing ends. Furthermore, an aerodynamic module is connected to the sensor modules and is disposed adjacent the upper housing end outside the aperture. This aerodynamic module has a plurality of stabilizers which radially extend outward therefrom and form a generally parallel relationship with the upper housing end. Such stabilizers provide aerodynamic stability during the deployment of the ground sensor assembly from the air to the selected ground location.

NTIS

Air Pollution; Pollution Monitoring; Ground Stations; Sensors

20070009606 Naval Undersea Warfare Center, Newport, RI, USA

Acoustic Flow Noise Cancellation Using Reference Hydrophone

Sullivan, E. J.; 5 Oct 05; 9 pp.; In English

Patent Info.: Filed Filed 5 Oct 05; US-Patent-Appl-SN-09-972-295

Report No.(s): PB2007-101456; No Copyright; Avail.: CASI: [A02](#), Hardcopy

The present invention relates to a system and a method for substantially eliminating flow noise from the signal output of each hydrophone in a hull mounted acoustic array. The system comprises a plurality of hydrophones forming an acoustic array mounted to a hull of a marine vessel, at least one reference hydrophone mounted to the hull in a laminar region of fluid flow over the hull, and a computational device for generating an output signal for each hydrophone in the acoustic array which is

substantially free of flow noise using signals inputted from the acoustic array hydrophones and the at least one reference hydrophone.

NTIS

Cancellation; Flow Noise; Hydrophones; Sound Waves

20070009614 Cherskov and Flaynik Lawyers, Chicago, IL, USA

High-Temperature Potentiometric Oxygen Sensor with Internal Reference

Routbort, J. L.; Singh, D.; Dutta, P. K.; Ramsamy, R.; Spirig, J. V.; 16 Sep 06; 13 pp.; In English

Contract(s)/Grant(s): DE-FC26-03NT-211615; DE-W-109-ENG-38

Patent Info.: Filed Filed 16 Sep 06; US-Patent-Appl-SN-11-228-064

Report No.(s): PB2007-101433; No Copyright; Avail.: CASI: [A03](#), Hardcopy

A compact oxygen sensor is provided, comprising a mixture of metal and metal oxide an enclosure containing said mixture, said enclosure capable of isolating said mixture from an environment external of said enclosure, and a first wire having a first end residing within the enclosure and having a second end exposed to the environment. Also provided is a method for the fabrication of an oxygen sensor, the method comprising confining a metal-metal oxide solid mixture to a container which consists of a single material permeable to oxygen ions, supplying an electrical conductor having a first end and a second end, whereby the first end resides inside the container as a reference (PO.sub.2).sup.ref, and the second end resides outside the container in the atmosphere where oxygen partial pressure (PO.sub.2).sup.ext is to be measured, and sealing the container with additional single material such that grain boundary sliding occurs between grains of the single material and grains of the additional single material.

NTIS

Gas Detectors; High Temperature; Oxygen

20070009620 Environmental Protection Agency, Research Triangle Park, NC USA

National Scale Modeling of Air Toxics for the Final Mobile Source Air Toxics Rule, Technical Support Document

Feb. 2007; 215 pp.; In English

Report No.(s): PB2007-106159; EPA/454/R-07/002; No Copyright; Avail.: CASI: [A10](#), Hardcopy

The purpose of the work described in this technical document was to project emissions for mobile source hazardous air pollutants (HAPs) to 2010, 2015, 2020, and 2030 from the 1999 National Emissions Inventory Version 3 (NEI) (U. S. EPA, 2004a), conduct air quality and exposure modeling, and estimate cancer and non-cancer risk for select future years. Air quality modeling utilized the Assessment System for Population Exposure Nationwide (ASPEN) model (U. S. EPA, 2000). Exposure modeling utilized the Hazardous Air Pollutant Exposure Model, Version 6 (HAPEM6) (U.S. EPA, 2007). Cancer risk and non-cancer risk were estimated for 1999, 2015, 2020, and 2030. Modeling was done for reference cases, which included programs currently planned and in place, as well as control scenarios that evaluated impacts of additional control programs being finalized in this rule. This work was done to support regulatory needs related to the 2007 final mobile source air toxics rule.

NTIS

Support Systems; Scale Models; Air Quality

20070009622 Office of Air Quality Planning and Standards, Research Triangle Park, NC USA

Technical Support Document for the Final Mobile Source Air Toxics Rule: Ozone Modeling

Feb. 2007; 51 pp.; In English

Report No.(s): PB2007-106158; EPA/454/R-07/003; No Copyright; Avail.: CASI: [A04](#), Hardcopy

This document was prepared to describe the ozone air quality modeling performed by EPA in support of the Mobile Source Air Toxics (MSAT) rule. Included is information on (1) the air quality modeling and the development of model inputs, (2) the performance of the models as compared to measured data, and (3) an assessment of the expected air quality improvements from the VOC emissions reductions that are part of this proposal. Because of the availability of reductions from different precursor pollutants and types of sources, applying the model for individual chosen control scenarios may miss alternative strategies that achieve greater air quality benefits at a lower cost. As a result, a new approach known as air quality metamodeling has been developed to aggregate numerous individual air quality modeling simulations into a multi-dimensional air quality 'response surface'. Simply, this metamodeling technique is a 'model of the model' and can be shown to reproduce the results from an individual modeling simulation with little bias or error. This approach allows for the rapid assessment of

air quality impacts of different combinations of emissions reductions and was used here to project the effects of the portable fuel container controls within the MSAT rule.

NTIS

Air Pollution; Ozone; Pollution Monitoring; Environment Models

20070009626 National Inst. for Occupational Safety and Health, Washington, DC, USA

NIOSH Health Hazard Evaluation Report: HETA No. 2006-0222-3037, Society for the Prevention of Cruelty to Animals, Cincinnati, Ohio, February 2007

Achutan, C.; Tubbs, R. L.; Feb. 2007; 16 pp.; In English

Report No.(s): PB2007-106155; HETA-2006-0222-3037; No Copyright; Avail.: CASI: [A03](#), Hardcopy

On April 25, 2006, the National Institute for Occupational Safety and Health (NIOSH) received a request for a health hazard evaluation (HHE) from the Society for the Prevention of Cruelty to Animals-Cincinnati (SPCA-Cincinnati) in Hamilton County, Ohio. The HHE request asked NIOSH to assess the noise levels experienced by kennel workers from barking dogs. On September 28 and 29, 2006, NIOSH investigators measured noise exposure levels for kennel workers. On October 11 and 16, 2006, NIOSH investigators returned to the facility to conduct hearing tests on employees working in the kennel area. Other employees including maintenance workers, veterinary technicians, animal rescue workers, and front-office personnel who frequent the kennel area were also invited to take a hearing test. Twelve employees contributed 19 personal noise measures over the 2-day survey. Seventeen of the 19 personal noise measures exceeded the daily allowable dose of 100% as calculated by the NIOSH recommended exposure limit criterion. In addition, 11 measures also exceeded the Occupational Safety and Health Administration (OSHA) action level and four measures exceeded the OSHA permissible exposure limit. Nine workers showed some degree of hearing loss (≥ 25 decibel hearing loss) at one or more test frequencies in one or both ears on the NIOSH-administered audiogram. Five workers with normal hearing showed notches (hearing levels worsen over test frequencies before improving in the highest frequencies, forming a 'notch' configuration) in one or both ears at 4000 and 6000 Hertz perhaps indicating early signs of hearing loss. There were 21 notches in one or both ears of the 19 employees. Kennel workers at SPCA-Cincinnati are exposed to excessive noise levels. Some kennel workers and others who frequent the kennel area have some hearing loss but it is not possible to determine whether this is related to noise exposures in the kennel. Recommendations are provided to reduce noise exposures and prevent further hearing loss. These recommendations include establishing a hearing loss prevention program, installing sound-absorbing materials in kennels, and wearing hearing protection devices when entering the kennel area.

NTIS

Animals; Exposure; Hazards; Health; Prevention; Safety

20070009628 National Inst. for Occupational Safety and Health, Washington, DC, USA

NIOSH Health Hazard Evaluation Report: HETA No. 2006-0212-3035, Kenton County Animal Shelter, Covington, Kentucky, February 2007

Achutan, C.; Tubbs, R. L.; Feb. 2007; 16 pp.; In English

Report No.(s): PB2007-106154; HETA-2006-0212-3035; No Copyright; Avail.: National Technical Information Service (NTIS)

On April 13, 2006, the National Institute for Occupational Safety and Health (NIOSH) received a management request for a health hazard evaluation (HHE) from the Kenton County Animal Shelter (KCAS) in Covington, Kentucky. The HHE request asked NIOSH to assess the noise levels experienced by the animal shelter workers from barking dogs. On April 18 and 19, 2006, NIOSH investigators measured noise exposure levels for animal shelter workers. NIOSH investigators returned to the facility on October 12, 2006, to conduct hearing tests for all animal shelter workers. Nine animal shelter workers contributed 18 full-shift personal dosimetry measures over 2 days. Hearing tests were performed on 10 workers. Six of the 18 (33%) of the personal noise dosimetry measures exceeded the NIOSH recommended exposure limit. The Occupational Safety and Health Administration (OSHA) action level and the OSHA permissible exposure limit were not exceeded. Exposures were highest for workers who cleaned the dog kennels in the morning. Exposures were lower for employees who rotated between cleaning cat cages, providing food to the animals, and staffing the front desk. Four of the 10 workers tested showed some degree of hearing loss. Five employees with normal hearing showed 'notches' (frequency at which there is a dip in the audiogram followed by an increase) at 4000 Hertz (Hz) and 6000 Hz in one or both ears. Notches occurring between 3000 to 6000 Hz may be indicative of the early stages of noise-induced hearing loss (NIHL). In addition, one employee with hearing loss had notches at 2000 Hz, 4000 Hz, and 6000 Hz. The notch at 2000 Hz is not consistent with NIHL. Some of the animal shelter workers at KCAS are exposed to excessive noise levels. Some of the workers have some hearing loss but it is not possible to assess whether it is related to noise exposure at the kennel. Recommendations are provided to reduce noise

exposures and prevent further hearing loss. These recommendations include establishing a hearing loss prevention program, installing sound-absorbing materials in kennels, and wearing hearing protection devices when entering the kennel area.

NTIS

Animals; Exposure; Hazards; Health; Kentucky; Safety; Shelters

20070009630 National Inst. for Occupational Safety and Health, Washington, DC, USA

NIOSH Health Hazard Evaluation Report: HETA No. 2006-0196-3036, Liberty Veterinary Hospital, Liberty Township, Ohio, February 2007

Achutan, C.; Tubbs, R. L.; Feb. 2007; 22 pp.; In English

Report No.(s): PB2007-106153; HETA-2006-0196-3036; No Copyright; Avail.: National Technical Information Service (NTIS)

On March 27, 2006, the National Institute for Occupational Safety and Health (NIOSH) received a management request to conduct a health hazard evaluation (HHE) at Liberty Veterinary Hospital in Liberty Township, Ohio. The requestor was interested in knowing the noise levels at the facility from barking dogs in boarding kennels or at the hospital. Thirteen kennel workers contributed 18 full-shift personal noise dosimetry measures over two days. In addition, hearing tests were performed on 14 employees. Ten of the 18 full-shift personal noise dosimetry measures collected on kennel workers exceeded the NIOSH Recommended Exposure Limit. Six of these measures exceeded the Occupational Safety and Health Administration (OSHA) Action Level and one exceeded the OSHA Permissible Exposure Limit. For kennel workers, noise exposures during the morning shift were slightly higher than those during the afternoon shift workers, which is consistent with the activity level of the dogs. Three of the 14 employees showed some degree of hearing loss (≥ 25 decibels hearing loss). Of the three, one was a veterinary staff member, one was a kennel worker, and one was an office worker. Five employees with normal hearing showed 'notches' (frequency at which there is a dip in the audiogram followed by an increase) in their audiograms at 6000 Hertz (Hz). Notches occurring between 3000 to 6000 Hz may be indicative of the early stages of noise-induced hearing loss (NIHL).

NTIS

Exposure; Hazards; Health; Hospitals; Safety; Veterinary Medicine

20070009632 HDR Engineering, Inc., Phoenix, AZ, USA

Evaluation of Benefits and Opportunities for Innovative Noise Barrier Designs

Watson, D.; Nov. 2006; 34 pp.; In English

Contract(s)/Grant(s): T0549A0012

Report No.(s): PB2007-106130; No Copyright; Avail.: CASI: [A03](#), Hardcopy

The primary goal of this project was to identify innovative noise barrier designs that had the potential to be implemented in Arizona. The study initially focused on gathering existing literature on noise barrier materials and designs that were non-conventional. Literature was collected on dozens of noise barrier research projects in 12 countries around the world. Many of the barrier designs consisted of treatments to the top edge of the barrier to change or disrupt the diffraction pathway from the noise source to the receiver. The results of the previous research studies were compiled into a matrix to assist in evaluating the various barrier designs and materials. The evaluation matrix was used to score the barrier designs based on their acoustic performance, as well as economic, constructability, maintenance, and aesthetic considerations. Also, an attempt was made to identify the processes by which ADOT selects and approves various barrier designs for implementation on a project. Based on the research and evaluation conducted for this study, it was recommended that two innovative barrier designs be implemented in Arizona--the T-top design with absorptive material placed on the top of the horizontal portion of the barrier and a vertical barrier with absorptive material applied to the face of the barrier. These two barrier designs have been shown in the available literature to reduce noise levels by up to 3 decibels, which could reduce overall barrier heights by as much as 5 feet compared with a conventional noise barrier of concrete or masonry block construction.

NTIS

Noise Reduction; Traffic; Noise Pollution

20070009649 Electric Power Research Inst., Palo Alto, CA, USA

Toxicological Evaluation of Realistic Emissions of Source Aerosols (TERESA): Application to Power Plant-Derived PM(2.5). Semi-Annual Technical Progress Report for the Period of March 1, 2006 to August 31, 2006

Rohr, A.; Oct. 03, 2006; 11 pp.; In English

Report No.(s): DE2006-893180; No Copyright; Avail.: Department of Energy Information Bridge

This report documents progress made on the subject project during the period of March 1, 2006 through August 31, 2006. The TERESA Study is designed to investigate the role played by specific emissions sources and components in the induction of adverse health effects by examining the relative toxicity of coal combustion and mobile source (gasoline and/or diesel engine) emissions and their oxidative products. The study involves on-site sampling, dilution, and aging of coal combustion emissions at three coal-fired power plants, as well as mobile source emissions, followed by animal exposures incorporating a number of toxicological endpoints. The DOE-EPRI Cooperative Agreement (henceforth referred to as the Agreement) for which this technical progress report has been prepared covers the performance and analysis of field experiments at the first TERESA plant, located in the Upper Midwest and henceforth referred to as Plant 0, and at two additional coal-fired power plants (Plants 1 and 2) utilizing different coal types and with different plant configurations. During this reporting period, data processing and analyses were completed for exposure and toxicological data collected during the field campaign at Plant 1, located in the Southeast. Toxicological results indicate some pulmonary, oxidative stress, and cardiovascular responses to certain exposure scenarios.

NTIS

Aerosols; Health; Toxicity

20070009661 Bechtel SAIC Company, LLC, Las Vegas, NV, USA

Inhalation Exposure Input Parameters for the Biosphere Model

Jun. 2006; 154 pp.; In English

Report No.(s): DE2006-893536; ANL-MGR-MD-00001-REV04; No Copyright; Avail.: National Technical Information Service (NTIS)

This analysis is one of the technical reports that support the Environmental Radiation Model for Yucca Mountain, Nevada (ERMYN), referred to in this report as the biosphere model. 'Biosphere Model Report' (BSC 2004 (DIRS 169460)) describes in detail the conceptual model as well as the mathematical model and its input parameters. This report documents development of input parameters for the biosphere model that are related to atmospheric mass loading and supports the use of the model to develop biosphere dose conversion factors (BDCFs). The biosphere model is one of a series of process models supporting the total system performance assessment (TSPA) for a Yucca Mountain repository. 'Inhalation Exposure Input Parameters for the Biosphere Model' is one of five reports that develop input parameters for the biosphere model. A graphical representation of the documentation hierarchy for the biosphere model is presented in Figure 1-1 (based on BSC 2006 (DIRS 176938)). This figure shows the interrelationships among the products (i.e., analysis and model reports) developed for biosphere modeling and how this analysis report contributes to biosphere modeling. This analysis report defines and justifies values of atmospheric mass loading for the biosphere model. Mass loading is the total mass concentration of resuspended particles (e.g., dust, ash) in a volume of air. Mass loading values are used in the air submodel of the biosphere model to calculate concentrations of radionuclides in air inhaled by a receptor and concentrations in air surrounding crops. Concentrations in air to which the receptor is exposed are then used in the inhalation submodel to calculate the dose contribution to the receptor from inhalation of contaminated airborne particles. Concentrations in air surrounding plants are used in the plant submodel to calculate the concentrations of radionuclides in foodstuffs contributed from uptake by foliar interception. This report is concerned primarily with the physical attributes of airborne particulate matter, such as the airborne concentrations of particles and their sizes. The conditions of receptor exposure (duration of exposure in various microenvironments), breathing rates, and dosimetry of inhaled particulates are discussed in more detail in 'Characteristics of the Receptor for the Biosphere Model' (BSC 2005 (DIRS 172827)).

NTIS

Biosphere; Environment Models; Mountains; Radioactive Wastes; Respiration; Waste Management

20070009683 National Bureau of Standards, Washington, DC, USA

Fire-Resistance and Sound-Insulation Ratings for Walls, Partitions, and Floors. Technical Report on Building Materials No. 44

January 1989; 52 pp.; In English

Report No.(s): PB2007-105052; No Copyright; Avail.: CASI: [A04](#), Hardcopy

In the construction of buildings, particularly those of the residential type, partition and floor constructions should provide safety to life from the spread of fire and should reduce transmitted sounds and objectional noises to inaudible levels. The ability of a construction to prevent the spread of fire may be expressed in periods of fire resistance, that is, the time for which the construction may be exposed to a fire of a standard intensity without collapse, passage of flame, or the transmission of heat sufficient to cause ignition of combustible material. The sound insulation may be measured by the decrease in intensity of the sound as it travels through the wall. This paper gives the fire-resistance and sound-insulation ratings of walls, partitions, and

floors. Most of the fire-resistance ratings are based on tests made at the National Bureau of Standards. Some are based on tests made at Underwriters' Laboratories or at Ohio State University. All of the sound-insulation ratings are based on tests made at the National Bureau of Standards. The detailed results of many of the fire tests of wood- and metal-framed partitions have been published in Building Materials and Structures Report BMS 71, 'Fire Tests of Wood- and Metal-Framed Partitions.' The details of the sound-insulation tests are given in Building Materials and Structures Report BMS 44, 'Sound Insulation of Wall and Floor Construction', and Supplemental. Since the present objective is to present information of value in selecting or designing constructions suitable for use as subdivisions between family units in multiple dwellings, those having fire-resistance ratings of less than 1/2 hr are not included. The ratings are applicable to walls and floors in other types of buildings.

NTIS

Construction; Flammability; Floors; Insulation; Ratings; Walls

20070009685 Oregon Dept. of Transportation, Salem, OR, USA

Oregon Modeling Improvement Program: An Overview

Jun. 2002; 71 pp.; In English

Report No.(s): PB2007-104865; No Copyright; Avail.: CASI: [A04](#), Hardcopy

State highway departments historically responded to the broad public view that roads are key to a mobile, accessible and prosperous America. Beginning in the 1970s, several mandates dealing with how projects are selected and designed resulted from public concerns about the environmental and social impacts of road construction. Generally, they require an open public process, agency coordination, and alternative solutions. The mandates prescribe the process of considering how transportation infrastructure investments are decided and designed, and specified measures to ensure compliance and coordination. To address these mandates, changing how to think about providing transportation services is important. Recognizing that land use, economic and transportation decisions and investments are related and interdependent is a big step towards addressing the intent of the mandates. The historic mathematical models used by engineers and planners are inadequate to analyze and predict the multi-dimensional environment that is now being considered. New methods that analyze travel behavior, location preferences, market forces, infrastructure, and policies are needed since past decisions were made without sophisticated modeling tools. The Oregon Department of Transportation (ODOT) embarked upon a comprehensive Oregon Modeling Improvement Program (OMIP) in 1994. OMIP was developed to consider how to meet the new rules and regulations. It includes three primary areas of focus. First, it is important to bring together all stakeholders and to provide forums for information exchange and development of new ideas. Second, new and expanded modeling tools are required to provide information for efficient and effective-decision making. These tools need to address the number and type of interactions involved to allow analysis of complex relationships of land use, transportation and economics. And last, education and training on the need for and application of these tools is an ongoing program.

NTIS

Construction; Decision Making; Roads; Transportation; Models; Oregon

20070010474 Sandia National Labs., Albuquerque, NM USA, Bechtel SAIC Company, LLC, Las Vegas, NV, USA

Integration and Abstraction of EBS Models in Yucca Mountain Performance Assessment

Sevougian, S. D.; Jain, V.; Van Luik, A.; Jan. 11, 2006; 16 pp.; In English

Report No.(s): DE2006-894817; SAND2006-0172; No Copyright; Avail.: National Technical Information Service (NTIS)

The safety strategy for geological disposal of radioactive waste at Yucca Mountain relies on a multi-barrier system to contain the waste and isolate it from the biosphere. The multi-barrier system consists of the natural barrier provided by the geological setting and the engineered barrier system (EBS). In the case of Yucca Mountain (YM) the geologic setting is the unsaturated-zone host rock, consisting of about 600 meters of layered ash-flow volcanic tuffs above the water table, and the saturated zone beneath the water table. Both the unsaturated and saturated rocks are part of a closed hydrologic basin in a desert surface environment. The waste is to be buried about halfway between the desert surface and the water table. The primary engineered barriers at YM consist of metal components that are highly durable in an oxidizing environment. The two primary components of the engineered barrier system are highly corrosion-resistant metal waste packages, made from a nickel-chromium-molybdenum alloy, Alloy 22, and titanium drip shields that protect the waste packages from corrosive dripping water and falling rocks. Design and performance assessment of the EBS requires models that describe how the EBS and near field behave under anticipated repository-relevant conditions.

NTIS

Evaluation; Mountains; Performance Tests; Radioactive Wastes; Waste Disposal

20070010475 Idaho National Engineering Lab., Idaho Falls, ID, USA

Spent Nuclear Fuel Transportation: An Examination of Potential Lessons Learned from Prior Shipping Campaigns

Keister, M.; McBride, K.; Aug. 2006; 15 pp.; In English

Report No.(s): DE2006-894818; INL/EXT-06-11223; No Copyright; Avail.: Department of Energy Information Bridge

The Nuclear Waste Policy Act of 1982 (NWPA), as amended, assigned the Department of Energy (DOE) responsibility for developing and managing a Federal system for the disposal of spent nuclear fuel (SNF) and high-level radioactive waste (HLW). The Office of Civilian Radioactive Waste Management (OCRWM) is responsible for accepting, transporting, and disposing of SNF and HLW at the Yucca Mountain repository (if licensed) in a manner that protects public health, safety, and the environment; enhances national and energy security; and merits public confidence. OCRWM faces a near-term challenge--to develop and demonstrate a transportation system that will sustain safe and efficient shipments of SNF and HLW to a repository. To better inform and improve its current planning, OCRWM has extensively reviewed plans and other documents related to past high-visibility shipping campaigns of SNF and other radioactive materials within the USA. This report summarizes the results of this review and, where appropriate, lessons learned. The objective of this lessons learned study was to identify successful, best-in-class trends and commonalities from past shipping campaigns, which OCRWM could consider when planning for the development and operation of a repository transportation system.

NTIS

Nuclear Fuels; Radioactive Wastes; Spent Fuels; Transportation; Waste Management

20070010476 Sandia National Labs., Albuquerque, NM USA

Making the Postclosure Safety Case for the Proposed Yucca Mountain Repository

Swift, P.; van Luik, A.; January 2006; 15 pp.; In English

Report No.(s): DE2006-894819; SAND2006-5105C; No Copyright; Avail.: National Technical Information Service (NTIS)

The International Atomic Energy Agency (IAEA), in its advisory standard for geological repositories promulgated jointly with the Nuclear Energy Agency (NEA) of the Organization for Economic Co-operation and Development, explicitly distinguishes between the concepts of a safety case and a safety assessment. As defined in the advisory standard, the safety case is a broader set of arguments that provide confidence and substantiate the formal analyses of system safety made through the process of safety assessment. Although the IAEA's definitions include both preclosure (i.e., operational) safety and postclosure performance in the overall safety assessment and safety case, the emphasis in here is on longterm performance after waste has been emplaced and the repository has been closed. This distinction between pre- and postclosure aspects of the repository is consistent with the U.S. regulatory framework defined by the U.S. Environmental Protection Agency (Chapter 40 of the Code of Federal Regulations, Part 197, or 40 CFR 197) and implemented by the U.S. Nuclear Regulatory Commission (Chapter 10 of the Code of Federal Regulations, Part 63, or 10 CFR 63).

NTIS

Mountains; Radioactive Wastes; Safety; Waste Disposal

20070010489 Pacific Northwest National Lab., Richland, WA, USA

Dust Plume Modeling at Fort Bliss: Full Training Scenario

Chapman, E. G.; Rishel, J. P.; Rutz, F. C.; Seiple, T. E.; Newsom, R. K.; Sep. 2006; 102 pp.; In English

Report No.(s): DE2006-894873; PNNL-15935; No Copyright; Avail.: National Technical Information Service (NTIS)

The potential for air quality impacts from heavy mechanized vehicles operating in the training ranges and on the unpaved main supply routes at Fort Bliss is being investigated. The investigation uses the atmospheric modeling system DUSTRAN to simulate fugitive dust emission and dispersion from typical activities occurring on the installation. This report conveys the results of DUSTRAN simulations conducted using a 'Full Training' scenario developed by Fort Bliss personnel. The Full Training scenario includes simultaneous off-road activities of two full Heavy Brigade Combat Teams (HCBTs) and one HCBT battalion on three training ranges. Simulations were conducted for the six-day period, April 25-30, 2005, using previously archived meteorological records. Simulation results are presented in the form of 24-hour average PM10 plots and peak 1-hour PM10 concentration plots, where the concentrations represent contributions resulting from the specified military vehicular activities, not total ambient PM10 concentrations.

NTIS

Dust; Education; Plumes

20070010491 Pacific Northwest National Lab., Richland, WA, USA

Assessment of the 296-S-21 Stack Sampling Probe Location

Glissmeyer, J. A.; Sep. 2006; 215 pp.; In English

Report No.(s): DE2006-894875; PNNL-16014; No Copyright; Avail.: National Technical Information Service (NTIS)

This series of tests documents an assessment of how the current air-monitoring system for the 296-S-21 Stack meets the applicable regulatory criteria regarding the placement of the air-sampling probe. Pacific Northwest National Laboratory conducted the tests on a scale model of the stack. CH2MHill staff also conducted some confirmatory tests at the actual 291-S-21 stack. The standard governing the performance of the tests, test methods, and acceptance criteria is ANSI/HPS N13.1-1999, Sampling and Monitoring Releases of Airborne Radioactive Substances From the Stack and Ducts of Nuclear Facilities.

NTIS

Air Pollution; Pollution Monitoring; Position (Location); Sampling; Stacks

20070010496 Advanced Technology Systems, Inc., Pittsburgh, PA, USA, Ohio Univ., Athens, OH, USA, Texas A&M Univ., Kingsville, TX, USA

Database and Analytical Tool Development for the Management of Data Derived from US DOE (NETL) Funded Fine Particulate (PM_{2.5}) Research. Semi-Annual Technical Progress Report, August 12, 2005-February 11, 2006

Khosah, R. P.; Crawford, C. G.; Feb. 2006; 36 pp.; In English

Report No.(s): DE2006-894909; No Copyright; Avail.: National Technical Information Service (NTIS)

Advanced Technology Systems, Inc. (ATS) was contracted by the U. S. Department of Energy's National Energy Technology Laboratory (DOE-NETL) to develop a state-of-the-art, scalable and robust web-accessible database application to manage the extensive data sets resulting from the DOE-NETL-sponsored ambient air monitoring programs in the upper Ohio River valley region. The data management system was designed to include a web-based user interface that will allow easy access to the data by the scientific community, policy- and decision-makers, and other interested stakeholders, while providing detailed information on sampling, analytical and quality control parameters. In addition, the system will provide graphical analytical tools for displaying, analyzing and interpreting the air quality data. The system will also provide multiple report generation capabilities and easy-to-understand visualization formats that can be utilized by the media and public outreach/educational institutions.

NTIS

Air Pollution; Data Bases; Particulates; Pollution Monitoring

20070010548 Lawrence Livermore National Lab., Livermore, CA USA

Synthetic Event Reconstruction Experiments for Defining Sensor Network Characteristics

Lundquist, J. K.; Kosovic, B.; Belles, R.; Dec. 16, 2005; 34 pp.; In English

Report No.(s): DE2006-894010; UCRL-TR-217762; No Copyright; Avail.: National Technical Information Service (NTIS)

An event reconstruction technology system has been designed and implemented at Lawrence Livermore National Laboratory (LLNL). This system integrates sensor observations, which may be sparse and/or conflicting, with transport and dispersion models via Bayesian stochastic sampling methodologies to characterize the sources of atmospheric releases of hazardous materials. We demonstrate the application of this event reconstruction technology system to designing sensor networks for detecting and responding to atmospheric releases of hazardous materials. The quantitative measure of the reduction in uncertainty, or benefit of a given network, can be utilized by policy makers to determine the cost/benefit of certain networks. Herein we present two numerical experiments demonstrating the utility of the event reconstruction methodology for sensor network design. In the first set of experiments, only the time resolution of the sensors varies between three candidate networks. The most 'expensive' sensor network offers few advantages over the moderately-priced network for reconstructing the release examined here. The second set of experiments explores the significance of the sensors detection limit, which can have a significant impact on sensor cost. In this experiment, the expensive network can most clearly define the source location and source release rate. The other networks provide data insufficient for distinguishing between two possible clusters of source locations. When the reconstructions from all networks are aggregated into a composite plume, a decision-maker can distinguish the utility of the expensive sensor network.

NTIS

Air Pollution; Pollution Monitoring

20070010625 Pacific Northwest National Lab., Richland, WA, USA

Dust Plume Modeling at Fort Bliss Move-Out Operations, Combat Training and Wind Erosion

Chapman, F. G.; Rishel, J. P.; Ruitz, F. C.; Seiple, I. E.; Newsom, R. K.; Sep. 2006; 277 pp.; In English

Contract(s)/Grant(s): DEAC0576RL01830

Report No.(s): DE2006-895176; PNNL-16123; No Copyright; Avail.: National Technical Information Service (NTIS)

The potential for air-quality impacts from heavy mechanized vehicles operating in the training ranges and on the unpaved main supply routes at Fort Bliss was investigated. This report details efforts by the staff of Pacific Northwest National Laboratory for the Fort Bliss Directorate of Environment in this investigation. Dust emission and dispersion from typical activities, including move outs and combat training, occurring on the installation were simulated using the atmospheric modeling system DUSTRAN. Major assumptions associated with designing specific modeling scenarios are summarized, and results from the simulations are presented.

NTIS

Combat; Dust; Education; Plumes; Wind Erosion

20070010639 Savannah River National Lab., Aiken, SC, USA

Holdup Measurements for Visual Examination Gloveboxes at the Savannah River Site

Sep. 19, 2006; 9 pp.; In English

Report No.(s): DE2006-895042; No Copyright; Avail.: National Technical Information Service (NTIS)

Visual Examination (VE) gloveboxes are used at the Savannah River Site (SRS) to remediate transuranic waste (TRU) drums. Noncompliant items are removed before the drums undergo further characterization in preparation for shipment to the Waste Isolation Pilot Plant (WIPP). Maintaining the flow of drums through the remediation process is critical to the program's seven-days-per-week operation. Conservative assumptions are used to ensure that glovebox contamination from this continual operation is below acceptable limits. Holdup measurements are performed in order to confirm that these assumptions are conservative. High Cs-137 backgrounds in the VE glovebox areas preclude the use of a sodium iodide spectrometer, so a high-purity germanium (HPGe) detector, having superior resolution, is used. Plutonium-239 is usually the nuclide of interest; however, Pu-241, Np-237 (including its daughter Pa-233) and Pu-238 (if detected) are typically assayed. Cs-137 and Co-60 may also be detected but are not reported since they do not contribute to the Pu-239 Fissile Gram Equivalent or Pu-239 Equivalent Curies. HEPA filters, drums and waste boxes are also assayed by the same methodology. If--for example--the HEPA is contained in a stainless steel housing, attenuation corrections must be applied for both the filter and the housing. Dimensions, detector locations, materials and densities are provided as inputs to Ortec's ISOTOPIC software to estimate attenuation and geometry corrections for the measurement positions. This paper discusses the methodology, results and limitations of these measurements for different VE glovebox configurations.

NTIS

Grasslands; Handling Equipment; Rivers; Pilot Plants; Radioactive Wastes

20070010650 Westinghouse Savannah River Co., Aiken, SC, USA

Evaluating an Innovative Oxygen Sensor for Remote Subsurface Oxygen Measurements

Oct. 12, 2006; 48 pp.; In English

Report No.(s): DE2006-895044; WSRC-ST-100600247-REV-0; DEAC0996SR18500; No Copyright; Avail.: National Technical Information Service (NTIS)

Oxygen is a primary indicator of whether anaerobic reductive dechlorination and similar redox based processes contribute to natural attenuation remedies at chlorinated solvent contaminated sites. Thus, oxygen is a viable indicator parameter for documenting that a system is being sustained in an anaerobic condition. A team of researchers investigated the adaptation of an optical sensor that was developed for oceanographic applications. The optical sensor, because of its design and operating principle, has potential for extended deployment and sensitivity at the low oxygen levels relevant to natural attenuation. The results of the research indicate this tool will be useful for in situ long-term monitoring applications, but that the traditional characterization tools continue to be appropriate for characterization activities.

NTIS

Activity (Biology); Anaerobes; Gas Detectors; Oxygen; Remote Sensing

20070010661 Kentucky Univ., Lexington, KY, USA

Pilot Demonstration of Technology for the Production of High Value Materials from the Ultra-Fine (PM2.5) Fraction of Coal Combustion Ash. Semi-Annual Status Report January 21, 2006-July 20, 2006

Perrone, R. S.; Groppo, J. G.; Robl, T. L.; Aug. 30, 2006; 16 pp.; In English

Report No.(s): DE2006-894295; No Copyright; Avail.: National Technical Information Service (NTIS)

Three types of chemically and functionally different thermoplastic polymers have been chosen for evaluation with the fly ash derived filler: high density polyethylene (HDPE), thermoplastic elastomer (TPE) and polyethylene terephthalate (PET). The selections were based on volumes consumed in commercial and recycled products. The reference filler selected for

comparison was 3 micron calcium carbonate, a material which is commonly used with all three types of polymers. A procedure to prepare filled polymers has been developed and the polymer/filler blends have been prepared. Selected samples of filled polymers were subjected to SEM analysis to verify that the fly ash derived filler and the calcium carbonate were well dispersed.

NTIS

Ashes; Coal; Combustion; Dispersing

20070010685 University of Western Kentucky, Bowling Green, KY, USA

Establishment of an Environmental Control Technology Laboratory with a Circulating Fluidized-Bed Combustion System. Quarterly Technical Progress Report July 1-September 30, 2006

Pan, W.; Cheng, Z.; Cao, Y.; Smith, J.; Oct. 2006; 18 pp.; In English

Report No.(s): DE2006-894407; No Copyright; Avail.: National Technical Information Service (NTIS)

This report is to present the progress made on the project entitled Establishment of an Environmental Control Technology Laboratory (ECTL) with a Circulating Fluidized-Bed Combustion (CFBC) System during the period July 1, 2006 through September 30, 2006. The following activities have been completed: the steel floor grating around the riser in all levels and the three-phase power supply for CFBC System was installed. Erection of downcomers, loop seals, ash bunker, thermal expansion joints, fuel and bed material bunkers with load cells, rotary air-lock valves and fuel flow monitors is underway. Pilot-scale slipstream tests conducted with bromine compound addition were performed for two typical types of coal. The purposes of the tests were to study the effect of bromine addition on mercury oxidization. From the test results, it was observed that there was a strong oxidization effect for Powder River Basin (PRB) coal. The proposed work for next quarter and project schedule are also described.

NTIS

Circulation; Combustion; Environmental Control

20070010691 Pacific Northwest National Lab., Richland, WA, USA

300 Area Pacific Northwest National Laboratory Facility Radionuclide Emission Points and Sampling Systems

Barfuss, B. C.; Barnett, J. M.; Harbinson, L. J.; Aug. 2006; 128 pp.; In English

Report No.(s): DE2006-894474; PNNL-15992; No Copyright; Avail.: Department of Energy Information Bridge

Radionuclide emission points for 300 Area and Battelle Private facilities are presented herein. The sampling systems and associated emission specifics are detailed.

NTIS

Air Pollution; Pollution Monitoring; Radioactive Isotopes

20070010695 Environmental Protection Agency, Washington, DC USA, USA Department of Agriculture Forest Service, USA

SPRAYTRAN 1.0 User's Guide: A GIS-Based Atmospheric Spray Droplet Dispersion Modeling System

Allwine, K. J.; Rutz, F. C.; Droppo, J. G.; Rishel, J. P.; Chapman, E. G.; Sep. 2006; 74 pp.; In English

Report No.(s): DE2006-894470; No Copyright; Avail.: National Technical Information Service (NTIS)

SPRAY TRANsport (SPRAYTRAN) is a comprehensive dispersion modeling system that is used to simulate the offsite drift of pesticides from spray applications. SPRAYTRAN functions as a console application within Environmental System Research Institute's ArcMap Geographic Information System (Version 9.x) and integrates the widely-used, U.S. Environmental Protection Agency (EPA)-approved CALifornia PUFF (CALPUFF) dispersion model and model components to simulate longer-range transport and diffusion in variable terrain and spatially/temporally varying meteorological (e.g., wind) fields. Area sources, which are used to define spray blocks in SPRAYTRAN, are initialized using output files generated from a separate aerial-spray-application model called AGDISP (AGricultural DISPersal). The AGDISP model is used for estimating the amount of pesticide deposited to the spray block based on spraying characteristics (e.g., pesticide type, spray nozzles, and aircraft type) and then simulating the near-field (less than 300-m) drift from a single pesticide application. The fraction of pesticide remaining airborne from the AGDISP near-field simulation is then used by SPRAYTRAN for simulating longer-range (greater than 300 m) drift and deposition of the pesticide.

NTIS

Atmospheric Models; Drops (Liquids); Pesticides; Sprayers; Spraying

20070011191 Civil Engineer Squadron (00319th), Grand Forks AFB, ND USA

Final Environmental Assessment Demolition of Alpha Ramp, Grand Forks Air Force Base, North Dakota

Jan 2007; 142 pp.; In English; Original contains color illustrations

Report No.(s): AD-A462823; XC-319 CES/ND; No Copyright; Avail.: CASI: [A07](#), Hardcopy

The 319 ARW is proposing to demolish A-Ramp and its associated facilities and buildings. The purposes of the project are: to remove the A-Ramp facilities and infrastructure that are no longer needed; to remove excess buildings and utilities that represent sources of potential contamination; and to remove excess buildings and facilities (including walls) that are in the 7:1 flight envelope, clear zone, and 50:1 approach-departure clearance zone and require flight-line waivers. Subsequent to removal of the facilities, buildings, roads, and associated utilities within 6 feet of the ground surface, the area would be graded for erosion and drainage control; and revegetated to suitable hay grass. The land would become unimproved hay lease land; any future use of the A-Ramp area is as yet undetermined. This EA has been prepared to evaluate the Proposed Action, No Action Alternative, and Implementation Alternatives of the Proposed Action. The evaluation of environmental impacts determined that an Environmental Impact Statement was not needed. This EA was made available to the public for review and comment.

DTIC

Environmental Surveys; Military Air Facilities

46

GEOPHYSICS

Includes Earth structure and dynamics, aeronomy; upper and lower atmosphere studies; ionospheric and magnetospheric physics; and geomagnetism. For related information see *47 Meteorology and Climatology*; and *93 Space Radiation*.

20070009861 NASA Johnson Space Center, Houston, TX, USA

More on the Possible Composition of the Meridiani Hematite-Rich Concretions

Jolliff, B. L.; Gellert, R.; Mittlefehldt, D. W.; [2007]; 2 pp.; In English; Lunar and Planetary Science Conference, 12-16 Mar. 2007, Houston, TX, USA; Original contains color illustrations; Copyright; Avail.: CASI: [A01](#), Hardcopy

Elsewhere in these proceedings, Schneider et al. discuss compositional constraints on hematite-rich spherule (blueberry) formation at Meridiani Planum. Schneider et al. provide the background for work done to date to understand the composition and mineralogy of the spherules and devise a test of possible concretion growth processes. They also report the results of area analyses of spherules in targets analyzed with the Alpha Particle X-ray Spectrometer (APXS) and test several possible models for included components other than hematite. In this abstract, we use the compositional trends for spherule-rich targets to compute possible elemental compositions of the spherules. This approach differs from that of, which also used a determination of the area of spherules in APXS targets, coupled with a correction for the radial acceptance function, to try to un-mix the compositions directly, using 2 and 3-component models and mass balance. That approach contained a fair amount of uncertainty owing to problems associated with irregular and heterogeneous target geometry, unknown composition of non-spherule lithic components, and variable dust coatings on spherules. Since then, Opportunity has analyzed additional spherule-rich targets, and the compositional trends so obtained permit a more direct assessment of the data.

Derived from text

Hematite; Chemical Composition; Spherules; Mineralogy; Mass Distribution; Alpha Particles; Mars Surface

20070009871 NASA Johnson Space Center, Houston, TX, USA

Lu-Hf and Sm-Nd Isotopic Studies of Shergottites and Nakhilites: Implications for Martian Mantle Sources

Debaille, V.; Yin, Q.-Z.; Brandon, A. D.; Jacobsen, B.; Treiman, A. H.; [2007]; 2 pp.; In English; Lunar and Planetary Science Conference, 12-16 Mar. 2007, Houston, TX, USA; Original contains black and white illustrations; Copyright; Avail.:

CASI: [A01](#), Hardcopy

We present a new Lu-Hf and Sm-Nd isotope systematics study of four enriched shergottites (Zagami, Shergotty, NWA856 and Los Angeles), and three nakhilites (Nakhla, MIL03346 and Yamato 000593) in order to further understand processes occurring during the early differentiation of Mars and the crystallization of its magma ocean. Two fractions of the terrestrial petrological analogue of nakhilites, the Archaean Theo's flow (Ontario, Canada) were also measured. The coupling of Nd and Hf isotopes provide direct insights on the mineralogy of the melt sources. In contrast to Sm/Nd, Lu/Hf ratios can be very large

in minerals such as garnet. Selective partial melting of garnet bearing mantle sources can therefore lead to characteristic Lu/Hf signatures that can be recognized with Hf-176/Hf-177Hf ratios.

Author

Shergottites; Nakhilites; Hafnium Isotopes; Neodymium Isotopes; Achondrites; Crystallization; Planetary Mantles; Petrology; Mineralogy

20070009873 NASA Johnson Space Center, Houston, TX, USA

Osmium Isotope Systematics of Ureilites

Rankenburg, K.; Brandon, A. d.; Humayun, M.; [2007]; 31 pp.; In English; Copyright; Avail.: CASI: [A03](#), Hardcopy

The Os-187/Os-188 for twenty-two ureilite whole rock samples, including monomict, augite-bearing, and polymict lithologies, were examined in order to constrain the provenance and subsequent magmatic processing of the ureilite parent body (or bodies). The Re/Os ratios of most ureilites show evidence for a recent disturbance, probably related to Re mobility during weathering, and no meaningful chronological information can be extracted from the present data set. The ureilite Os-187/Os-188 ratios span a range from 0.11739 to 0.13018, with an average of 0.1258 \pm 0.0023 (1(sigma)), similar to typical carbonaceous chondrites, and distinct from ordinary or enstatite chondrites. The similar mean of Os-187/Os-188 measured for the ureilites and carbonaceous chondrites suggests that the ureilite parent body probably formed within the same region of the solar nebula as carbonaceous chondrites. From the narrow range of the 187Os/188Os distribution in ureilite meteorites it is further concluded that Re was not significantly fractionated from Os during planetary differentiation and was not lost along with the missing ureilitic melt component. The lack of large Re/Os fractionations requires that Re/Os partitioning was controlled by a metal phase, and thus metal had to be stable throughout the interval of magmatic processing on the ureilite parent body.

Author

Carbonaceous Chondrites; Ureilites; Osmium Isotopes; Lithology; Enstatite

20070009875 NASA Johnson Space Center, Houston, TX, USA

A Rb-Sr and Sm-Nd Isotope Geochronology and Trace Element Study of Lunar Meteorite LaPaz Icefield 02205

Rankenburg, K.; Brandon, A. D.; Norman, M. D.; [2007]; 44 pp.; In English; Copyright; Avail.: CASI: [A03](#), Hardcopy

Rubidium-strontium and samarium-neodymium isotopes of lunar meteorite LaPaz Icefield (LAP) 02205 are consistent with derivation of the parent magma from a source region similar to that which produced the Apollo 12 low-Ti olivine basalts followed by mixing of the magma with small amounts (1 to 2 wt%) of trace element-enriched material similar to lunar KREEP-rich sample SaU 169. The crystallization age of LAP 02205 is most precisely dated by an internal Rb-Sr isochron of 2991 \pm 14 Ma, with an initial Sr-87/Sr-88 at the time of crystallization of 0.699836 \pm 0.000010. Leachable REE-rich phosphate phases of LAP 02205 do not plot on a Sm-Nd mineral isochron, indicating contamination or open system behavior of the phosphates. Excluding anomalous phases from the calculation of a Sm-Nd isochron yields a crystallization age of 2992 \pm 85 (initial Epsilon Nd-143 = +2.9 \pm 0.8) that is within error of the Rb-Sr age, and in agreement with other independent age determinations for LAP 02205 from Ar-Ar and U-Pb methods. The calculated Sm-147/Nd-144 source ratios for LAP 02205, various Apollo 12 and 15 basalts, and samples with strong affinities to KREEP (SaU 169, NWA 773, 15386) are uncorrelated with their crystallization ages. This finding does not support the involvement of a common KREEP component as a heat source for lunar melting events that occurred after crystallization of the lunar magma ocean.

Author

Rubidium; Samarium Isotopes; Neodymium Isotopes; Strontium; Lunar Rocks; Meteorites; Crystallization; Geochronology

20070009878 NASA Johnson Space Center, Houston, TX, USA

Minor Elements in Nakhilite Pyroxenes: Does Cr Record Changes in REDOX Conditions during Crystallization?

McKay, G.; Schwandt, C.; Le, L.; Mikouchi, T.; [2007]; 2 pp.; In English; Lunar and Planetary Science Conference, 12-16 Mar. 2007, Houston, TX, USA; Original contains color illustrations; Copyright; Avail.: CASI: [A01](#), Hardcopy

Nakhilites are olivine-bearing clinopyroxene cumulates. Based on petrographic characteristics, they may be divided into groups that cooled at different rates and may have been formed at different depths in a single flow. The order of cooling rate from slowest to fastest is NWA998\hLafayette \h Governador Valadares approx. Nakhla \h Yamato000593 \h NWA817 approx. MIL03346. Nakhilite cumulus pyroxene grains consist of large cores that are nearly homogeneous in major element composition surrounded by thin rims that are zoned to Fe-rich compositions. Detailed study of these pyroxenes is important because they retain a record of the crystallization history of the nakhilite magma. Moreover, because the composition of the nakhilite parent melt cannot be directly determined, inversion of the major and minor element composition of the cumulate

pyroxene cores can be used to estimate the composition of that melt. Moreover, minor and trace element zoning of pyroxenes can provide information about the oxidation conditions under which these samples crystallized. Thus it is important to understand the major and minor element zoning in the cumulus pyroxenes. While major elements are nearly homogeneous, minor elements exhibit distinctive zoning patterns that vary from one nakhlite to another. This abstract reports unusual Cr zoning patterns in pyroxenes from MIL03346 (MIL) and contrast these with pyroxenes from Y593 and Nakhla.

Derived from text

Oxidation-Reduction Reactions; Inversions; Nakhrites; Olivine; Pyroxenes; Trace Elements; Crystallization; Magma

2007000929 NASA Johnson Space Center, Houston, TX, USA

Compositional Constraints on Hematite-Rich Spherule (Blueberry) Formation at Meridiani Planum, Mars

Schneider, A. L.; Mittlefehldt, D. W.; Gellert, R.; Jolliff, B.; [2007]; 2 pp.; In English; Lunar and Planetary Science Conference, 12-16 Mar. 2007, Houston, TX, USA; Original contains color illustrations; Copyright; Avail.: CASI: [A01](#),

Hardcopy

Meridiani Planum was chosen as the landing site for the Mars Exploration Rover Opportunity partially based on Mars Global Surveyor Thermal Emission Spectrometer data indicating an abundance of hematite. Hematite often forms through processes that involve water, so the site was a promising one to determine whether conditions on Mars were ever suitable for life. Opportunity struck pay dirt; its Miniature Thermal Emission Spectrometer (Mini-TES) and Mossbauer Spectrometer (MB) confirmed the presence of hematite in sulfate-rich sedimentary beds and in lag deposits. Meridiani Planum rocks contain three main components: silicate phases, sulfate and possibly chloride salts, and ferric oxide phases such as hematite. Primary igneous phases are at low abundance despite the basaltic origin of the protoliths. Jarosite, an alkali ferric sulfate, was identified by Mossbauer. Some of the hematite is contained in the spherules, and some resides in finer grains in outcrops. Mossbauer and Mini-TES data indicate that hematite is a dominant constituent of the spherules. Panoramic Camera (Pancam) and Microscopic Imager (MI) images of spherule interiors show that hematite is present throughout. The exact composition of the spherules is unknown. Mini-TES only identifies a hematite signature in the spherules; any other constituents have an upper limit of 5-10%. The MB data are consistent with the spherules being composed of only hematite.

Derived from text

Mars Exploration; Hematite; Spherules; Thermal Emission; Spectrometers; Mars Surface; Mars Environment; Sulfates

20070010667 NASA Johnson Space Center, Houston, TX, USA

Analysis of Cometary Dust Impact Residues in the Aluminum Foil Craters of Stardust

Graham, G. A.; Kearsley, A. T.; Vicenzi, E. P.; Teslich, N.; Dai, Z. R.; Rost, D.; Hoerz, F.; Bradley, J. P.; 2007; 2 pp.; In English; Lunar and Planetary Science Conference, 12-16 Mar. 2007, Houston, TX, USA; Original contains color and black and white illustrations

Contract(s)/Grant(s): W-7405-eng-48; NNH06AD67I; Copyright; Avail.: CASI: [A01](#), Hardcopy

In January 2006, the sample return capsule from NASA's Stardust spacecraft successfully returned to Earth after its seven year mission to comet Wild-2. While the principal capture medium for comet dust was low-density graded silica aerogel, the 1100 series aluminum foil (approximately 100 μ m thick) which wrapped around the T6064 aluminum frame of the sample tray assembly (STA) contains micro-craters that constitute an additional repository for Wild-2 dust. Previous studies of similar craters on spacecraft surfaces, e.g. the Long Duration Exposure Facility (LDEF), have shown that impactor material can be preserved for elemental and mineralogical characterization, although the quantity of impact residue in Stardust craters far exceeds previous missions. The degree of shock-induced alteration experienced by the Wild-2 particles impacting on foil will generally be greater than for those captured in the low-density aerogel. However, even some of the residues found in LDEF craters showed not only survival of crystalline silicates but even their solar flare tracks, which are extremely fragile structures and anneal at around 600 C. Laboratory hypervelocity experiments, using analogues of Wild-2 particles accelerated into flight-grade foils under conditions close to those of the actual encounter, showed retention of abundant projectile residues at the Stardust encounter velocity of 6.1 km/s. During the preliminary examination (PE) of the returned foils, using optical and electron microscopy studies, a diverse range in size and morphologies of micro-craters was identified. In this abstract we consider the state of residue preservation in a diverse range of craters with respect to their elemental composition and inferred mineralogy of the original projectiles.

Author

Cometary Atmospheres; Stardust Mission; Sample Return Missions; Metal Foils; Craters; Wild 2 Comet; Interplanetary Dust

20070010668 NASA Johnson Space Center, Houston, TX, USA

Stardust in STARDUST - the C, N, and O Isotopic Compositions of Wild 2 Cometary Matter in Al foil Impacts

Stadermann, Frank J.; Hoppe, Peter; Floss, Christine; Hoerz, Friedrich; Huth, Joachim; Kearsley, Anton T.; Leitner, Jan; Marhas, Kuljeet K.; McKeegan, Kevin D.; Stephan, Thomas; Heck, Philipp R.; [2007]; 46 pp.; In English; Original contains color and black and white illustrations

Contract(s)/Grant(s): NNG05GJ26G; STE 576/17-1; Copyright; Avail.: CASI: [A03](#), Hardcopy

In January 2006, the STARDUST mission successfully returned dust samples from the tail of comet 81P/Wild 2 in two principal collection media, low density silica aerogel and Al foil. While hypervelocity impacts at 6.1 km/s, the encounter velocity of STARDUST, into Al foils are generally highly disruptive for natural, silicate-dominated impactors, previous studies have shown that many craters retain sufficient residue to allow a determination of the elemental and isotopic compositions of the original projectile. We have used the NanoSIMS to perform C, N, and O isotope imaging measurements on four large (59-370 microns diameter) and on 47 small (0.32-1.9 microns diameter) Al foil impact craters as part of the STARDUST Preliminary Examination. Most analyzed residues in and around these craters are isotopically normal (solar) in their C, N, and O isotopic compositions. However, the debris in one large crater shows an average 15N enrichment of approx. 450 %, which is similar to the bulk composition of some isotopically primitive interplanetary dust particles. A 250 nm grain in another large crater has an O-17 enrichment with approx. 2.65 times the solar O-17/O-16 ratio. Such an O isotopic composition is typical for circumstellar oxide or silicate grains from red giant or asymptotic giant branch stars. The discovery of this circumstellar grain clearly establishes that there is authentic stardust in the cometary samples returned by the STARDUST mission. However, the low apparent abundance of circumstellar grains in Wild 2 samples and the preponderance of isotopically normal material indicates that the cometary matter is a diverse assemblage of presolar and solar system materials.

Author

Interplanetary Dust; Chemical Composition; Stardust Mission; Oxygen 17; Isotopic Labeling; Wild 2 Comet

20070010819 Little (Arthur D.), Inc., Cambridge, MA USA

Geotechnical Report Army Materials Technology Laboratory Watertown, Massachusetts

Lambe, Robert N; Aug 1988; 272 pp.; In English

Report No.(s): AD-A462363; No Copyright; Avail.: CASI: [A12](#), Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA462363>

As part of the remedial investigation and feasibility study being conducted at the Army Materials Technology Laboratory in Watertown, Massachusetts, Arthur D. Little, Inc., conducted a program of physical characterization and sampling of the site. The geology and hydrology of the site was summarized using data from 17 soil borings, one of which was cored 15 feet into bedrock, physical testing of soil samples, water level measurements and determination of in situ hydraulic conductivity from 16 monitor wells, a seismic refraction survey to determine depth to bedrock and stratigraphic variation, and two borehole geophysical surveys. Bedrock at the site consists of the Pennsylvanian Cambridge Argillite, a dense, finely laminated siltstone. The siltstone is overlain by a basal, bouldery till with a gray green, silt-rich sandy to gravelly matrix. Laying on top of the till is a laminated, silty sand found across the site, which is composed of moderately well sorted, very fine to fine-grained sand, with a clayey-silty matrix. Overlying the silty sand is a texturally variable layer of medium to coarse-grained sand and gravel, which is not found over the entire site. It is absent in the northwest corner of the site and grades to a gravelly sand eastward. The coarser sand-gravel unit is generally overlain by fill of disturbed gravel with exotic debris (concrete, brick, ceramic, etc.). Surface run-off across the site is to the south, toward the Charles River, which is within 100-400 feet of the site. Groundwater flow estimated by water level data, is to the south. The gradient averages 0.03 across the site, but in the southeast corner it decreases to 0.003. In situ hydraulic conductivities (k) were determined by falling head and rising head tests. For the silty sand, k ranges from $7.06 \times 10(\text{exp } -4)$ to $1.30 \times 10(\text{exp } -2)$ cm/sec and averages $6.4 \times 10(\text{exp } -2)$ cm/sec.

DTIC

Geophysics; Geotechnical Engineering; Ground Water; Hydrology

20070011095 Carnegie-Mellon Univ., Pittsburgh, PA USA

AutoMap User's Guide

Carley, Kathleen M; Diesner, Jana; De Reno, Matt; Oct 2006; 111 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): N00014-06-1-0772; N00014-06-1091

Report No.(s): AD-A462550; CMU-ISRI-06-114; No Copyright; Avail.: Defense Technical Information Center (DTIC)

AutoMap is software for computer-assisted Network Text Analysis (NTA). NTA encodes the links among words in a text

and constructs a network of the linked words. AutoMap subsumes classical Content Analysis by analyzing the existence, frequencies, and covariance of terms and themes.

DTIC

Autonomous Navigation; Computer Aided Design; Digital Data; Manuals; Maps

20070011144 Woods Hole Oceanographic Inst., MA USA

SeisCORK Engineering Design Study

Stephen, Ralph; Pettigrew, Tom; Pettitt, Jr, Robert; May 2006; 101 pp.; In English

Contract(s)/Grant(s): OCE-0221832; OCE-0450318

Report No.(s): AD-A462759; WHOI-2006-10; No Copyright; Avail.: CASI: [A06](#), Hardcopy

The goal of SeisCORK is to make simultaneous and co-located seismic, pressure, temperature, pore water chemistry and pore water biology measurements in the seafloor. We want to see the small events in the vicinity of the borehole for three reasons: (1) After an event, fluid may flow in the formation in response to the changing stress regime. Down to what magnitude of event do the pressure transients in the well respond? (2) Fluid flow causes small earthquakes. One mechanism, for example, is by changing the temperature of the rocks which expand and contract, altering the stress regime. We want to look for this fluid flow. (3) Laboratory studies or rock deformation show that shear fracture is preceded by the coalescence of interacting tensile microcracks which are observed as 'acoustic emissions.' By placing high frequency geophones next to faults it may be possible to observe these 'acoustic' precursors to rock failure.

DTIC

Earthquakes; Measurement; Microcracks; Seismology

47

METEOROLOGY AND CLIMATOLOGY

Includes weather observation forecasting and modification.

20070009691 National Oceanic and Atmospheric Administration, Boulder, CO, USA

Scientific Rationale for the Placement of Sites to Monitor the Surface Energy Budget for Climate Applications

Augustine, J.; Dutton, E. G.; Meyers, T.; Michalsky, J.; Oct. 2006; 22 pp.; In English

Report No.(s): PB2007-103352; NOAA/TM/OAR/GMD-17; No Copyright; Avail.: National Technical Information Service (NTIS)

Long-term monitoring of climate forcing and associated climatic signatures at acceptable levels of accuracy is necessary to not only detect climate change but to help in understanding the fundamental processes that enable regional and global modeling activities to provide credible future predictions. By observing actual components of the surface energy budget (SEB), comparisons can be made with theoretically predicted values for parameters responsible for driving the entire global atmospheric and oceanic circulation system. In a recent book from the National Academy of Sciences Board of Atmospheric Science and Climate (BASC), one of the recommendations for improving the observational record was to 'Explore the value of creating a network of surface sites that provide representative monitoring of the surface energy budget' (NRC, 2005). This recommendation stems from an understanding that climate forcing can be due to non-atmospheric factors such as land use changes and responses directly affect how much energy, and in what form (sensible or latent), is transferred to the atmosphere. The fundamental forcing of climate and the driving components of the surface energy budget, solar and thermal radiation, have been identified as essential climate variables by the Global Climate Observing System (GCOS) and adopted by the Global Earth Observation System of Systems (GEOSS). It is, therefore, imperative that appropriate and adequate observations of these variables be made by NOAA to fulfill the nation's commitment to these international efforts.

NTIS

Energy Budgets; Surface Energy; Climate Models

20070009700 Intelligent Management Systems, LLC, Henderson, NV, USA

Ground-Based or Airborne Scanning Radiometer with Precision All-Weather Calibration

Klein, M.; Gaslewski, A. J.; 25 May 05; 9 pp.; In English

Patent Info.: Filed Filed 25 May 05; US-Patent-Appl-SN-10-907-258

Report No.(s): PB2007-101451; No Copyright; Avail.: CASI: [A02](#), Hardcopy

This invention describes a design of a structure that allows microwave radiometers to be calibrated under all conditions of weather and atmospheric fallout. The thermal emission standards radiating surfaces are kept free of hydrometeors (liquid

water, ice, or snow), dust, dirt, soot, oils, ash, or other organic and inorganic matter during extended operation. Meanwhile, the radiometer are allowed an unobstructed view of scene under observation, for example, the entire sky from horizon to horizon as well as most of the ground underneath. The effects of any attenuating or scattering matter that accumulates on the elements of the beam forming system are compensated for since the thermal emission standards are viewed in front of the first element of beam forming system (e.g. lens, radome, protective window). In this manner the same amount of dirt, hydrometeors, etc. on radiometer first element of beam forming system as present during the viewing of the scene under observation will be present during calibration. The thermal emission standards' radiating surfaces are kept clean and free of attenuating or scattering matter, thus the precision, stability, and radiation characteristics of thermal reference are maintained.

NTIS

Airborne Equipment; Calibrating; Microwave Radiometers; Precision; Radiometers

20070009727 Naval Research Lab., Washington, DC USA

A Nonlinear Optimization Algorithm for WindSat Wind Vector Retrievals

Bettenhausen, Michael H; Smith, Craig K; Bevilacqua, Richard M; Wang, Nai-Yu; Gaiser, Peter W; Cox, Stephen; Mar 2006; 15 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): N000WX-05-7-3003

Report No.(s): AD-A462113; No Copyright; Avail.: CASI: [A03](#), Hardcopy

WindSat is a space-based polarimetric microwave radiometer designed to demonstrate the capability to measure the ocean surface wind vector using a radiometer. We describe a nonlinear iterative algorithm for simultaneous retrieval of sea surface temperature, columnar water vapor, columnar cloud liquid water, and the ocean surface wind vector from WindSat measurements. The algorithm uses a physically based forward model function for the WindSat brightness temperatures. Empirical corrections to the physically based model are discussed. We present evaluations of initial retrieval performance using a six-month dataset of WindSat measurements and collocated data from other satellites and a numerical weather model. We focus primarily on the application to wind vector retrievals.

DTIC

Algorithms; Nonlinearity; Radiometers; Wind Direction; Wind Velocity

20070009789 NASA Langley Research Center, Hampton, VA, USA

GIFTS EDU Ground-based Measurement Experiment

Zhou, Daniel K.; Smith, W. L., Sr.; Zollinger, L. J.; Huppi, R. J.; Reisse, R. A.; Larar, A. M.; Liu, X.; Tansock, J. J., Jr.; Jensen, S. M.; Revercomb, H. E.; Feltz, W. F.; Bingham, G. E.; [2007]; 3 pp.; In English; Hyperspectral Imaging and Sounding of the Environment Topical Meeting and Tabletop Exhibit (HISE), 11-15 Feb. 2007, Santa Fe, NM, USA; Original contains color illustrations

Contract(s)/Grant(s): WBS 509496.02.01.01.03; Copyright; Avail.: CASI: [A01](#), Hardcopy

Geosynchronous Imaging Fourier Transform Spectrometer (GIFTS) Engineering Demonstration Unit (EDU) is an imaging infrared spectrometer designed for atmospheric soundings. The EDU groundbased measurement experiment was held in Logan, Utah during September 2006 to demonstrate its extensive capabilities for geosynchronous and other applications.

Author

Forecasting; Fourier Transformation; Imaging Spectrometers; Temperature Measurement; Atmospheric Temperature; Atmospheric Circulation

20070009922 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Evaluating Clouds in Long-Term Cloud-Resolving Model Simulations with Observational Data

Zeng, Xiping; Tao, Wei-Kuo; Zhang, Minghua; Peters-Lidard, Christa; Lang, Stephen; Simpson, Joanne; Kumar, Sujay; Xie, Shaoheng; Eastman, Joseph L.; Shie, Chung-Lin; Geiger, James V.; May 03, 2006; 62 pp.; In English; Original contains black and white illustrations; Copyright; Avail.: CASI: [A04](#), Hardcopy

Two 20-day, continental midlatitude cases are simulated with a three-dimensional (3D) cloud-resolving model (CRM) and compared to Atmospheric Radiation Measurement (ARM) data. This evaluation of long-term cloud-resolving model simulations focuses on the evaluation of clouds and surface fluxes. All numerical experiments, as compared to observations, simulate surface precipitation well but over-predict clouds, especially in the upper troposphere. The sensitivity of cloud properties to dimensionality and other factors is studied to isolate the origins of the over prediction of clouds. Due to the difference in buoyancy damping between 2D and 3D models, surface precipitation fluctuates rapidly with time, and spurious dehumidification occurs near the tropopause in the 2D CRM. Surface fluxes from a land data assimilation system are compared

with ARM observations. They are used in place of the ARM surface fluxes to test the sensitivity of simulated clouds to surface fluxes. Summertime simulations show that surface fluxes from the assimilation system bring about a better simulation of diurnal cloud variation in the lower troposphere.

Author

Cloud Physics; Clouds (Meteorology); Simulation; Three Dimensional Models; Data Acquisition

20070010448 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Regional and Global Aspects of Aerosols in Western Africa: From Air Quality to Climate

Chin, Mian; Diehl, Thomas; Kucsera, Tom; Spinhime, Jim; Palm, Stephen; Holben, Brent; Ginoux, Paul; [2006]; 1 pp.; In English; Joint CACGP/IGAC/WMO Symposium: Atmospheric Chemistry at the Interfaces 2006, 9-24 Sep. 2006, Cape Town, South Africa; No Copyright; Avail.: Other Sources; Abstract Only

Western Africa is one of the most important aerosol source regions in the world. Major aerosol sources include dust from the world's largest desert Sahara, biomass burning from the Sahel, pollution aerosols from local sources and long-range transport from Europe, and biogenic sources from vegetation. Because these sources have large seasonal variations, the aerosol composition over the western Africa changes significantly with time. These aerosols exert large influences on local air quality and regional climate. In this study, we use the Goddard Chemistry Aerosol Radiation and Transport (GOCART) model to analyze satellite lidar data from the GLAS instrument on the ICESat and the sunphotometer data from the ground-based network AERONET taken in both the wet (September - October 2003) and dry (February - March 2004) seasons over western Africa. We will quantify the seasonal variations of aerosol sources and compositions and aerosol spatial (horizontal and vertical) distributions over western Africa. We will also assess the climate impact of western African aerosols. Such studies will be applied to support the international project, Africa Monsoon Multidisciplinary Analysis (AMMA) and to analyze the AMMA data.

Author

Aerosols; Air Quality; Climate; Dust; Biomass Burning

20070010449 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Intercontinental Transport of Aerosols: Implication for Regional Air Quality

Chin, Mian; Diehl, Thomas; Ginoux, Paul; [2006]; 1 pp.; In English; Joint CACGP/IGAC/WMO Symposium: Atmospheric Chemistry at the Interfaces 2006, 9-24 Sep. 2006, Cape Town, South Africa; No Copyright; Avail.: Other Sources; Abstract Only

Aerosol particles, also known as PM_{2.5} (particle diameter less than 2.5 microns) and PM₁₀ (particle diameter less than 10 microns), is one of the key atmospheric components that determine ambient air quality. Current US air quality standards for PM₁₀ (particles with diameter \leq 10 microns) and PM_{2.5} (particles with diameter \leq 2.5 microns) are 50 $\mu\text{g}/\text{m}^3$ and 15 $\mu\text{g}/\text{m}^3$, respectively. While local and regional emission sources are the main cause of air pollution problems, aerosols can be transported on a hemispheric or global scale. In this study, we use the Goddard Chemistry Aerosol Radiation and Transport (GOCART) model to quantify contributions of long-range transport vs. local/regional pollution sources and from natural vs. anthropogenic sources to PM concentrations different regions. In particular, we estimate the hemispheric impact of anthropogenic sulfate aerosols and dust from major source areas on other regions in the world. The GOCART model results are compared with satellite remote sensing and ground-based network measurements of aerosol optical depth and concentrations.

Author

Aerosols; Air Pollution; Air Quality; Radiation Transport; Satellite Observation

20070010480 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Online Simulations and Forecasts of the Global Aerosol Distribution in the NASA GEOS-5 Model

Colarco, Peter; [2006]; 1 pp.; In English; Joint CACGP/IGAC/WMO Symposium: Atmospheric Chemistry at the Interfaces 2006, 9-24 Sep. 2006, Cape Town, South Africa; No Copyright; Avail.: Other Sources; Abstract Only

We present an analysis of simulations of the global aerosol system in the NASA GEOS-5 transport, radiation, and chemistry model. The model includes representations of all major tropospheric aerosol species, including dust, sea salt, black carbon, particulate organic matter, and sulfates. The aerosols are run online for the period 2000 through 2005 in a simulation driven by assimilated meteorology from the NASA Goddard Data Assimilation System. Aerosol surface mass concentrations are compared with existing long-term surface measurement networks. Aerosol optical thickness is compared with ground-based AERONET sun photometry and space-based retrievals from MODIS, MISR, and OMI. Particular emphasis is

placed here on consistent sampling of model and satellite aerosol optical thickness to account for diurnal variations in aerosol optical properties. Additionally, we illustrate the use of this system for providing chemical weather forecasts in support of various NASA and community field missions.

Author

Aerosols; Troposphere; Radiation Chemistry; Optical Thickness; Meteorology; MODIS (Radiometry)

20070010482 NASA Goddard Space Flight Center, Greenbelt, MD, USA

The Ozone Budget in the Upper Troposphere from Global Modeling Initiative (GMI) Simulations

Rodriguez, J.; Duncan, Bryan N.; Logan, Jennifer A.; [2006]; 1 pp.; In English; Joint CACGP/IGAC/WMO Symposium: Atmospheric Chemistry at the Interfaces 2006, 9-24 Sep. 2006, Cape Town, South Africa; Copyright; Avail.: Other Sources; Abstract Only

Ozone concentrations in the upper troposphere are influenced by in-situ production, long-range tropospheric transport, and influx of stratospheric ozone, as well as by photochemical removal. Since ozone is an important greenhouse gas in this region, it is particularly important to understand how it will respond to changes in anthropogenic emissions and changes in stratospheric ozone fluxes. This response will be determined by the relative balance of the different production, loss and transport processes. Ozone concentrations calculated by models will differ depending on the adopted meteorological fields, their chemical scheme, anthropogenic emissions, and treatment of the stratospheric influx. We performed simulations using the chemical-transport model from the Global Modeling Initiative (GMI) with meteorological fields from (1) the NASA Goddard Institute for Space Studies (GISS) general circulation model (GCM), (2) the atmospheric GCM from NASA's Global Modeling and Assimilation Office (GMAO), and (3) assimilated winds from GMAO. These simulations adopt the same chemical mechanism and emissions, and adopt the Synthetic Ozone (SYNOZ) approach for treating the influx of stratospheric ozone. In addition, we also performed simulations for a coupled troposphere-stratosphere model with a subset of the same winds. Simulations were done for both 4degx5deg and 2degx2.5deg resolution. Model results are being tested through comparison with a suite of atmospheric observations. In this presentation, we diagnose the ozone budget in the upper troposphere utilizing the suite of GMI simulations, to address the sensitivity of this budget to: a) the different meteorological fields used; b) the adoption of the SYNOZ boundary condition versus inclusion of a full stratosphere; c) model horizontal resolution. Model results are compared to observations to determine biases in particular simulations; by examining these comparisons in conjunction with the derived budgets, we may pinpoint deficiencies in the representation of chemical/dynamical processes.

Author

Ozone; Troposphere; Atmospheric General Circulation Models; Meteorological Parameters; Reaction Kinetics; Greenhouse Effect; Boundary Conditions; Atmospheric Composition

20070010483 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Discoveries from EOS Aura

Douglass, Anne; [2006]; 1 pp.; In English; No Copyright; Avail.: Other Sources; Abstract Only

Aura, the third and final of three large observatories that are part of NASA's Earth Observing System, was launched July 15, 2004. Aura carries four instruments - the Microwave Limb Sounder (MLS), the Tropospheric Emission Spectrometer (TES), the Ozone Monitoring Instrument (OMI) and the High Resolution Dynamics Limb Sounder (HIRDLS), all of which measure atmospheric constituents. Aura measurements provide information to address broad questions about the Earth atmosphere, particularly concerning the recovery of the stratospheric ozone layer, tropospheric air quality, and climate change. TES has made the simultaneous measurements of carbon monoxide and ozone in the lower and upper troposphere. OMI continues to observe the total ozone column and measures columns of important pollutants like NO₂ at unprecedented horizontal resolution and coverage. MLS measures profiles of stratospheric ozone and constituents that affect ozone from the mesosphere into the upper troposphere. This talk will highlight results from Aura's first years in orbit, and will emphasize the way information from Aura and other satellites has contributed to the development, evaluation, and application of global chemistry climate models.

Author

Earth Observing System (EOS); Climate Models; Atmospheric Composition; Air Quality; Climate Change; Troposphere; Mesosphere; Ozone

20070010484 NASA Goddard Space Flight Center, Greenbelt, MD, USA

When will the Antarctic Ozone Hole Recover?

Newman, Paul A.; Nash, Eric R.; Kawa, S. Randolph; Montzka, Steve; [2006]; 1 pp.; In English; Copyright; Avail.: Other Sources; Abstract Only

The Antarctic ozone hole develops each year and culminates by early Spring. Antarctic ozone values have been monitored since 1979 using satellite observations from the TOMS instrument. The severity of the hole has been assessed from TOMS using the minimum total ozone value from the October monthly mean (depth of the hole) and by calculating the average size during the September-October period. Ozone is mainly destroyed by halogen catalytic cycles, and these losses are modulated by temperature variations in the collar of the polar lower stratospheric vortex. In this presentation, we show the relationships of halogens and temperature to, both the size and depth of the hole. Because atmospheric halogen levels are responding to international agreements that limit or phase out production, the amount of halogens in the stratosphere should decrease over the next few decades. Using projections of halogen levels combined with age-of-air estimates, we find that the ozone hole is recovering at an extremely slow rate and that large ozone holes will regularly recur over the next 2 decades. The ozone hole will begin to show first signs of recovery in about 2023, and the hole will fully recover to pre-1980 levels in approximately 2070. This 2070 recovery is 20 years later than recent projections.

Author

Total Ozone Mapping Spectrometer; Antarctic Regions; Ozone Depletion; Satellite Observation; Atmospheric Temperature; Air Pollution

20070010490 NASA Langley Research Center, Hampton, VA, USA

The CALIPSO Mission and Initial Observations of Aerosols and Clouds from CALIOP

Winker, David M.; [2007]; 3 pp.; In English; Hyperspectral Imaging and Sounding of the Environment Topical Meeting and Tabletop Exhibit (HISE), 11-15 Feb. 2007, Santa Fe, NM, USA; Original contains color illustrations; No Copyright; Avail.: CASI: [A01](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20070010490>

Launched in April 2006, the CALIPSO satellite provides unique global measurements of aerosols and clouds using a two-wavelength polarization lidar. This paper discusses mission status, instrument performance, and initial results.

Author

Aerosols; Optical Radar; Pulsed Lasers; Infrared Radiation; Climate

20070010556 Department of Energy, Washington, DC, USA

ARM Climate Research Facility Annual Report - 2005

January 2006; 48 pp.; In English

Report No.(s): DE2006-876681; DOE/SC-ARM-0507; No Copyright; Avail.: National Technical Information Service (NTIS)

Through the Atmospheric Radiation Measurement (ARM) Program, the DOE funded the development of several highly instrumented ground stations for studying cloud formation processes and their influence on radiative transfer, and for measuring other parameters that determine the radiative properties of the atmosphere. This scientific infrastructure, and resultant data archive, is a valuable national and international asset for advancing scientific knowledge of Earth systems. In fiscal year (FY) 2003, the DOE designated ARM sites as a national scientific user facility: the ARM Climate Research (ACRF). The ACRF has enormous potential to contribute to a wide range interdisciplinary science in areas such as meteorology, atmospheric aerosols, hydrology, biogeochemical cycling, and satellite validation, to name only a few.

NTIS

Atmospheric Radiation; Climate; Radiative Transfer; Research Facilities

20070010567 National Renewable Energy Lab., Golden, CO USA

Real Time Weather Data Access Guide. Updated February 2006

Long, N.; Mar. 01, 2006; 16 pp.; In English

Report No.(s): DE2006-895249; NREL/BR-550-34303; No Copyright; Avail.: National Technical Information Service (NTIS)

The format of the weather data received from the National Weather Service is extremely inconvenient for building engineers to read, especially for trending historical data; therefore, a weather parsing program was created by NREL building engineers to simplify the data. The weather-parsing program collects current weather conditions for over 4,000 sites around the world and allows access to the data via a web page designed by NREL building researchers. The database provides data for some locations from late 1998 through today. Users can request data to be sent to them via e-mail by using the interactive web page.

NTIS

Real Time Operation; Meteorology

20070010575 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Anomalies in the South American Monsoon Induced by Aerosols

Lau, K. M. William; Kyu-Mong, Kim; [2007]; 1 pp.; In English; 8th International Conference on Southern Hemisphere Meteorology and Oceanography, 22-29 Apr. 2006, Fo do Iguacu, Brazil; No Copyright; Avail.: Other Sources; Abstract Only

We have investigated the direct effects of aerosols on the water cycle of the South American monsoon using the NASA finite-volume general circulation model (fvGCM). Global aerosol forcings are computed from radiative transfer functions derived from global distributions of five species of aerosols, i.e., dust, black carbon, organic carbon, sulphate and sea salt from the Goddard Chemistry Aerosol Radiation Transport (GOCART) model. Comparing fvGCM experiments without aerosol forcing, and with different combinations of aerosol forcing, we evaluate the impacts of aerosol direct heating on the onset, maintenance and evolution of the South American summer monsoon. We find that during the pre-monsoon season (September-October-November) Saharan dust contribute to heating of the atmosphere over the central and eastern equatorial Atlantic/Africa region through the elevated heat pump mechanism. The heating generates an anomalous Walker circulation with sinking motion, and low level northeasterlies over the Caribbean and northwestern South America. The low level flow is blocked by the Andes, and turn south and southeastward, increasing the low level jet (LLJ) along the eastern slope of the Andes. The increased LLJ transports more moisture from the Atlantic and the Amazon, enhancing the moisture convergence over subtropical land regions of South America. The moisture convergence was further accelerated by atmospheric heating by biomass burning over the Amazon. The net results of the dust and biomass heating are: a) an advance of the monsoon rainy season, b) an enhanced LLJ and c) a shifting the South America monsoon land precipitation equatorward, with increased rain over southern Brazil and reduced rain over the La Plata basin. ramifications of this elevated heating heat pump mechanism in aerosol monsoon water cycle on climate variability and change will be discussed. The ramifications of this 'elevated heating heat pump' mechanism in aerosol monsoon water cycle on climate variability and change will be discussed.

Author

Aerosols; Anomalies; Monsoons; South America; Precipitation (Meteorology); Hydrological Cycle

20070010576 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Characterizing Diurnal and Seasonal Cycles in Monsoon Systems from TRMM and CEOP Observations

Lau, William K. M.; [2007]; 1 pp.; In English; Winter MONEX: A Quarter Century and Beyond, 4-7 Apr. 2006, Kuala Lumpur, Malaysia; No Copyright; Avail.: Other Sources; Abstract Only

The CEOP Inter-Monsoon Study (CIMS) is one of the two main science drivers of CEOP that aims to (a) provide better understanding of fundamental physical processes in monsoon regions around the world, and (b) demonstrate the synergy and utility of CEOP data in providing a pathway for model physics evaluation and improvement. As the data collection phase for EOP-3 and EOP-4 is being completed, two full annual cycles (2003-2004) of research-quality data sets from satellites, reference sites, and model output location time series (MOLTS) have been processed and made available for data analyses and model validation studies. This article presents preliminary results of a CIMS study aimed at the characterization and intercomparison of all major monsoon systems. The CEOP reference site data proved its value in such exercises by being a powerful tool to cross-validate the TRMM data, and to intercompare with multi-model results in ongoing work. We use 6 years (1998-2003) of pentad CEOP/TRMM data with 2 deg x 2.5 deg. latitude-longitude grid, over the domain of interests to define the monsoon climatological diurnal and annual cycles for the East Asian Monsoon (EAM), the South Asian Monsoon (SAM), the West Africa Monsoon (WAM), the North America/Mexican Monsoon (NAM), the South American Summer Monsoon (SASM) and the Australian Monsoon (AUM). As noted, the TRMM data used in the study were cross-validated using CEOP reference site data, where applicable. Results show that the observed diurnal cycle of rain peaked around late afternoon over monsoon land, and early morning over the oceans. The diurnal cycles in models tend to peak 2-3 hours earlier than observed. The seasonal cycles of the EAM and SAM show the strongest continentality, i.e, strong control by continental processes away from the ITCZ. The WAM, and the AUM shows the less continentality, i.e, strong control by the oceanic ITCZ.

Author

Climatology; Diurnal Variations; Monsoons; TRMM Satellite; Annual Variations

20070010690 Corps of Engineers, Vicksburg, MS, USA

ARAMS/Frames Joint Frequency Data (JFD) Generator. An Interface Based on a Revised Version of the EPA STAR Meteorological Joint Frequency Program

Droppo, J. G.; Pelton, M. A.; Sep. 2006; 91 pp.; In English

Report No.(s): DE2006-894479; PNNL-16149; No Copyright; Avail.: Department of Energy Information Bridge

An ARAMS/Frames utility entitled 'Joint Frequency Data (JFD) Generator' provides the capability of creating joint

frequency tables. The resultant JFD tables contain summaries of the frequency of occurrence of meteorological dispersion, wind speed, and wind direction that are required as input in climatological air dispersion models. The JFD Generator computations are made by an updated version of the EPA STAR (STAbility ARray) program. Surface observations are combined with computed seasonally and diurnally varying solar flux rates to estimate the ambient atmospheric dispersion rates, represented as a stability category. The wind speeds and directions are obtained directly from the hourly surface observation data. The product is a file in a format that can be directly read by an air dispersion model. The JFD Generator can input hourly meteorological surface observation data in CD-144, Samson, and SCRAM data formats. An enhanced joint frequency table file that can be read directly by the ARAMS/FRAMES interface is produced. The output file has a format can be used by the MEPAS air dispersion program or can be modified for input to other models requiring joint frequency input.

NTIS

Meteorological Parameters; Tables (Data); Frequencies

20070011116 Naval Postgraduate School, Monterey, CA USA

The Military and Domestic Disaster Response: Lead Role Revealed Through the Eye of Hurricane Katrina?

Walker, Juliana M; Dec 2006; 127 pp.; In English; Original contains color illustrations

Report No.(s): AD-A462715; No Copyright; Avail.: CASI: [A07](#), Hardcopy

The traditional role of the active-duty military force at home is one of support to a civilian Lead Federal Agency (LFA) that primarily falls under the Department of Homeland Security (DHS). During emergencies military domestic assistance is historically provided when local state and federal resources have been overwhelmed. During and in the aftermath of Hurricane Katrina however the slow and perceived inept response to the massive disaster prompted a national debate on the appropriate role of the military in major domestic disasters. Many concerned with the federal response to Katrina believed that America's homeland security system could not aptly respond to a large- scale natural or man-made catastrophe without the military in a lead role. Defining the roles and understanding the responsibilities of the Department of Defense (DOD) within the National Response Plan (NRP) is an important first step toward an effectively coordinated Federal disaster response. The purpose of this research is to explore the role of the active-duty military in domestic disaster response using Hurricane Katrina to determine if the DOD and DHS response was implemented according to the NRP. This research will help to explain the role that the military plays in supporting the civilian LFA in disaster response.

DTIC

Disasters; Eye (Anatomy); Hurricanes

20070011127 Naval Postgraduate School, Monterey, CA USA

Increasing Range and Lethality of Extended-Range Munitions (ERMS) using Numerical Weather Prediction (NWP) and the AUV Workbench to Compute a Ballistic Correction (BALCOR)

Wahl, Douglas T; Dec 2006; 147 pp.; In English; Original contains color illustrations

Report No.(s): AD-A462735; No Copyright; Avail.: CASI: [A07](#), Hardcopy

Extended-Range Munitions (ERMs) are gun-launched rocket-boosted munitions having an effective range over 27 km. In accordance with Sea Power 21 and the Marine Corps requirements for sea-based fire support, three ERMs are being developed. The purpose of this work is to increase the range and lethality of these munitions by applying environmental effects when computing the projectiles trajectory. A broad review of artillery and munitions literature reveals that historically 66% of ballistic error can be attributed to meteorological factors. The most important factors are wind (speed and direction), temperature, and pressure. It has also been shown that global atmospheric numerical weather prediction (NWP) data typically outperforms the traditional radiosonde data and is suitable for use in ballistic corrections. Forecasted NWP products provided by the Fleet Numerical Meteorology and Oceanographic Center (FNMOC) are integrated using the Joint Meteorology and Oceanographic (METOC) Broker Language (JMBL) into a Five-Degree of Freedom (5DOF) aerodynamic model within the Autonomous Unmanned Vehicle (AUV) Workbench producing a ballistic correction (BALCOR) for the munition. This new capability can significantly enhance naval gunfire effectiveness since the BALCOR increase the munitions range and the ability apply kinetic energy onto the target rather than using it to maneuver to the target.

DTIC

Correction; Lethality; Mathematical Models; Numerical Weather Forecasting; Projectiles

20070011397 NASA Goddard Space Flight Center, Greenbelt, MD, USA

A Coupled GCM-Cloud Resolving Modeling System, and a Regional Scale Model to Study Precipitation Processes

Tao, Wei-Kuo; [2007]; 1 pp.; In English; International Workshop on High resolution and Cloud Modeling, 2-5 Oct. 2006, Kusatsu, Japan; No Copyright; Avail.: Other Sources; Abstract Only

Recent GEWEX Cloud System Study (GCSS) model comparison projects have indicated that cloud-resolving models (CRMs) agree with observations better than traditional single-column models in simulating various types of clouds and cloud systems from different geographic locations. Current and future NASA satellite programs can provide cloud, precipitation, aerosol and other data at very fine spatial and temporal scales. It requires a coupled global circulation model (GCM) and cloud-scale model (termed a superparameterization or multi-scale modeling framework, MMF) to use these satellite data to improve the understanding of the physical processes that are responsible for the variation in global and regional climate and hydrological systems. The use of a GCM will enable global coverage, and the use of a CRM will allow for better and more sophisticated physical parameterization. NASA satellite and field campaign cloud related datasets can provide initial conditions as well as validation for both the MMF and CRMs. The Goddard MMF is based on the 2D Goddard Cumulus Ensemble (GCE) model and the Goddard finite volume general circulation model (fvGCM), and it has started production runs with two years results (1998 and 1999). Also, at Goddard, we have implemented several Goddard microphysical schemes (2ICE, several 3ICE), Goddard radiation (including explicitly calculated cloud optical properties), and Goddard Land Information (LIS, that includes the CLM and NOAH land surface models) into a next generation regional scale model, WRF. In this talk, I will present: (1) A brief review on GCE model and its applications on precipitation processes (microphysical and land processes), (2) The Goddard MMF and the major difference between two existing MMFs (CSU MMF and Goddard MMF), and preliminary results (the comparison with traditional GCMs), and (3) A discussion on the Goddard WRF version (its developments and applications).

Author

Atmospheric Models; Climatology; Cloud Physics; Clouds (Meteorology); Scale Models; Simulation

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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*.

20070010001 NorthWest Research Associates, Inc., Bellevue, WA, USA

A New Sea Ice Model: Pancakes to Metrics

Coon, M.; Kwok, R.; Pruis, M.; Levy, G.; Schreyer, H. L.; Sulsky, D.; Toudal, L.; [2007]; 1 pp.; In English

Contract(s)/Grant(s): NNNH04CC45C

Report No.(s): H23I-03; Copyright; Avail.: Other Sources; Abstract Only

We are developing, testing, and validating a new sea ice dynamics model that treats the ice cover as an elastic/decohesive material in the permanent pack and includes the correct frazil/pancake behavior in the marginal zone. Two salient features of present ice dynamics models are that they do not: 1) reproduce the oriented fracture patterns of openings and closings in the pack ice, and 2) accurately model the effects of frazil/pancake ice formation in the ice margin. These poorly modeled areas account for a substantial portion of the ice growth, turbulent heat flux to the atmosphere, salt flux to the ocean, and energy dissipation due to slippage, ridging, and rafting, in the Arctic. Existing sea ice models have shown limited success in predicting the degree to which a lead will open for prescribed or observed forcing conditions. An important aspect of the new model we are developing is that the existence of cracks, along with their orientation, opening, and closing, is predicted. To put this effort in perspective a short history of ice dynamics modeling and data collection is presented. The RGPS data set is used to validate the model. As part of the testing and validation of the model, we are working on a new metric for comparing linear features (leads and ridges) in the data and model to be used in data assimilation for this model. The model framework is presented as well as some results showing the creation and development of leads in a simulation of ice dynamics in the Beaufort Sea. Other presentations by the authors will show other results from this effort.

Author

Ice Formation; Arctic Regions; Energy Dissipation; Predictions; Oceans

20070010003 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

Contrasts in Sea Ice Formation and Production in the Arctic Seasonal and Perennial Ice Zones

Kwok, R.; Journal of Geophysical Research; August 2006; Volume 111, Issue C11; 1 pp.; In English

Contract(s)/Grant(s): NNNH04CC45C

Report No.(s): H23I-02; Copyright; Avail.: Other Sources; Abstract Only

Four years (1997-2000) of RADARSAT Geophysical Processor System (RGPS) data are used to contrast the sea ice deformation and production regionally, and in the seasonal (SIZ) and perennial (PIZ) ice zones. Ice production is of seasonal

ice in openings during the winter. 3-day estimates of these quantities are provided within Lagrangian elements initially 10 km on a side. A distinct seasonal cycle is seen in both zones with these estimates highest in the late fall and with seasonal minimums in the mid-winter. Regional divergence over the winter could be up to 30%. Spatially, the highest deformation is in the SIZ north of coastal Alaska. Both ice deformation and production are higher in the SIZ: deformation-related ice production in the SIZ (approx.0.5 m) is 1.5-2.3 times that of the PIZ (approx.0.3 m) - this is connected to ice strength and thickness. Atmospheric forcing and boundary layer structure contribute to only the seasonal and interannual variability. Seasonal ice growth in ice fractures accounts for approx.25-40% of the total ice production of the Arctic Ocean. By itself, this deformation-ice production relationship could be considered a negative feedback when thickness is perturbed. However, the overall effect on ice production in the face of increasing seasonal and thinner/weaker ice coverage could be modified by: local destabilization of the water column promoting overturning of warmer water due to increased brine rejection; and, the upwelling of the pycnocline associated with increased occurrence of large shear motion in sea ice.

Author

Ice Formation; Arctic Ocean; Arctic Regions; Geophysics; Sea Ice

20070010008 NorthWest Research Associates, Inc., Bellevue, WA, USA

Metrics for Linear Kinematic Features in Sea Ice

Levy, G.; Coon, M.; Sulsky, D.; December 2006; 1 pp.; In English

Contract(s)/Grant(s): NNH04CC45C

Report No.(s): H31D-1462; Copyright; Avail.: Other Sources; Abstract Only

The treatment of leads as cracks or discontinuities (see Coon et al. presentation) requires some shift in the procedure of evaluation and comparison of lead-resolving models and their validation against observations. Common metrics used to evaluate ice model skills are by and large an adaptation of a least square 'metric' adopted from operational numerical weather prediction data assimilation systems and are most appropriate for continuous fields and Eulerian systems where the observations and predictions are commensurate. However, this class of metrics suffers from some flaws in areas of sharp gradients and discontinuities (e.g., leads) and when Lagrangian treatments are more natural. After a brief review of these metrics and their performance in areas of sharp gradients, we present two new metrics specifically designed to measure model accuracy in representing linear features (e.g., leads). The indices developed circumvent the requirement that both the observations and model variables be commensurate (i.e., measured with the same units) by considering the frequencies of the features of interest/importance. We illustrate the metrics by scoring several hypothetical 'simulated' discontinuity fields against the lead interpreted from RGPS observations.

Author

Lagrangian Function; Sea Ice; Kinematics; Prediction Analysis Techniques; Cracks; Defects

20070010010 New Mexico Univ., Albuquerque, NM, USA

Kinematics of Strong Discontinuities

Peterson, K.; Nguyen, G.; Sulsky, D.; December 2006; 1 pp.; In English

Contract(s)/Grant(s): NNH04CC45C

Report No.(s): H31D-1464; Copyright; Avail.: Other Sources; Abstract Only

Synthetic Aperture Radar (SAR) provides a detailed view of the Arctic ice cover. When processed with the RADARSAT Geophysical Processor System (RGPS), it provides estimates of sea ice motion and deformation over large regions of the Arctic for extended periods of time. The deformation is dominated by the appearance of linear kinematic features that have been associated with the presence of leads. The RGPS deformation products are based on the assumption that the displacement and velocity are smooth functions of the spatial coordinates. However, if the dominant deformation of multiyear ice results from the opening, closing and shearing of leads, then the displacement and velocity can be discontinuous. This presentation discusses the kinematics associated with strong discontinuities that describe possible jumps in displacement or velocity. Ice motion from SAR data are analyzed using this framework. It is assumed that RGPS cells deform due to the presence of a lead. The lead orientation is calculated to optimally account for the observed deformation. It is shown that almost all observed deformation can be represented by lead opening and shearing. The procedure used to reprocess motion data to account for leads will be described and applied to regions of the Beaufort Sea. The procedure not only provides a new view of ice deformation, it can be used to obtain information about the presence of leads for initialization and/or validation of numerical simulations.

Author

Synthetic Aperture Radar; Discontinuity; Kinematics; RADARSAT; Sea Ice; Geophysics

20070010013 NorthWest Research Associates, Inc., Bellevue, WA, USA

The Use of RGPS Kinematic Data to Estimate Nonlinear Sea Ice Motion

Pruis, M.; Coon, M.; December 2006; 2 pp.; In English

Contract(s)/Grant(s): NNH04CC45C

Report No.(s): H31D-1461; Copyright; Avail.: Other Sources; Abstract Only

In current simulations of the interaction between sea ice and its environment, large significance is placed on the deformation of the sea ice. Sea ice deformation is an important process in determining the sea ice thickness distribution across a wide range of space and time scales. Changes in the sea ice thickness distribution affect energy and mass fluxes between the atmosphere and ocean and also the strength of the ice. While most current ice models assume linear variation in the ice motion field to calculate strain, deformation of sea ice occurs through the opening, closing and shearing of ice along discrete linear features. New numerical models are being developed which explicitly account for discontinuities in ice motion, and the need for requisite data sets for model validation has emerged. Multiple buoy data sets, as well as satellite data, have been used to examine the movement and deformation of sea ice. Generally it has been found that the ice motion field has been represented well by buoy data, as well as satellite data over a broad range of scales. However, the underlying deformation (spatial variation in displacement) as represented by different data sets may vary. For the work presented here, sea ice motion

In current simulations of the interaction between sea ice and its environment, large significance is placed on the deformation of the sea ice. Sea ice deformation is an important process in determining the sea ice thickness distribution across a wide range of space and time scales. Changes in the sea ice thickness distribution affect energy and mass fluxes between the atmosphere and ocean and also the strength of the ice. While most current ice models assume linear variation in the ice motion field to calculate strain, deformation of sea ice occurs through the opening, closing and shearing of ice along discrete linear features. New numerical models are being developed which explicitly account for discontinuities in ice motion, and the need for requisite data sets for model validation has emerged. Multiple buoy data sets, as well as satellite data, have been used to examine the movement and deformation of sea ice. Generally it has been found that the ice motion field has been represented well by buoy data, as well as satellite data over a broad range of scales. However, the underlying deformation (spatial variation in displacement) as represented by different data sets may vary. For the work presented here, sea ice motion

Author

Discontinuity; Sea Ice; Spatial Distribution; Motion Simulation; Mathematical Models; Kinematics; Nonlinearity

20070010014 New Mexico Univ., Albuquerque, NM, USA, New Mexico Univ., Albuquerque, NM, USA

A Decohesive Constitutive Formulation for Modeling Failure of Sea Ice

Schreyer, H. L.; Sulsky, D. L.; Coon, M. D.; December 2006; 1 pp.; In English

Contract(s)/Grant(s): NNH04CC45C

Report No.(s): H23I-04; Copyright; Avail.: Other Sources; Abstract Only

One of the dominant characteristics of Arctic ice as reflected by RADARSAT Geophysical Processor System data is the development and persistence of leads. Experimental data from small specimens as well as in situ data from Arctic ice suggest that failure may occur under compression. Presented here is a decohesive constitutive model for which one of the distinguishing new features is that failure is predicted under uniaxial compression. More generally, the model specifically indicates when a lead is initiated, provides the orientation of the lead, gives the mode of failure, and allows one to numerically determine the width of leads. In addition, the approach allows multiple failure planes, a feature that is necessary to simulate crack branching. Pre-existing planes of weakness such as those formed from previous leads can be incorporated. Sample calculations indicate how such a model can be used for large-scale numerical simulations.

Author

Arctic Regions; Sea Ice; Geophysics; Crack Propagation; Failure; In Situ Measurement

20070010015 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

Simulations of Sea-Ice Dynamics Using the Material-Point Method

Sulsky, D.; Schreyer, H.; Peterson, K.; Nguyen, G.; Coon, G.; Kwok, R.; December 2006; 1 pp.; In English

Report No.(s): H31D-1463; Copyright; Avail.: Other Sources; Abstract Only

In recent years, the availability of large volumes of recorded ice motion derived from high-resolution SAR data has provided an amazingly detailed look at the deformation of the ice cover. The deformation is dominated by the appearance of linear kinematic features that have been associated with the presence of leads. These remarkable data put us in a position to begin detailed evaluation of current coupled mechanical and thermodynamic models of sea ice. This presentation will describe the material point method (MPM) for solving these model equations. MPM is a numerical method for continuum mechanics that combines the best aspects of Lagrangian and Eulerian discretizations. The material points provide a Lagrangian

description of the ice that models convection naturally. Thus, properties such as ice thickness and compactness are computed in a Lagrangian frame and do not suffer from errors associated with Eulerian advection schemes, such as artificial diffusion, dispersion, or oscillations near discontinuities. This desirable property is illustrated by solving transport of ice in uniform, rotational and convergent velocity fields. Moreover, the ice geometry is represented by unconnected material points rather than a grid. This representation facilitates modeling the large deformations observed in the Arctic, as well as localized deformation along leads, and admits a sharp representation of the ice edge. MPM also easily allows the use of any ice constitutive model. The versatility of MPM is demonstrated by using two constitutive models for simulations of wind-driven ice. The first model is a standard viscous-plastic model with two thickness categories. The MPM solution to the viscous-plastic model agrees with previously published results using finite elements. The second model is a new elastic-decohesive model that explicitly represents leads. The model includes a mechanism to initiate leads, and to predict their orientation and width. The elastic-decohesion model can provide similar overall deformation as the viscous-plastic model; however, explicit regions of opening and shear are predicted. Furthermore, the efficiency of MPM with the elastic-decohesive model is competitive with the current best methods for sea ice dynamics. Simulations will also be presented for an area of the Beaufort Sea, where predictions can be validated against satellite observations of the Arctic.

Author

Sea Ice; Mathematical Models; Simulation; Velocity Distribution; Thermodynamics; Arctic Regions; Lagrangian Function; Discontinuity

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*.

20070009621 Defence Science and Technology Organisation, Victoria, Australia
Heterologous Prime-Boost Immunisation Regimens Against Infectious Diseases

Shahin, Susan; Proll, David; Aug 2006; 42 pp.; In English

Report No.(s): AD-A461350; DSTO-GD-0474; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA461350>

Development of prophylactic vaccines against infectious diseases (such as malaria, tuberculosis and HIV) has been hindered by the lack of effective immunisation strategies that induce the cellular arm of the immune system necessary for protection against these intracellular pathogens. DNA vaccines, recombinant proteins and recombinant viral vectors are all effective antigen delivery systems for inducing cellular immunity. However, when used alone, the levels of specific immune response they induce is often low. Heterologous prime boost immunisation strategies involve using two different vaccines, each encoding the same antigen. In the past decade, numerous published reports have demonstrated that such prime boost immunisation strategies effectively enhance cellular immunity in several different animal and disease models. Since several intracellular pathogens are considered potential biowarfare threats, the objective of this review is to assess whether prime-boost vaccination is likely to be effective in protecting against those intracellular pathogens of defence interest. This review focuses on heterologous prime boost immunisation studies using DNA vaccines as the priming vehicle followed by either recombinant protein or recombinant viral vector boost. Included is a summary of studies up to July 2005, for a number of diseases. This paper evaluates if this approach may be applied to those intracellular pathogens considered a threat to the ADF in our vaccine development program.

DTIC

Infectious Diseases; Vaccines

20070009677 Defence Research and Development Suffield, Suffield, Alberta Canada
Evaluation of a Solid Phase DNA Binding Matrix for Downstream PCR Analysis

Bader, Douglas E; Fisher, Glen R; Stratilo, Chad W; Dec 2005; 26 pp.; In English

Report No.(s): AD-A461528; DRDC-SUFFIELD-TM-2005-226; No Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA461528>

A commercially available solid-phase DNA binding matrix (FTA cards) was evaluated for its ability to capture and release DNA for downstream gene amplification and detection assays using polymerase chain reaction (PCR) analysis, as part of a project to determine the utility of FTA cards for sampling, archiving, and transport of samples that may contain biowarfare

(BW) or bioterrorist (BT) agents. PCR was performed using assays designed to amplify and detect two different *Bacillus anthracis* virulence genes, namely the lethal toxin gene (*lef*) found on plasmid pXO1, and the capsule B gene (*capB*), located on plasmid pXO2. PCR assays were conducted using real-time, Taqman fluorescent probe detection on a Cepheid Smart Cycler instrument. A baseline detection limit of about 300 gene copies was observed for each assay prior to DNA-FTA card binding studies using *B. anthracis* Ames DNA. Direct PCR of DNA bound to FTA discs resulted in a loss of sensitivity compared to DNA in solution; however, this method proved better than the heat-elution method since PCR signals were observed at earlier cycles. Furthermore, FTA bound DNA generated a reproducible PCR signal for 12 of 12 replicate tests (100%), compared to 11 of 12 (92%) for a single heat elution treatment, and 5 of 12 (42%) replicates for a double heat elution treatment.

DTIC

Binders (Materials); Biological Weapons; Deoxyribonucleic Acid; Matrices (Mathematics); Solid Phases

20070009754 Michigan Univ., Ann Arbor, MI USA

Mechanisms in Chronic Multisymptom Illnesses

Clauw, Daniel J; Jun 2006; 264 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAMD17-00-2-0018

Report No.(s): AD-A462010; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The overall objectives of this cooperative agreement are to conduct research in pursuit of identifying the physiologic mechanisms responsible for the symptoms of pain, fatigue, and memory difficulties commonly seen in patients with Chronic Multisymptom Illnesses (CMI) (i.e., fibromyalgia, chronic fatigue syndrome, Gulf War Illnesses, etc.); to identify the risk factors for developing these syndromes as well as programs aimed at both preventing these illnesses and treating established cases. These objectives will be achieved through multiple research studies using innovative, technologically advanced (e.g., functional MRI and telemedicine) methodologies in a multidisciplinary environment. Various studies will be conducted to explore all aspects of pain processing, the effects of exercise deprivation and sleep reduction on symptomatology, the ability of exercise and/or cognitive behavioral therapies to alter patients locus of control for pain, the neurobiological mechanism(s) of acupuncture on analgesia, the presence of hypersensitivity to auditory stimuli, and the effectiveness of cognitive behavioral therapy delivered via telemedicine and the internet. These studies will be conducted on well-characterized cohorts of CMI subjects and healthy controls taken from our burgeoning subject registry. Research will occur over the next 3 years at the University of Michigan, Ann Arbor, MI and Avera Research Institute, Sioux Falls, SD.

DTIC

Sicknesses; Signs and Symptoms; Physiology

20070009763 New York Hospital-Cornell Medical Center, New York, NY USA

Bioenergetic Approaches and Inflammation of MPTP Toxicity

Beal, M F; Sep 2006; 22 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-04-01-0802

Report No.(s): AD-A462190; No Copyright; Avail.: CASI: A03, Hardcopy

We wish to continue to examine a number of new neuroprotective agents in the MPTP model of PD, which act by inhibiting the mitochondrial permeability transition (MPT). We also wish to utilize metabolomic profiling to identify novel biomarkers for PD and to investigate whether these occur in animal models of PD. We will develop and characterize a new animal model of PD making a knockout of PINK 1, which is a nuclear-encoded kinase localized to mitochondria, and which causes autosomal recessive PD. Lastly, we wish to study the effects of human dopaminergic stem cells in the 6-hydroxy-dopamine model of PD.

DTIC

Toxicity; Biomarkers; Mitochondria; Permeability; Nervous System

20070009938 NASA Johnson Space Center, Houston, TX, USA

Spatial Pattern of Cell Damage in Tissue from Heavy Ions

Ponomarev, Artem L.; Huff, Janice L.; Cucinotta, Francis A.; [2007]; 1 pp.; In English; NASA Models of Space Radiation Risks Workshop, 6-7 Mar. 2007, Dallas, TX, USA; Copyright; Avail.: Other Sources; Abstract Only

A new Monte Carlo algorithm was developed that can model passage of heavy ions in a tissue, and their action on the cellular matrix for 2- or 3-dimensional cases. The build-up of secondaries such as projectile fragments, target fragments, other light fragments, and delta-rays was simulated. Cells were modeled as a cell culture monolayer in one example, where the data

were taken directly from microscopy (2-d cell matrix). A simple model of tissue was given as abstract spheres with close approximation to real cell geometries (3-d cell matrix), as well as a realistic model of tissue was proposed based on microscopy images. Image segmentation was used to identify cells in an irradiated cell culture monolayer, or slices of tissue. The cells were then inserted into the model box pixel by pixel. In the case of cell monolayers (2-d), the image size may exceed the modeled box size. Such image was is moved with respect to the box in order to sample as many cells as possible. In the case of the simple tissue (3-d), the tissue box is modeled with periodic boundary conditions, which extrapolate the technique to macroscopic volumes of tissue. For real tissue, specific spatial patterns for cell apoptosis and necrosis are expected. The cell patterns were modeled based on action cross sections for apoptosis and necrosis estimated based on BNL data, and other experimental data.

Author

Cells (Biology); Monte Carlo Method; Heavy Ions; Culture Techniques; Extrapolation; Damage; Apoptosis

20070010797 Duke Univ., Durham, NC USA

Design, Implementation, and Characterization of a Dedicated Breast Computed Mammotomography System for Enhanced Lesion Imaging

McKinley, Randolph L; Mar 2006; 74 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-05-1-0280

Report No.(s): AD-A462330; No Copyright; Avail.: CASI: [A04](#), Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA462330>

The overall goal of this work is to design, implement, and characterize a novel dedicated mammotomography system for enhanced lesion detection. This novel system will allow fully 3-D imaging of a pendant, uncompressed breast using novel 3-D complex orbit capabilities. The system has been successfully implemented on a mounting system providing azimuthal and polar tilt capability. System components have been automated to allow synchronized tomographic data acquisitions at the touch of a button. Image corrections have been implemented to maximize image quality and initial phantom measurements are promising. Half cone-beam orbits have been implemented and investigated and have indicated they are feasible for a wide range of breast sizes. Future studies will focus on characterizing the system in terms of dose efficiency, contrast sensitivity, and evaluation for a range of breast sizes and compositions. Patient bed optimization will also be investigated.

DTIC

Breast; Cancer; Imaging Techniques; Lesions; Mammary Glands

20070010801 California Univ., Irvine, CA USA

Roles of Breast Cancer Susceptibility Genes BRCA's in Mammary Epithelial Cell Differentiation

Furuta, Saori; Mar 2006; 67 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-05-1-0322

Report No.(s): AD-A462337; No Copyright; Avail.: CASI: [A04](#), Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA462337>

We examined if BRCA1 is involved in MEC differentiation and how its dysfunction pertains to breast tumor pathogenesis. We demonstrated that BRCA1 mediates acinar differentiation of MEC using 3-D culture. Reduction of BRCA1 by RNAi impairs acinus formation but enhances proliferation. Such aberrations can be rescued by expression of wild-type BRCA1 as well as a mutant in the central domain but not in the C-terminal BRCT domain, suggesting that the BRCT domain has a critical role in this process. Consistently, depletion of BRCA1 up-regulates the gene expression for proliferation but down-regulates that for differentiation. Moreover, application of the medium conditioned by differentiating normal MEC can reverse the phenotype of differentiation-defective breast cancer cells bearing reduced BRCA1 functions. This result implies BRCA1 is involved in secretion of certain paracrine/autocrine factors that induce MEC differentiation in response to extracellular matrix signals.

DTIC

Breast; Cancer; Diseases; Genetics; Mammary Glands; Oncogenes

20070010804 Columbia Univ., New York, NY USA

Endoplasmic Reticulum Stress as a Mediator of Neurotoxin-Induced Dopamine Neuron Death

Burke, Robert E; Jul 2006; 35 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAMD17-03-1-0492

Report No.(s): AD-A462341; No Copyright; Avail.: CASI: [A03](#), Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA462341>

The molecular processes of programmed cell death (PCD) are important mediators of neural degeneration in Parkinson's disease (PD). The goal of this proposal is to examine in living animals the possible role of ER stress, a mediator of PCD, in dopamine neuron death. This is being done by the study of mice with targeted deletions of CHOP and caspase-12, mediators of ER stress-induced apoptosis. We have demonstrated that CHOP is universally expressed in neurotoxin models of parkinsonism. Assessment of the functional significance of CHOP expression by study of CHOP null mice has shown that in the adult 6OHDA model there is diminished apoptosis. The null mutation does not, however, protect dopamine neurons in the chronic MPTP model. We therefore conclude that CHOP is expressed and uniquely plays a functional role in the adult 6OHDA model. It may do so either in response to ER stress, or to oxidative stress. Since our last progress report, we have completed our studies of caspase-12 mice in the adult 6OHDA model. These studies have shown that caspase-12 mice are not protected from 6OHDA; they do not show a diminished level of apoptosis, and they do not show an increased survival of dopaminergic neurons. Since caspase-12 is a proven critical mediator of PCD due to ER stress, these results would suggest that the upregulation of CHOP in the 6OHDA model is not mediated by ER stress, but rather oxidative insult. In the final year of this award, we intend to determine where CHOP acts in the molecular pathways of PCD in relation to signaling by c-jun phosphorylation. This will be done by examining the effect on CHOP expression of null mutations in both JNK2 and JNK3.

DTIC
Apoptosis; Death; Diseases; Dopamine; Endoplasmic Reticulum; Neurons

20070010806 Dorn Research Inst., Inc., Columbia, SC USA

Sage Gene Expression Profiles Characterizing Cure

Hrushesky, William; Bulkhauls, Phillip; You, Shaojin; Oct 2006; 61 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-04-1-0856

Report No.(s): AD-A462344; No Copyright; Avail.: CASI: A04, Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA462344>

The timing of breast cancer resection within the estrous cycle of the cycling C3H mouse and the menstrual cycle of the premenopausal woman determines to some extent whether the disease is cured in the mouse and the ten-year disease free survival of the woman. Two metaanalyses have demonstrated the positive effect of timing breast cancer resection as near to midcycle (early luteal phase) as possible. A third study has estimated this beneficial effect of surgery timing to be potentially more than two-fold greater than the positive effect of adjuvant chemotherapy. Recent editorial review demonstrates that established prognostic indicators including: tumor histopathologic grade, tumor cell proliferation markers, tumor cell estrogen and progesterone receptor content, tumor cell molecular characteristics associated with angiogenesis and tumor cell invasion and motility are more frequently ominous and more severely negative in tumors resected in the follicular as compared to the luteal phase of the patient's menstrual cycle. We hypothesize that there are characteristic patterns of tumor cell gene expression that change throughout the menstrual (estrous) cycle, and that a subset of these cycling genes are in part associated with, and responsible for the changes in curability of resected breast cancers. We used Serial Analysis of Gene Expression (SAGE) to identify hormone-responsive genes by performing comprehensive gene expression profiling of experimental mouse(tumors resected during the estrus phase (when we observe a 100% cure rate) and the diestrus phase (when we observe a 35% cure rate).

DTIC

Breast; Cancer; Gene Expression; Genes; Mammary Glands

20070010807 Beth Israel Deaconess Medical Center, Boston, MA USA

Role of the Telomerase Inhibitor PinX1 in Breast Cancer

Soohoo, Christina; Apr 2006; 9 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-05-1-0281

Report No.(s): AD-A462345; No Copyright; Avail.: CASI: A02, Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA462345>

Aim 1 is to determine if PinX1 levels are altered in breast cancer tissues and cell lines. We have currently identified several breast cancer samples with reduced PinX1 levels and at least two with barely detectable expression when compared to normal breast tissue. Our screen to identify mutations in the PINX1 gene in breast cancer samples (Aim 2) has thus far identified four C-terminal mutations which are currently being tested for functional significance. To define the region of PinX1 responsible for telomerase inhibition (Aim 3), we have generated a series of truncated proteins and tested their ability to bind to and inhibit telomerase. We have further defined the residues responsible for PinX1 activity in telomerase inhibition and tumorigenesis by generating PinX1 mutant proteins harboring single and multiple amino acid substitutions of conserved residues within the minimal TID and of breast cancer genetic alterations identified in our screen. Our results indicate that the

mutation of several conserved residues are sufficient to disrupt hTert binding and telomerase inhibition and that the mutations identified in our screen disrupt telomerase activity slightly and may be crucial in the development of cancer. These results reflect substantial progress toward determining the mechanism and role of PinX1 in breast cancer.

DTIC

Breast; Cancer; Inhibitors; Mammary Glands

20070010809 California Univ., Los Angeles, CA USA

Non-Invasive Gene Therapy of Experimental Parkinson's Disease

Pardridge, William M; Sep 2006; 130 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAMD17-01-1-0773

Report No.(s): AD-A462348; No Copyright; Avail.: CASI: [A07](#), Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA462348>

The present research has developed a non-viral gene targeting technology, whereby the effects of a neurotoxin on the brain can be reversed shortly after the intravenous injection of a therapeutic gene medicine without the use of viral vectors. The brain gene targeting technology developed in this work creates an artificial virus which is comprised of non-immunogenic lipids and proteins, wherein the therapeutic gene is packaged in the interior of the gene delivery vehicle, which is called a pegylated immunoliposome (PIL). The PIL carrying the gene is a 85 nm stealth nanocontainer, which is relatively invisible to the body's reticuloendothelial system, which normally removes nanocontainers from the blood. The surface of the nanocontainer is studded with a receptorspecific monoclonal antibody (MAB). This MAB acts as a molecular Trojan horse, and triggers the transport of the stealth nanocontainer across the 2 biological membrane barriers that separate the blood from the interior of brain cells. These barriers are the brain microvascular endothelial wall, which forms the blood-brain barrier in vivo, and the brain cell plasma membrane. Both barriers express the transferrin receptor, and the anti-receptor MAB enables the PIL to cross the membrane barriers via normal physiological transport processes usually used for endogenous ligands such as transferrin. With this approach non-viral, non-invasive gene therapy of the brain is now possible.

DTIC

Diseases; Gene Therapy

20070010830 Massachusetts General Hospital, Boston, MA USA

Optical Strategies for Studying Metastatic Mechanisms, Tumor Cell Detection and Treatment of Prostate Cancer

Solban, Nicolas; Oct 2006; 91 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-04-1-0870

Report No.(s): AD-A462383; No Copyright; Avail.: CASI: [A05](#), Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA462383>

Prostate cancer is the most common cancer in men. Current treatments have limitations due to undesirable side effects. The objective of this proposal is to evaluate the effect of photodynamic therapy (PDT) on prostate tumors in order to design optimal treatment regimens. We have shown that subcurative PDT induces the release of the Vascular Endothelial Growth Factor (VEGF) both in vitro and in an orthotopic model of prostate cancer. Furthermore, we report that combining PDT with an antiangiogenic molecule, to prevent the action of VEGF, improves local control of prostate cancer and reduces the incidence of metastasis. Using a highly aggressive and metastatic prostate cancer cell line, we also report a PDT-induced decrease in $\alpha_5\beta_1$ integrin coinciding with a decrease in adhesion to the extracellular matrix protein, collagen IV. Finally experimental metastasis assay showed that PDT-treated cells circulate longer in animals than control cells. We conclude that the most effective application of PDT for long-term cure, may involve combined therapeutic regimens.

DTIC

Cancer; Cells (Biology); Metastasis; Prostate Gland; Tumors

20070010831 San Francisco Univ., CA USA

Structural Characterization and Determinants of Specificity of Single-Chain Antibody Inhibitors of Membrane-Type Serine Protease 1

Farady, Christopher J; Mar 2006; 8 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-05-1-300

Report No.(s): AD-A462384; No Copyright; Avail.: CASI: [A02](#), Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA462384>

Membrane-type serine protease 1 (MT-SP1) is a cancer-associated serine protease implicated in the tumorigenesis and

metastasis of breast cancer. Inhibition of MT-SP1 activity has been shown to decrease metastatic potential. We have developed a number of potent and specific single-chain (scFv) antibody inhibitors to MT-SP1, and have begun to characterize their mechanism of inhibition. Through kinetic characterization and site-directed mutagenesis experiments, it has been determined that three potent inhibitors have separate and novel mechanisms of inhibition which do not mimic either biologically or pharmaceutically relevant protease inhibitors. These novel modes of binding and inhibition are the basis for their specificity, and suggest these inhibitors will have less cross-reactivity and toxicity problems when used in vivo to further dissect DTIC

Antibodies; Breast; Cancer; Inhibitors; Mammary Glands; Membranes; Protease

20070010832 Cold Spring Harbor Lab., New York, NY USA

In-Vivo Characterization of Mammalian Polarity Genes as Novel Tumor Suppressors Involved in Breast Cancer Development and Progression in a Mouse Model

Rosenberg, Avi Z; Mar 2006; 8 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-05-1-0253

Report No.(s): AD-A462385; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA462385>

The purpose of our study is to understand the role of novel polarity regulators mammary gland development and their ability to cooperate with oncogenes in tumorigenesis within this gland. We are using mouse systems as well as an analysis of cell lines to understand the role of a particular gene, Scribble, in this process. So far, I have been able to identify one human breast cancer cell line with little scribble expression. In a normal mouse cell line, comma-1D, we are doing further analysis as to the effects of scribble loss using RNAi technology. We have observed a morphological change, with a loss of e-cadherin, as well as a mild proliferative change in scribble knockdown cells. We have also observed a change in lineage specific cytokeratins in these cells. This data is significant as it possibly demonstrates the role of a polarity gene the differentiation of the breast as well as in tumors with concomitant growth changes to the affected tissue.

DTIC

Breast; Cancer; Genes; In Vivo Methods and Tests; Mammals; Mammary Glands; Mice; Polarity; Suppressors; Tumors

20070010833 Medical Coll. of Wisconsin, Milwaukee, WI USA

Proteinated Subnano Particles of Elemental Selenium for the Treatment of Breast Cancer

Sieber, Fritz; Sep 2006; 9 pp.; In English

Contract(s)/Grant(s): W81XWH-04-1-0525

Report No.(s): AD-A462390; No Copyright; Avail.: CASI: [A02](#), Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA462390>

The purpose of this award is to test in preclinical models the hypothesis that cytotoxic conjugates of elemental selenium and proteins are safe and effective for the systemic therapy of invasive breast cancer. The grant has three specific aims, 1) to evaluate the safety and efficacy of systemically administered Se(0)- protein conjugates in athymic nude mice bearing xenografts of human breast cancer cells, 2) to assess the functional integrity of conjugate-treated normal human hematopoietic stem cells, and 3) to determine by use of the combination index method how Se(0)-protein conjugates interact with standard chemotherapeutic agents that are commonly used in the treatment of invasive breast cancer. We report here on the preparation and evaluation of high potency cytotoxic Se(0)-protein conjugates, a quantitative in vitro analysis of the interactions of Se(0)-protein conjugates with other chemotherapeutic agents, the surprise finding that certain antibiotics can interfere with the generation of cytotoxic conjugates, and a simple and rapid spectroscopic method to detect such interferences.

DTIC

Breast; Cancer; Mammary Glands; Proteins; Selenium; Stem Cells; Therapy

20070010834 Michigan Univ., Ann Arbor, MI USA

Molecular Modulation of Inhibitors of Apoptosis as a Novel Approach for Radiosensitization of Human Prostate Cancer

Xu, Liang; Nov 2006; 11 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-06-1-0010

Report No.(s): AD-A462392; No Copyright; Avail.: CASI: [A03](#), Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA462392>

The major goal of the project is to investigate the radiosensitization activity and mechanism of action of novel

IAP-inhibitors in prostate cancer. We have investigated the in vitro radiosensitization activity of our lead IAP-inhibitors, SH-130 and Embelin, in human prostate cancer cell lines. IAP-inhibitors potently enhanced TRAIL-/radiation-induced apoptosis and growth inhibition. Using NMR and Crystal Structure Analysis, we conclusively show that these IAP inhibitors bind to the pocket in the XIAP BIR3 domain where Smac binds. Biotin-labeled SH-130 pull-down assay further confirm that BIR3 domain in XIAP and cIAP-1 is indeed the molecular target of the IAP inhibitors in apoptosis-potential. Based on our exciting data obtained from this PCRP project, together with data from other collaborators, we are working with FDA for ND filing aiming for Phase I clinical trial with SH-130 as radiosensitizer for prostate cancer.

DTIC

Apoptosis; Cancer; Inhibitors; Modulation; Prostate Gland

20070010837 Chicago Univ., Chicago, IL USA

Characterization of a Dopaminergic Stimulatory Factor Derived from Monoclonal Cell Lines of Striatal Origin

Heller, Alfred; Gross, Martin; Won, Lisa; Dec 2006; 48 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAMD17-01-1-0819

Report No.(s): AD-A462395; No Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA462395>

A lysate of an immortalized monoclonal cell line derived from the striatum (X61) contains two types of chemically distinct factors which are capable of increasing the dopamine content of an immortalized, dopaminergic mouse mesencephalic cell line (MN9D). One type of factor could be extracted from the cell lysate by isoamyl alcohol/chloroform and was identified to be composed primarily of oleic acid. The other type of factor was water-soluble and consisted of ethanolamine and phosphoethanolamine. Our experimental results indicate that both types of dopaminergic stimulatory factors elevate the dopamine content of mesencephalic-derived MN9D cells through an increase in storage capacity, possibly via a membrane fusion mechanism, rather than by enhancing neurotransmitter synthesis. These findings suggest a novel mechanism of action by which such factors regulate the dopaminergic phenotype. Although developing, fetal primary dopaminergic neurons in reaggregate culture were not responsive to the dopaminergic stimulatory effect of ethanolamine, there remains the possibility that phospholipid precursor therapy may be of some utility in neurodegenerative disorders, such as Parkinson's disease, given the need of neurons to repair damaged cell membranes.

DTIC

Cells (Biology); Diseases; Dopamine; Fatty Acids; Nervous System; Neurophysiology

20070010838 Alabama Univ., Birmingham, AL USA

Chemoprevention Against Breast Cancer With Genistein and Resveratrol

Whitsett, Jr, Timothy G; Lamartiniere, Coral A; Mar 2006; 9 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-05-1-0308

Report No.(s): AD-A462396; No Copyright; Avail.: CASI: A02, Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA462396>

Breast cancer remains a destructive disease and a leading killer among women in the USA and throughout the world. It has been recognized that genetic alterations (such as BRCA mutations) account for only 10-15% of breast cancer. Thus, environmental exposures, especially diet, can play a very important role in the causation or prevention of this disease. We believe that the dietary polyphenols genistein, the major phytoestrogen in soy, and resveratrol, a component of red grapes and red wine, can protect a woman against mammary carcinogenesis. We, and others, have shown that dietary exposure to genistein or soy, especially early in life, can protect against chemically-induced carcinogenesis. We demonstrated that prepubertal exposure to genistein caused a significant reduction in terminal end buds, the most susceptible structures for mammary carcinogenesis. We and others have also shown a protection against breast cancer in a chemically-induced rat model with dietary exposure to resveratrol (data unpublished, 4-5). Resveratrol caused a significant reduction in mammary tumor multiplicity and increased tumor latency. The epithelial cells of the terminal end buds show a significant reduction in proliferation and increase in apoptosis, which might help to explain the chemoprotection that we observed. With observations from the tumorigenesis, mammary gland maturation, and cell proliferation experiments, we proposed to look for changes at the molecular level that could account for the protection we observe with dietary genistein and resveratrol. We propose to focus on steroid and growth factor receptor pathways, and the steroid receptor coactivator family, a possible link between critical sex steroid and growth factor pathways. Understanding the in vivo mechanisms of these polyphenols will allow them to be used to protect women against breast cancer.

DTIC

Breast; Cancer; Mammary Glands; Mutations

20070010839 Florida Univ., Gainesville, FL USA

Cognitive Changes in Presymptomatic Parkinson's Disease

Heilman, Kenneth M; Sep 2006; 74 pp.; In English

Contract(s)/Grant(s): DAMD17-98-1-8616

Report No.(s): AD-A462398; No Copyright; Avail.: CASI: A04, Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA462398>

Many of the neuropsychological changes reported with PD are not typically seen early in the disease. One possible action of dopamine on the cerebral cortex is that of influencing activation within semantic networks. Thus, the goal of this project has been to study the semantic organization of verbal information in PD patients and matched controls, and determine the influence of dopamine on these cognitive processes. Data collected in our healthy subjects on the research task confirm our expectations that semantic processing can occur along a continuous gradient. Our preliminary data indicate that, when taking prescribed dopaminergic medication, our PD subjects demonstrate semantic processing that is similar to that of our control subjects. However, after an approximately 12-hour medication abstinence period, our PD subjects rated all semantically-associated stimuli as less similar than did controls. These results tentatively indicate that, as hypothesized, dopamine is involved in the mediation of neural activity.

DTIC

Cognition; Diseases; Signs and Symptoms

20070010840 Baylor Coll. of Medicine, Houston, TX USA

Prognostic Value of the K303R Estrogen Receptor Alpha Mutation in Breast Cancer

Herynk, Matthew H; Fuqua, Suzanne A; Jun 2006; 9 pp.; In English

Contract(s)/Grant(s): DAMD17-03-1-0417

Report No.(s): AD-A462399; No Copyright; Avail.: CASI: A02, Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA462399>

The estrogen receptor (ER)-alpha plays a major role in breast tumor progression, we have recently discovered a somatic mutation (A908G) that leads to a lysine to arginine (K303R) amino acid change. Here we proposed to study if the K303R ER-alpha mutation is prognostic clinical factor for invasive breast cancer. We have determined that the mutation is present in approximately 56% of invasive breast cancers and its expression correlates with lymph node involvement. Expression constructs containing the wild-type or mutant ER-alpha fused to a yellow-fluorescent protein have been developed and stably transfected into MCF-7 breast cancer cells. In vivo nude mouse studies are underway to analyze experimental metastases. Specific Aim 1 has previously been completed and the mutation frequency has been determined in Aim 2. Additional analysis of clinical parameters is ongoing. Specific Aim 3 is underway and mice will be analyzed for experimental metastases in the near future.

DTIC

Breast; Cancer; Estrogens; Mammary Glands; Mutations

20070010841 Baylor Coll. of Medicine, Houston, TX USA

A Fusogenic Oncolytic Herpes Simplex Virus for Therapy of Advanced Ovarian Cancer

Zhang, Xiaoliu; Jun 2006; 9 pp.; In English

Contract(s)/Grant(s): DAMD17-03-1-0434

Report No.(s): AD-A462400; No Copyright; Avail.: CASI: A02, Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA462400>

For efficient therapy of solid tumors such as ovarian cancer, two obstacles need to be overcome before the therapeutic potential of virotherapy could be fully materialized. Firstly, the potency of oncolytic HSVs needs to be improved. During the first two years of this funded project, we have demonstrated that incorporation of cell-membrane fusion activity into an oncolytic HSV could significantly and safely increase the antitumor potency of the virus. Secondly, host's antiviral immunity is likely to be a major obstacle for successful administration of an oncolytic virus. We proposed in the third year of this project to develop strategies to overcome this potential problem. Our hypothesis is that the ability of a fusogenic oncolytic HSV to induce cell membrane fusion would make the virus less vulnerable to the innate and/or acquired antiviral immunity once it had entered to the tumor cells, as it would be able to spread from cell to cell through syncytia formation. Thus, a strategy that could initially send the virus to the tumor site in the presence of host's antiviral immunity would be what was needed to overcome the initial hurdle of its delivery. Our data demonstrated that: 1) the fusogenic oncolytic HSVs have the ability to spread to surrounding tumor cells even in the presence of high concentration of antiviral immune sera, indicating its ability to evade the host's neutralizing antibodies once the virus has entered into the target cells; 2) an HSV-2-based fusogenic

oncolytic HSV (Fusion-H2) has the ability to evade the host's innate antiviral immunity; 3) oncolytic HSVs could be formulated with liposomes for in vivo delivery; 4) in addition to T lymphocytes, NK cells and macrophages could also function as carrier cells for delivery of oncolytic HSVs by the recently reported hitchhike strategy. This represents a very efficient way of loading oncolytic virus to the carrier cells, which are otherwise nonpermissive to infection of oncolytic HSVs.

DTIC

Cancer; Drugs; Lymphocytes; Ovaries; Therapy; Viruses

20070010843 Maryland Univ. Baltimore County, Catonsville, MD USA

Novel MHC Class II Breast Cancer Vaccine Using RNA Interference (RNAi) to Down Regulate Invariant Chain (Ii)

Thompson, James A; May 2006; 42 pp.; In English

Contract(s)/Grant(s): DAMD17-03-1-0337

Report No.(s): AD-A462403; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA462403>

Our goal is to induce a strong CD4+ T cell response against tumor antigens by preferentially presenting endogenous tumor antigens via class II major histocompatibility complex molecules (MHC II). MHC II can present endogenous tumor antigens if expressed in the absence of Invariant chain (Ii). We have up-regulated MHCII and down regulated Ii without affecting MHC II expression in tumor cells. Using the key transcription factor class II trans-activator (CIITA) we have coordinately up-regulated all class II MHC molecules (DR, DP, DQ) and associated molecules such as the Invariant chain in a Human mammary carcinoma (MCF10). We have successfully down regulated the invariant chain in MCF10 cells, up regulated for MHC II, using retroviral vectors that express siRNAs as hairpin loops. Immuno-fluorescence shows no down regulation of MHC II molecules on the cell surface after Ii was down regulated. We will test the ability of our vaccine to present tumor antigen by observing whether these cells can stimulate HER2/neu restricted CD4+ or CD8+ T cells. These tumor cells could be used as a vaccine stimulating both CD4+ and CD8+ T cells in close proximity inducing a powerful long-term immune response against tumor sharing common tumor antigen with the vaccine.

DTIC

Antigens; Breast; Cancer; Lymphocytes; Mammary Glands; Ribonucleic Acids; Vaccines

20070010846 Wisconsin Univ., Madison, WI USA

Delphinidin: A Novel Agent for Inhibition of Breast Tumor Kinase Signaling by Targeting EGFR

Afaq, Farrukh; Aug 2006; 15 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-05-1-0511

Report No.(s): AD-A462406; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA462406>

Abnormalities in the expression and signaling pathways downstream of the epidermal growth factor receptor (EGFR) contribute to the progression, invasion, and maintenance of the malignant phenotype in breast cancer. EGFR is expressed at high levels in at least 25% of breast cancers and is associated with poor prognosis. Upon epidermal growth factor (EGF)-stimulation, breast tumor kinase (Brk) is recruited to the EGFR, and this event activates the catalytic activity of Brk, which in turn phosphorylates paxillin a binding partner and substrate for Brk. The phosphorylation of paxillin promotes the activation of Rac1, thereby stimulating cell migration and invasion in response to EGF. Many synthetic inhibitors of EGFR are known, but their use is limited because of their unacceptable cytotoxic effects on normal cells. Therefore, identification of a natural, nontoxic agent(s) as an inhibitor of EGFR is of utmost importance. Delphinidin, a major anthocyanin known to be present in pigmented fruits and vegetables, inhibits constitutive and EGF-induced phosphorylation of EGFR, activation of PI3K, phosphorylation of AKT, and MAPK. We also found that delphinidin treatment inhibits constitutive and EGF-induced activation of Brk signaling mediated through EGFR. Furthermore, treatment of breast cancer cells with delphinidin inhibited cell growth and induced apoptosis. In summary this study identifies an abundant fruits and vegetables based anthocyanin delphinidin as an effective blocker of EGFR signaling at least in breast cancer cells that act through novel Brk signaling pathway.

DTIC

Abnormalities; Breast; Cancer; Enzyme Activity; Mammary Glands; Tumors

20070010852 Duke Univ., Durham, NC USA

Increasing Sustained Participation in Free Mass Prostate Cancer Screening Clinics

Price, Marva M; May 2006; 115 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAMD17-02-1-0235

Report No.(s): AD-A462415; No Copyright; Avail.: CASI: A06, Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA462415>

The overall objective of this study was to determine factors associated with sustaining regular participation in free prostate cancer screening clinics, particularly among African American men. Intervention strategies were designed and used at the community level by nurses in free screening clinics to improve screening sustainability. Strategies used in this study show that African American participation can be increased significantly. Men will respond to tailored messages. African American men who should be targeted for mass screening programs are those from lower educational attainment (less than high school and high school); African American men at age 40 and older who have never been screened; men who present for screening in their 40 s and 50 s but who decrease screening as they age; and African American men who present for an initial screening with no follow up screening in subsequent years. The challenge remains to sustain high participation in the free prostate cancer screening from one year to the next, and over several years. Churches can be a source of prostate cancer screening promotion once the church leaders identify men s health as a priority. The study sample contained 1,882 individuals primarily of African American and Caucasian ethnicity. Sustainability was at 40% for Blacks and 46% for Whites. Recruitment efforts in this study continued to be in the risk and age-related screening range that is supported by national health care organizations. We increased participation by African American men, and the majority of participants fell primarily in their 50 s and the next larger group in their 40 s. Consistency from one year to the next in scheduling free clinics and in developing marketing materials is important.

DTIC

Africa; Cancer; Clinical Medicine; Medical Services; Prostate Gland

20070010855 Oregon Univ., Eugene, OR USA

A Non-Nuclear Role of the Estrogen Receptor Alpha in the Regulation of Cell-Cell Interactions

Darimont, Beatrice D; Aug 2006; 11 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-05-1-0519

Report No.(s): AD-A462419; No Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA462419>

Proliferation and metastasis of many breast cancers depend on the steroid hormone estrogen. The actions of estrogens are mediated by the estrogen receptors ERalpha and ERbeta. These hormone-regulated transcription factors translate the presence of estrogen into changes in gene expression. According to new findings, these receptors also act outside of the nucleus and are often found associated with the plasma membrane. In contrast to their roles in regulating cell proliferation, very little is known about the mechanisms by which estrogens promote metastasis. It has been suggested that estrogens aid this process by changing the expression of cell adhesion proteins, such as E-cadherin. However, results in our laboratory have opened the possibility that disruption of cell adhesions by estrogens involves the direct interaction of ER with cell adhesion proteins. The goal of this grant is to explore this possibility. If true, this mechanism would represent a novel example of a non-nuclear activity of the estrogen receptor, steer ongoing studies on the role of estrogens in the regulation of cellular adhesions into a new direction, and open new venues for the prevention, diagnosis and therapy of breast cancer.

DTIC

Breast; Cancer; Estrogens; Mammary Glands

20070010856 Albert Einstein Medical Center, Philadelphia, PA USA

Analysis of Activity Patterns and Performance in Polio Survivors

Klein, Mary; Oct 2006; 81 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAMD17-01-1-0822

Report No.(s): AD-A462420; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA462420>

The goals of this project were: 1) to study the temporal relationship between activity level and health status in polio survivors and to compare the results with those obtained from an age-matched control population and 2) to look at the effect of localized muscle weakness and the associated compensation response on performance of a walking task. Simulation modeling techniques were used to identify factors critical to task performance, which provided valuable information for optimizing rehabilitation interventions for polio survivors and other populations with lower extremity muscle weakness. A

total of 97 polio survivors and 116 controls were enrolled and tested for Study #1. Longitudinal data was analyzed. For Study #2, the functional deficits database was compiled and an analysis was performed using the mechanical-based compensation scheme.

DTIC

Health; Muscles; Poliomyelitis

20070010863 Jackson (Henry M.) Foundation, Rockville, MD USA

Carcinogenicity and Immunotoxicity of Embedded Depleted Uranium and Heavy-Metal Tungsten Alloy in Rodents

Kalinich, John F; Miller, Alexandra C; McClain, David E; Oct 2006; 159 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-01-1-0821

Report No.(s): AD-A462431; No Copyright; Avail.: CASI: [A08](#), Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA462431>

This study investigated the carcinogenic and immunotoxic potential of embedded fragments of depleted uranium (DU) and a heavy-metal tungsten alloy (WA) consisting of tungsten, nickel, and cobalt. Male Fisher 344 rats were surgically implanted with pellets of DU, WA, tantalum (inert metal, negative control), or nickel (known carcinogen, positive control). Implanted WA resulted in the rapid formation of tumors, identified as rhabdomyosarcomas, surrounding the pellets. These tumors had, within the same area, histopathological characteristics of both the pleomorphic and embryonal subtypes of rhabdomyosarcomas. Eventually these tumors metastasized to the lung. Rats implanted with tantalum or DU pellets did not develop tumors at the implantation site. In addition, WA-implanted rats (high-dose group) exhibited splenomegaly and hematological changes suggesting polycythemia as early as 1 month after pellet implantation.

DTIC

Carcinogens; Embedding; Heavy Metals; Hematology; Rodents; Spent Fuels; Tungsten Alloys; Uranium

20070010864 Baylor Coll. of Medicine, Houston, TX USA

Unmasking Stem/Progenitor Cell Properties in Differentiated Epithelial Cells Using Short-term Transplantation

Lewis, Michael T; Aug 2006; 47 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-05-1-0427

Report No.(s): AD-A462432; No Copyright; Avail.: CASI: [A03](#), Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA462432>

Background: Prevailing models maintain that stem cells comprise a minority of epithelial cells. However, some data suggest the percentage of mammary stem cells may be underestimated using common assays. Rationale: Short term transplantation using fragments of mammary duct offer an opportunity to test the prevailing stem cell model. If division-competent stem cells represent a small percentage of all epithelial cells, the initial rate of cell division in transplanted fragments should be low. However, if stem cells can include more differentiated, yet division-competent cells, the initial rate of cell division in fragments should be high Objectives: 1) To determine the range of mammary stem cell types participating in gland regeneration. 2) To develop the short-term transplantation assay as a means by which critical regulators of stem and progenitor cell behavior can be discovered and evaluated. Relevance: Studies will provide a direct test of prevailing stem cell models.

DTIC

Breast; Cancer; Mammary Glands; Stem Cells; Transplantation

20070010865 Texas Univ. Health Science Center, San Antonio, TX USA

Nuclear Dynamics of BRCA1-Dependent Transcription Regulation

Sharp, Zelton D; Aug 2005; 8 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-04-1-0700

Report No.(s): AD-A462433; No Copyright; Avail.: CASI: [A02](#), Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA462433>

BRCA1 coordinates cellular responses to DNA damage. It functions as a co-repressor of GADD45 transcription through interactions with a DNA-binding protein termed ZBRK1. Our goal is to develop a biosensor system to visualize transcription control by ZBRK1 and BRCA1 in single living and/or fixed cells. The rationale is to use integrated DNA binding sites to obtain real time, multiplex-based data. The reportable outcomes for the period are: 1) UAS and ZREarray-bearing plasmids have been constructed; 2) Transient and stable reporter expression have been demonstrated; 3) Stable cell lines with G20, G40 and Z32 are on line for studies; 4) Construction of fluorescent GAL4-DBD and ZBRK1 fusion protein has been achieved, and

BRCA1 derivatives are in progress. When operational, this system will document real time nuclear dynamics of ZBRK1/BRCA1-dependent chromatin modification systems, as cells mount transcriptional responses to genotoxins.

DTIC

Breast; Cancer; Deoxyribonucleic Acid; Genes; Mammary Glands; Ovaries; Proteins

20070010866 Harvard Medical School, Boston, MA USA

A New Concept for Androgen Receptor-Independent Growth of Prostate Cancer

Hu, Guo-fu; Kishikawa, Hiroko; Yoshioka, Norie; Nov 2006; 15 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-06-1-0031

Report No.(s): AD-A462435; No Copyright; Avail.: CASI: [A03](#), Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA462435>

Angiogenin is an angiogenic ribonuclease that is upregulated in prostate cancer. The objective of this project is to explore the role angiogenin plays in the development of androgen-independent disease. The hypothesis to be tested is that angiogenin plays an essential role in rRNA transcription in prostate cancer cells and that constitutive nuclear translocation of angiogenin is a driving force for transition to androgen independence. Toward this goal, we have carried out experiments to show that overexpression of angiogenin in androgen-dependent LNCaP prostate cancer cells enable them to grow in the absence of androgen, and that knocking-down angiogenin expression in androgen-independent PC-3 prostate cancer cells inhibits cell proliferation in vitro and in vivo, accompanied with a decrease in both cancer cell proliferation and angiogenesis. These results are consistent with our hypothesis and indicate that angiogenin is a novel therapeutic target for prostate cancer.

DTIC

Cancer; Hormones; Males; Prostate Gland

20070010868 Temple Univ., Philadelphia, PA USA

Role of CDK4 in Breast Development and Cancer

Reddy, Haritha; Apr 2006; 10 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-05-1-0262

Report No.(s): AD-A462437; No Copyright; Avail.: CASI: [A02](#), Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA462437>

Cdk4 is an important regulator of G1/S cell cycle progression in mammalian cells. In about 15.8% (15 out of 95) of breast cancers cdk4 gene was shown to be amplified and this amplification of cdk4 gene was correlated with high Cdk4 protein expression. Our studies with the breast tissues of cdk4 (neo/neo) mice revealed the presence of small fat pads and poor ductal branching when compared to that of wild type mice. In order to determine the importance of cdk4 in Wnt- and Neu-induced breast tumorigenesis we generated cdk4 (neo/neo): MMTV-transgenic lines that express Wnt and Neu in breast specific manner. Our results from these studies indicated that there is impaired lobuloalveolar compartment development and poor ductal branching in case of cdk4 (neo/neo): MMTV-neu mice when compared to cdk4 (+1+): MMTV-neu mice. In contrast the mammary gland development in case of both Wnt transgenic mice cdk4 (+1+): MMTV-Wnt and cdk4 (neoneo): MMTV-Wnt is comparable. Further studies revealed that there is resistance to neu-induced breast tumorigenesis in case of cdk4 (neo/neo): MMTV-neu mice when compared to cdk4 (+1+): MMTV-neu mice. In contrast in case of Wnt transgenic mice the tumorigenesis studies revealed that both cdk4 (+1+): MMTV-Wnt and cdk4 (neo/neo): MMTV-Wnt mice are equally susceptible to breast cancer induced by Wnt. This indicates that cdk4 is essential for neu-induced tumorigenesis and not for Wnt-induced tumorigenesis.

DTIC

Breast; Cancer; Genes; Mammary Glands; Oncogenes

20070010870 Minnesota Univ., Minneapolis, MN USA

Daily Migraine Prevention and Its Influence on Resource Utilization in the Military Health System

Devine, Joshua W; Aug 2006; 220 pp.; In English

Report No.(s): AD-A462439; No Copyright; Avail.: CASI: [A10](#), Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA462439>

Migraine is a widespread and disabling neurological disorder with a substantial economic burden due to the frequency and severity of the disease. Daily migraine prevention is recommended for patients who experience regular migraine headaches. While the safety and efficacy of this treatment has been established it is unclear what impact migraine prevention has on health care resource consumption. This study was undertaken to determine if the initiation of daily migraine prevention

had an effect on ambulatory health care utilization compared to acute migraine treatment alone. Administrative claims data from the Military Health System were used to conduct a retrospective longitudinal cohort study of 8%436 beneficiaries who received both a diagnosis of headache and a prescription for a migraine-specific abortive medication over a two year time period from 1 October 2002 to 30 September 2004. Patients were categorized by exposure status to daily migraine prevention. New users (N = 1%144) were compared to subjects receiving acute headache treatment alone (N = 2618) during 18 months of follow-up. A series of regression and matching estimators modeled the effect of prevention on ambulatory health care utilization while controlling for patient characteristics selected from Andersen's Behavioral Model of Health Care Utilization.

DTIC

Headache; Health; Medical Services; Military Operations; Prevention

20070010871 California Univ., San Francisco, CA USA

Biological Function of Plasma Kallikrein in Mammary Gland Stromal Development and Tumor Metastasis

Lilla, Jennifer; Mar 2006; 8 pp.; In English

Contract(s)/Grant(s): W81XWH-05-1-0272

Report No.(s): AD-A462440; No Copyright; Avail.: CASI: A02, Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA462440>

The plasminogen cascade of serine proteases has been affiliated in the mammary gland with both development and tumorigenesis. We have found that the dominant plasminogen activator during mammary gland stromal involution is plasma kallikrein (PKal), and that active PKal appears in connective tissue-type mast cells in the mammary stromal during different phases of development. Thus, to determine the role of PKal in mammary gland involution, a prekallikrein-deficient mouse is being produced that will be analyzed for developmental defects as well as defects in mammary gland tumor metastasis. After unanticipated difficulties in the cloning of a knockout construct, correctly targeted embryonic stem cell lines have been established that will be used to make the PKal knockout mouse. Additionally, examination of the extra hepatic expression of PKal has shown that PKal message is present in the mammary gland, and that increased expression levels correlate to periods of stromal remodeling.

DTIC

Breast; Cancer; Enzymes; Mammary Glands; Metastasis; Peptides; Plasmas (Physics); Protease; Tumors

20070010874 University of Southern California, Los Angeles, CA USA

SRD5A1 Genetic Variation and Prostate Cancer Epidemiology

Phipps, Troy; May 2006; 21 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAMD17-03-1-0136

Report No.(s): AD-A462447; No Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA462447>

The human steroid 5-alpha reductase type I (SRD5A1) gene was sequenced in 101 men in order to identify genetic variants that might predispose carriers to prostate cancer. In these analyses, we uncovered a series of single nucleotide polymorphisms (SNPs) in the 3'-untranslated region (3'-UTR) of the SRD5A1 mRNA. However, we did not find SNPs that changed amino acid identities of the SRD5A1 protein. To further pursue the relevance of the SNPs in the 3'-UTR of this gene, we used cell culture assays to measure how they may alter RNA half-life, steady-state, and translation. Different combinations of 3'-UTR SNPs (RNA haplotypes) resulted in reduced SRD5A1 mRNA half-life and steady state levels in our assay system. This data is consistent with the hypothesis that SNPs in the 3'-UTRs of mRNAs may play a role in the regulation of the SRD5A1 gene. Therefore, these SNPs should be considered as candidates for having biological function that might predispose to prostate cancer.

DTIC

Cancer; Epidemiology; Genetics; Prostate Gland; Ribonucleic Acids

20070010876 Duke Univ., Durham, NC USA

Computer Aided Detection of Breast Masses in Digital Tomosynthesis

Singh, Swatee; Lo, Joseph; Jun 2006; 20 pp.; In English

Contract(s)/Grant(s): W81XWH-05-1-0293

Report No.(s): AD-A462451; No Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA462451>

The objective of this study is to investigate if digital tomosynthesis can fundamentally improve sensitivity of detecting

breast masses compared to conventional mammography. Overlapping dense tissue in mammography is one of the most common causes for unnecessary callbacks as well as missed cancers. By removing such overlapping tissue, breast tomosynthesis can obviate unnecessary callbacks as well as missed cancers. The goal is to provide 3D information at high resolution, comparable dose to mammography, and with lower cost and hardware requirements compared to other common alternatives such as breast Computed Tomography (CT) or breast Magnetic Resonance (MR). In the first stage of this study we applied 2-D CAD algorithms to individual projection images of the tomosynthesis data set. We also reconstructed pre-processed projection images using filtered back projection algorithm, where suspicious regions were identified using a DoG filter. Lastly, we studied feasibility of implementing Laguerre-Gauss channelized hotelling observers on mammographic ROIs and compared their performance against that of another visual model proposed by Watson.

DTIC

Breast; Cancer; Computer Aided Design; Computer Aided Tomography; Computer Techniques; Digital Systems; Mammary Glands

20070010877 Maryland Univ., Baltimore, MD USA

Immune Suppression and Inflammation in the Progression of Breast Cancer

Bunt, Stephanie K; Mar 2006; 19 pp.; In English

Contract(s)/Grant(s): W81XWH-05-1-0276

Report No.(s): AD-A462452; No Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA462452>

Epidemiological and experimental observations support the hypothesis that chronic inflammation contributes to the development and progression of cancers; however the mechanisms underlying the relationship between inflammation and breast cancer are poorly understood. To study these mechanisms we have used an experimental mouse system in which 4T1 mammary carcinoma cells constitutively express the pro-inflammatory cytokine, IL-1, resulting in an inflammatory microenvironment at the tumor site. Our results confirm the hypothesis that a pro-inflammatory microenvironment enhances tumor progression. More importantly, they suggest a novel mechanism by which inflammation facilitates tumor growth. We find that mice with IL-1-producing tumors have in their spleens elevated levels of immature myeloid-derived cells with a Gr1+CD11b+ phenotype, which inhibit the activation of CD4+ and CD8+ T lymphocytes. Similar cells, termed myeloid suppressor cells, are frequently present in patients and experimental animals with tumors. These findings suggest that inflammation may promote malignancy by producing pro-inflammatory cytokines, such as IL-1, that enhance systemic immune suppression through the induction of myeloid suppressor cells, thereby counteracting immune surveillance and allowing the outgrowth and proliferation of transformed cells.

DTIC

Breast; Cancer; Immunity; Mammary Glands; Suppressors

20070010880 Texas Univ., Houston, TX USA

The Role of Cyclin E and Its Lower Molecular Forms in the Oncogenesis of Ovarian Cancer and Its Predictive Value in Patients with Early Stage Ovarian Tumor

Keyomarsi, Khandan; Apr 2005; 21 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAMD17-03-1-0259

Report No.(s): AD-A462458; No Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA462458>

The deregulation of cell cycle checkpoints, with loss of regulation at the G1/S transition, has been shown to play an important role in the transformation to a malignant phenotype. Our studies have focused on cyclin E, which appears in late G1 and flanks the restriction point. We hypothesize that alterations of cyclin E in ovarian cancer cells contributes to the oncogenesis of ovarian tumors and negatively impacts outcome in patients with Stage I-III cancer. In this proposal we will (1) develop a comprehensive ovarian cell line model for characterization of the role of cyclin E in ovarian cancer; (2) delineate the role of cyclin E and its tumor specific LMW forms in the development of malignant phenotype in vitro and in nude mice; (3) establish the prognostic value of the hyperactive forms of cyclin E in patients with Stage I-III ovarian cancer; and (4) examine the biochemical significance of the LMW forms of cyclin E in tumor specimens. The results from our studies will provide much needed information about the molecular biology of ovarian carcinoma and may open new avenues for the development of targeted therapies.

DTIC

Cancer; Neoplasms; Ovaries; Patients; Predictions; Proteins; Tumors

20070010882 Illinois Univ. at Urbana-Champaign, Urbana, IL USA

The Design and Analysis of Pediatric Vaccine Formularies: Theory and Practice

Hall, Shane N; Jun 22, 2006; 153 pp.; In English

Report No.(s): AD-A462462; No Copyright; Avail.: CASI: [A08](#), Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA462462>

Vaccination against infectious disease is hailed as one of the greatest public health achievements. However, the USA Recommended Childhood Immunization Schedule is becoming increasingly complex, often requiring numerous separate injections in a single pediatric visit. To address the issue of vaccine delivery complexity, vaccine manufacturers have developed combination vaccines that immunize against several diseases in a single injection. These combination vaccines are creating challenges such as how these vaccines should be administered to ensure that immunity is safely achieved. Furthermore, these vaccines are also creating a combinatorial explosion of alternatives and choices for public health policy-makers and administrators, pediatricians, and parents/guardians. This dissertation applies operations research methodologies to designing pediatric vaccine formularies that capture this combinatorial explosion of alternatives and choices and ensure that immunity is safely achieved. In particular, the dissertation presents three fundamental problems for designing pediatric vaccine formularies. The first problem models a general childhood immunization schedule to design a vaccine formulary that minimizes the cost of fully immunizing a child. The second problem models a general childhood immunization schedule to design a vaccine formulary that safely immunizes a child against several infectious diseases by restricting or limiting extraimmunization (i.e., extra doses of vaccine). These problems are vitally important since the cost of vaccinating a child contributes to the underimmunization of children, and extraimmunization poses biological risks, amplifies philosophical concerns with vaccination, and creates an unnecessary economic burden on society.

DTIC

Design Analysis; Immunology; Public Health; Vaccines

20070010883 Army Research Inst. of Environmental Medicine, Natick, MA USA

Dietary Tyrosine Benefits Cognitive and Psychomotor Performance During Body Cooling

O'Brien, Catherine; Mahoney, Caroline; Tharion, William J; Sils, Ingrid V; Castellani, John W; Jan 2007; 8 pp.; In English

Report No.(s): AD-A462464; M06-28; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA462464>

Supplemental tyrosine is effective at limiting cold-induced decreases in working memory, presumably by augmenting brain catecholamine levels, since tyrosine is a precursor for catecholamine synthesis. The effectiveness of tyrosine for preventing cold-induced decreases in physical performance has not been examined. This study evaluated the effect of tyrosine supplementation on cognitive, psychomotor, and physical performance following a cold water immersion protocol that lowered body core temperature. Fifteen subjects completed a control trial (CON) in warm (35 deg C) water and two cold water trials, each spaced a week apart. Subjects ingested an energy bar during each trial; on one cold trial (TYR) the bar contained tyrosine (300 mg/kg body weight), and on the other cold trial (PLB) and on CON the bar contained no tyrosine. Following each water immersion, subjects completed a battery of performance tasks in a cold air (10 deg C) chamber. Core temperature was lower ($p=0.0001$) on PLB and TYR (both 35.5 ± 0.6 deg C) than CON (37.1 ± 0.3 deg C). On PLB, performance on a Match-to-Sample task decreased 18% ($p=0.02$) and marksmanship performance decreased 14% ($p=0.002$), compared to CON, but there was no difference between TYR and CON. Step test performance decreased by 11% ($p=0.0001$) on both cold trials, compared to CON. These data support previous findings that dietary tyrosine supplementation is effective for mitigating cold-induced cognitive performance such as working memory, even with reduced core temperature, and extends those findings to include the psychomotor task of marksmanship.

DTIC

Cooling; Diets; Hypothermia; Mental Performance; Performance Tests; Psychomotor Performance; Tyrosine

20070010886 Tufts Univ., Boston, MA USA

Promotion of Epithelial to Mesenchymal Transition by Hyaluronan

Krause, Silva; Jul 2005; 7 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAMD17-03-1-0467

Report No.(s): AD-A462484; No Copyright; Avail.: CASI: [A02](#), Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA462484>

The mammary gland is comprised of stromal and epithelial cells that communicate with each other through the extracellular matrix (ECM). Disruption of communication between the epithelium and stroma can both induce and promote breast cancer. Crosstalk between the mammary epithelium and stroma is also crucial for the proper patterning and function

of the normal mammary gland. It has been proposed that HA may induce malignant transformation in normal cells through interaction with its receptors. We therefore wanted to elucidate its function during normal mammary gland development. The expression of HA in the stroma increased at week 5 and peaked at week 7, the time of puberty coinciding with ductal growth. We observed a decrease with age when the mammary gland achieves mature virginal development (week 9 and 11). The peak of HA expression during the time of puberty led us to hypothesize that HA expression may be estrogen-mediated. Preliminary data suggest a role of estrogen as a mediator for HA expression but the analysis is still ongoing.

DTIC

Breast; Cancer; Estrogens; Mammary Glands

20070010887 Minnesota Univ., Minneapolis, MN USA

Exploring the Role of Ubiquitination in Progesterone Receptor Transcriptional Activation and Turnover in Breast Cancer Cells

Daniel, Andrea R; Jun 2006; 11 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-05-1-0257

Report No.(s): AD-A462489; No Copyright; Avail.: CASI: [A03](#), Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA462489>

Progesterone Receptors (PR) play important roles in both normal breast development and in the development and progression of breast cancers. PR action contributes to cell growth and survival in the presence of progestins and/or growth factors. The growth factor inputs can create receptors with increased transcription in response to lower concentrations of progestins, or receptors hypersensitive to ligand. Post-translational modifications such as ubiquitination and SUMOylation may be mediating these effects. The goal of these studies is to elucidate the functional consequences of the post-translational modifications, specifically, phosphorylation/ubiquitination and SUMOylation on PR, and to determine the temporal and functional relationship between these modifications. To accomplish this goal mutants of various phosphorylation sites, conjugation sites and consensus sequences have been generated to create receptors deficient in one or more of these modifications. Our preliminary data suggests that S294A PR-B has increased sumoylation relative to wt PR-B, whereas S294A PR-B is unable to be ubiquitinated. Phosphorylation may be differentially regulating these modifications. Transcription reporter assays with S294 phosphomimic mutant PR-B display heightened transcription and the mutant deficient in sumoylation indicate SUMO is a negative regulator of PR transcriptional activity. Phosphorylation of PR by growth factor pathways differentially regulates ubiquitination and SUMOylation of the receptor mediating changes in hormone responsiveness of breast cancer.

DTIC

Breast; Cancer; Females; Hormones; Mammary Glands

20070010888 General Hospital Corp., Boston, MA USA

Ovarian Cancer Training Program at the Dana Farber/Harvard Cancer Center

Seiden, Michael; Apr 2006; 9 pp.; In English

Contract(s)/Grant(s): DAMD17-03-1-0161; Proj-W23RYX-2356-N903

Report No.(s): AD-A462490; No Copyright; Avail.: CASI: [A02](#), Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA462490>

This Award funded the initiation of a mentored research experience in ovarian cancer biology at the Dana Farber/Harvard Cancer Center. The primary aims, articulated in the Statement of Work, included creating a mechanism to identify and select outstanding postdoctoral fellows who had a commitment to serious multi-year experience in research that was directly related to a topic in or immediately applicable to ovarian cancer. The second aim was to provide a mentored experience for selected fellows. The third aim specified the delivery of feedback to the trainees by mentors and the program PI. The final aim described a rigorous review process for the program. These aims are all being addressed. Of the four senior post doctoral fellows selected to work with Faculty at Harvard Medical School in the fields of oncogenesis, signal transduction, pathology and mouse models and cell biology, one fellow graduated from the program and is successfully transitioning towards an independent academic research career. The vacancy was competed for and filled successfully. A new faculty member with extensive training in biologic models was added to the program to mentor the fellows, who continue to pursue their research productively at 3 different institutions within the Dana Farber/Harvard Cancer Center.

DTIC

Cancer; Education; Medical Science; Ovaries

20070010896 Howard Univ., Washington, DC USA

Short-Term Exercise and Prostate Cancer Prevention in African-American Men

Taylor, Teletia R; Apr 2006; 17 pp.; In English

Contract(s)/Grant(s): W81XWH-05-1-0366

Report No.(s): AD-A462507; No Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA462507>

This study seeks to examine the impact of exercise on serum factors related to prostate cancer in African-American men. Aims and Objectives: 2) To examine the effect of 12 days of aerobic exercise over 4 weeks on PSA levels in African American men. 3) To examine the effect of 12 days of aerobic exercise on free and total testosterone insulin IGF1 and SHBG levels in African American men. A total of 40 AA men (ages of 40 - 70 yrs, BMI \g 25 and \h 35 kg/sq m, sedentary) will be randomized into 2 groups 12 days of aerobic exercise (20 participants) or a control group (20 participants). Exercise participants will engage in 12 days of exercise (30 minutes of walking on a treadmill at 50 - 60% of their maximal oxygen consumption (VO2max)). Free testosterone lipids glucose insulin SHBG body weight BMI and body fat composition anthropometric measurements height weight will be measured before and after the study.

DTIC

Africa; Cancer; Human Beings; Males; Physical Exercise; Prevention; Prostate Gland

20070010908 California Univ., Livermore, CA USA

Protein Adducts of the Prostate Carcinogen PhIP in Children

Henderson, Paul T; Feb 2006; 10 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAMD17-03-1-0076

Report No.(s): AD-A462546; No Copyright; Avail.: CASI: A02, Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA462546>

The goal of this project is to develop an assay to measure the binding a common food-borne carcinogen (PhIP) to human serum albumin (HSA) an abundant protein in blood that frequently binds to small molecules in the blood stream. Measurement of HSA-bound PhIP may allow determination of the exposure (dosimetry) of large populations of humans to PhIP. Such critical data are almost never included in epidemiology studies owing to low detection sensitivity of current methods. Based upon our earlier results in humans demonstrating that PhIP binds to HSA we are developing an ultrasensitive mass spectrometry assay that depends upon competitive binding of adducted HSA to an antibody saturated with a radiocarbon labeled PhIP-bound peptide. This assay will allow quantitative measurement with the naturally occurring substrate from archived human samples. We report progress towards antibody development that will enable the assay to be realized.

DTIC

Adducts; Antibodies; Cancer; Carcinogens; Children; Mass Spectroscopy; Prostate Gland; Proteins

20070010909 Florida Univ., Gainesville, FL USA

Biochemical Markers of Brain Injury: An Integrated Proteomics-Based Approach

Hayes, Ronald L; Feb 2006; 110 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAMD17-03-1-0066

Report No.(s): AD-A462547; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA462547>

Background: Brain injury poses a major problem to military care accounting for 25% of all combat casualties and is the leading cause of death among wounded soldiers reaching Echelon I medical treatment. Incidence of brain injury and resultant long-term disabilities caused by traumatic insults and ischemic events is significantly greater in the civilian population. No clinically useful diagnostic tests exist for traumatic or ischemic brain injury to provide physicians with quantifiable neurochemical markers to help determine the seriousness of the injury the anatomical and cellular pathology of the injury and to guide implementation of appropriate triage and medical management. Study Design: SOW 1 employs integrated proteomics-based technologies to identify specific proteins or peptide fragments in brain released into CSF and/or blood of rats following experimental traumatic brain injury or focal cerebral ischemia. Technologies include mass spectrometry 2-D gel electrophoresis phage display of single chain antibodies and antibody chips. SOW 2 employs antibody chips to determine which proteins or peptide fragments released into CSF following injury are reliably associated with different injury magnitudes and predict changes in histopathological behavioral and electrophysiological outcome measures. SOW 3 develops ELISA-based assays capable of detecting biomarkers in blood. Relevance: Development of objective tngage capabilities for

combat medics and/or Echelon I providers would represent a major fieldable breakthrough in the medical management of combat related head trauma.

DTIC

Biochemistry; Brain; Brain Damage; Markers; Proteome

20070010910 Retina Foundation, Boston, MA USA

Molecular Solutions to Low Vision Resulting from Battlefield Injuries

Dartt, Darlene A; May 2006; 14 pp.; In English

Contract(s)/Grant(s): W81XWH-04-2-0008

Report No.(s): AD-A462548; No Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA462548>

We hypothesize that targeted molecular intervention can preserve vision threatened by battlefield trauma-induced corneal and retinal inflammation, corneal and retina/optic nerve apoptosis, ocular surface dry eye after refractive surgery and retinal degeneration. We are studying the consequences of trauma-induced (1) corneal inflammation using a gene therapy approach of providing soluble Fas ligand to the cornea to determine if this ligand can suppress corneal inflammation in mice; (2) retinal inflammation by examining if transforming growth factor-beta, thrombospondin and somatostatin in subretinal space can suppress inflammation within retina secondary to autoimmune uveoretinitis and light-induced damage in mice; (3) corneal cell death by apoptosis and promote regeneration by identifying the anti-apoptotic gene with the greatest capacity to suppress corneal cell apoptosis using mice; (4) retinal cell death and regeneration by using mice to determine if systemic treatment with lithium chloride can prevent collateral damage to retinal neurons and promote optic nerve regeneration; (5) dry eye by determining how to minimize dry eye after LASIK refractive surgery by developing new tests to predict pre-disposition to refractive surgery induced dry eye; and (6) retinal injury by generating stem cell polymer composites.

DTIC

Cornea; Gene Therapy; Injuries; Retina; Vision

20070010913 Colorado Univ., Aurora, CO USA

Validation of a Pre-Clinical Model for the Investigation of Menarcheal Age on Breast Cancer Risk

Schedin, Pepper J; Sep 2006; 9 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-05-1-0499

Report No.(s): AD-A462556; No Copyright; Avail.: CASI: A02, Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA462556>

Individuals with late menarche have breast cancer rates that are approximately 2 fold lower than individuals with early menarche, however the mechanism of protection is unknown. Two theories dominate; the model of breast tissue aging proposes that cumulative lifetime exposure to circulating ovarian hormones determines risk. The second theory suggests that early menarche is associated with persistent qualitative differences in the hormone axis or in the gland itself. Purpose: Determine whether an extensively utilized preclinical model for human breast cancer, the SD rat model, demonstrates the relationship between age of sexual maturation and mammary cancer risk that is observed in humans. Aims: 1) Determine the relationship between age at vaginal opening (VO), a marker for ovarian function, and susceptibility to MNU-induced mammary cancer and 2) investigate the hypothesis that early sexual maturation confers increased breast cancer risk by persistently altering systemic hormone levels and/or by altering the response of the gland to subsequent hormone stimulation. Methods: Sexually immature female SD rats, monitored for VO, will be separated into Gp 1, the first 25% of rats to reach VO and Gp 2, the last 25% to reach VO. Effect of age of VO on estrous cycling, mammatrophic hormone levels, ER and PR expression in the mammary gland, exogenous hormone stimulation, and susceptibility to mammary carcinogenesis will be determined. Relevance: Once characterized, this pre-clinical model can be utilized by the breast cancer community to investigate the mechanism(s) by which early menarche increases breast cancer risk.

DTIC

Breast; Cancer; Hormones; Mammary Glands; Risk

20070010914 Wright State Univ., Dayton, OH USA

Proteomic Analysis of Cisplatin-Resistant Ovarian Cancers

Turchi, John; Mar 2006; 9 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAMD17-03-1-0155

Report No.(s): AD-A462560; No Copyright; Avail.: CASI: A02, Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA462560>

One of the major clinical challenges in the treatment of ovarian cancer is that the cancer cells are, or become, resistant to the drugs used to treat the disease. When the cell no longer responds to the drugs, the cancer continues to grow unabated. Some cellular factors that contribute to making a cell resistant to chemotherapy drugs have been identified, though many still remain to be discovered. These cellular factors or proteins involved in drug resistance can be measured using sensitive analytical techniques. A major goal of the research proposed in this study is to analyze these proteins from ovarian cancer cell lines that are known to be either sensitive or resistant to the chemotherapeutic drug cisplatin, a first line treatment for ovarian cancer. We will determine if there is a specific protein Thnge%mnt' that is indicative of either sensitivity or resistance to cisplatin. Once the useful factors that influence drug resistance are identified in cell lines and verified using tumor biopsies, we anticipate that this information could then be used to help predict whether a specific tumor will respond to a specific treatment. To date, the sensitivity of a specific ovarian carcinoma to a specific treatment can only be assessed by administration of the treatment and then observing the outcome. Knowing the factors that contribute to a cancer being sensitive or resistant and having the methods to determine if these factors are present or absent in a given tumor are the goals of this proposal. This information could then be used in the clinical assessment to determine the best course of treatment for a specific cancer.

DTIC

Cancer; Ovaries; Proteome

20070010915 Wisconsin Univ., Madison, WI USA

Fluorescence and Diffuse Reflectance Spectroscopy for Breast Cancer Diagnosis During Core Needle Biopsy

Zhu, Changfang; Sep 2006; 10 pp.; In English

Contract(s)/Grant(s): W81XWH-05-1-0380

Report No.(s): AD-A462562; No Copyright; Avail.: CASI: [A02](#), Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA462562>

The goal of this project is to exploit the potential of using fluorescence and diffuse reflectance spectroscopy for breast cancer detection during a core needle breast biopsy. A novel side-firing fiber optic probe has been developed for use in a vacuum-assisted core biopsy needle. The probe design has been evaluated using tissue phantom studies before embarking on the clinical study and proved to be capable of making fluorescence measurements with good signal-to-noise ratio. Clinical trials have been carried out to use the optical probe for in vivo fluorescence spectroscopy of breast tissues during a core needle breast biopsy to determine the feasibility of using this technique for a near real time discrimination between malignant and benign breast tissues. Preliminary results showed that in vivo fluorescence spectroscopy during a percutaneous breast biopsy is feasible and has the potential to quickly characterize tissue composition and pathology.

DTIC

Breast; Cancer; Diagnosis; Diffuse Radiation; Fluorescence; Mammary Glands; Needles; Reflection; Spectroscopy

20070010917 Cold Spring Harbor Lab., New York, NY USA

Dicer in Mammary Tumor Stem Cell Maintenance

Murchison, Elizabeth P; Mar 2006; 9 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-05-1-0256

Report No.(s): AD-A462567; No Copyright; Avail.: CASI: [A02](#), Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA462567>

RNA interference (RNAi) is a gene silencing pathway with roles in mRNA stability, translational control, chromatin organization and genome regulation. MicroRNAs (miRNAs) are a set of small RNAs produced by the RNAi machinery that play important functions in tissue organization and maintenance of cell identity. Several miRNAs have been shown to collaborate with oncogenes in the progression of cancer, and in addition, miRNA expression profiling has revealed widespread miRNA misregulation in cancer. To address the role of miRNAs in the onset and maintenance of breast cancer, we have created embryonic stem (ES) cells and mice in which Dicer, a key enzyme in miRNA biogenesis, can be conditionally inactivated. Using these systems we have demonstrated that Dicer is required for the continued proliferation of ES cells, and that there is indeed a loss of all miRNAs and RNAi-related functions in Dicer null cells. We are using a transplantation model to test the requirement of Dicer for the proliferation of mammary stem cells, and in addition we are cloning small RNAs from mammary stem cells in order to determine the regulatory niches that miRNAs may fill in this cell type. Our ultimate goal is to assess the role of Dicer in mammary tumor stem cell maintenance.

DTIC

Breast; Cancer; Cells (Biology); Enzymes; Maintenance; Mammary Glands; Stem Cells; Tumors

20070010949 Medical Univ. of Warsaw, Poland

Effect of Nanoparticles on Complement System in Cell Culture Model

Sladowski, Dariusz T; Sep 15, 2006; 21 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): FA8655-05-1-3008

Report No.(s): AD-A462666; No Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA462666>

The research focused on complement activation by nanoparticles which have been already tested in cell culture by AFRL/HEPB Identification of complement activation pathways was carried out by evaluation of the concentration of pathway specific complement split products generated during human plasma exposure to nanoparticles, Measurements were performed using assay kits supplied by QUIDEL Corporation San Diego California, Different sizes of nanoparticles such as silver (Ag; 151,000 nm) molybdenum (MoO₃; 30 150 nm), aluminum (Al; 30 103 nm), iron oxide (Fe₃O₄; 30, 47 nm) and titanium dioxide (TiO₂-40nm) were evaluated for their complement activation potential, The complement activation properties of relatively larger particles of cadmium oxide (CdO; 1 micrometer) manganese oxide (MnO₂; 1-2 micrometers), and tungsten (W; 27 micrometers) were assessed, Additionally the effects of nanoparticles coated with lipopolysaccharide on complement activator properties were evaluated,

DTIC

Blood Plasma; Cells (Biology); Culture Techniques; Nanoparticles; Titanium Oxides; Toxicology

20070010950 Chicago Univ., Chicago, IL USA

Extranuclear Signaling Effects Mediated by the Estrogen Receptor

O'Neill, Erin; Greene, Geoffrey; Mar 2006; 12 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-05-1-0241

Report No.(s): AD-A462667; No Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA462667>

Recent evidence has made it clear that ER-mediated extranuclear signaling is involved in the growth and survival of ER-expressing cells and tissues including the mammary gland. Specifically we are interested in examining the ability of ER action to modulate MAPK signaling as well as other key signaling molecules and our main goals with this research are to: 1) better define the mechanism responsible for the observed cross-talk 2) investigate the observed signaling in an animal model 3) determine and compare the target genes that are regulated by ER rapid signaling versus classical ER transactivation and 4) examine the subsequent cellular and biological responses to rapid 17beta-estradiol (E2) action. Previously we confirmed that E2 and other ER-specific ligands can rapidly phosphorylate and activate Erk-1 and -2 in the breast cancer cell line MCF-7 an effect that is blocked by the potent ER antagonist ICI 182 780. We have also provided preliminary evidence that demonstrated that E2 administration to ovariectomized immature rats can induce Erk-1 and -2 phosphorylation in the uterine horn. We show here our continued investigation of ER-mediated Erk-1 and -2 activation in vivo and that E2 administration can in fact result in a significant increase of Erk-1 and -2 phosphorylation over saline control in both the uterine horn and brain. In each case E2-induced Erk-1 and -2 activation is at least partially decreased by the co-administration of raloxifene a selective estrogen receptor modulator (SERM). Additionally we have identified CaMKII as an important player in ER-mediated Erk-1 and -2 activation. In cultured neuronal cells the inhibition of CaMKII with KN-62 blocks E2- induced Erk-1 and -2 phosphorylation. Interestingly as little as 15 minutes of E2 administration to ovariectomized rats results in a significant increase in CaMKII autophosphorylation and thus its activation in the brain.

DTIC

Breast; Cancer; Estrogens; Genes; Mammary Glands

20070010951 University of Southern California, Los Angeles, CA USA

Effects of Androgen Ablation on Anti-Tumor Immunity

Kast, W M; Sep 2006; 46 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAMD17-02-1-0244

Report No.(s): AD-A462669; No Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA462669>

Androgen Ablation (AA) constitutes the most common therapy for the treatment of advanced prostate cancer. While initially effective at reducing tumor burden, most patients recur with androgen insensitive disease. AA affects the immune system both systemically as well as at the prostate. Androgens have immunosuppressive effects and it is therefore of interest to investigate if immunotherapy can benefit from androgen ablation when immunosuppression is reduced. AA results in infiltration of activated T cells, dendritic cells (DCs) and macrophages into the prostate. DCs are the only antigen-presenting

cells that can activate naive T cells to a novel antigen and are the key players of successful vaccination regimes. Many DC-directed prostate cancer immunotherapy strategies are in clinical trials but there is little information with regards to the effects of androgen ablation on DC function. We have set forth to investigate the effects of androgen ablation on DC costimulation. The ultimate goal of studying the effects of AA on the immune system is to determine if a prostate-directed immunotherapy strategy can benefit from androgen ablation and we have directly tested this in an antigen-specific manner using a prostate-specific antigen, six transmembrane epithelial antigen of the prostate (STEAP).

DTIC

Ablation; Cancer; Hormones; Males; Prostate Gland; Tumors

20070010952 Baylor Coll. of Medicine, Houston, TX USA

Tumor Localization Using Radio Frequency Implants

McGary, John E; Sep 2006; 19 pp.; In English

Contract(s)/Grant(s): W81XWH-04-1-0054

Report No.(s): AD-A462672; No Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA462672>

A real-time, 3D tumor localization system for radiotherapy treatment was investigated. The proposed system is based upon generating detectable magnetic fields to calculate the transmitter position. To determine feasibility, the problem was divided into several tasks: (1) to generate a real-time signal with sufficient strength to be detected at large distances, and (2) to determine a suitable detection system and calculation algorithm to determine the position. To develop the system, a theoretical foundation for the system was developed to characterize the system design including the transmitter, dipole energy source, the detector configuration, and calculation algorithm. The first part of the theory development was tested using analog components. These experiments demonstrated that the theoretical development was sufficient to design the system. The conclusion is that the transmitter will charge within one second and generate a detectable signal at approximately 1 meter from the inductor. The remaining task of localizing the transmitter from the signal was solved using SQUID detectors and a localization algorithm. The detectors are arranged in a specific configuration to limit expense and accurately locate the transmitter. The overall theory and experiments demonstrate that tumors can be localized in real-time at sufficiently large distances required for clinical treatment.

DTIC

Implantation; Magnetic Fields; Neoplasms; Position (Location); Radiation Therapy; Radio Frequencies; Tumors

20070010953 Texas Univ., Brownsville, TX USA

Interrelationships of Hormones, Diet, Body Size and Breast Cancer Among Hispanic Women

Peltz, Gerson; Sep 2006; 25 pp.; In English

Contract(s)/Grant(s): DAMD17-03-1-0274

Report No.(s): AD-A462673; No Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA462673>

The purpose of this Minority Institution Partnership Training Award is to train University of Texas at Brownsville (UTB) faculty to conduct breast cancer research by collaborating with faculty from the University of Texas-Houston School of Public Health (UTSPH). Three UTB faculty will undergo intensive training provided by six UTSPH faculty during year 1. To reinforce training, faculty from UTB and UTSPH will conduct a clinic-based case-control study of breast cancer to investigate its association with hormones, diet and body size in years 2 through 4. Specific aims include: 1) to provide UTB faculty training through classes, presentations and seminars to gain knowledge of epidemiology, proposal development, behavioral sciences, and biostatistics offered by UTSPH faculty, and 2) to design and conduct a clinic-based case-control study to include completion of a questionnaire, anthropometry and a blood draw. During the third year of the project, Dr. Peltz (UTB) received his Masters of Public Health, and Dr. Johnson (UTB) audited an epidemiology and a behavioral science course. Data collection continued for the clinic-based case-control study, the South Texas Women's Health Project. To increase the number of breast cancer cases, Dr. Peltz (UTB) requested, but did not receive, supplemental funding from the Department of Defense to add two staff members to begin interviewing in Hidalgo county. Dr. Sanderson (UTSPH) became principal investigator of a project funded by the National Center on Minority Health and Health Disparities to conduct a study of women diagnosed with high risk-human papillomavirus which places them at high risk of cervical cancer. Dr. Sanderson (UTSPH) submitted grants to conduct a validation study and awareness campaign of family history of breast cancer among South Texas Women's Health Project subjects, and to conduct a case-only study of prostate cancer.

DTIC

Breast; Cancer; Diets; Females; Hormones; Mammary Glands; Medical Science

20070010954 Virginia Univ., Charlottesville, VA USA

Identification and Characterization of Ovarian Carcinoma Peptide Epitopes Recognized by Cytotoxic T Lymphocytes

Hogan, Kevin T; Nov 2006; 43 pp.; In English

Contract(s)/Grant(s): W81XWH-05-1-0012

Report No.(s): AD-A462674; No Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA462674>

The purpose of the research is to identify new ovarian cancer tumor antigens that can be used in the immunotherapeutic treatment of ovarian cancer. The scope of this work involves (1) identifying the peptide antigens recognized by ovarian reactive cytotoxic T lymphocytes (CTL) by using an antigen-unbiased mass spectrometric approach to antigen identification; and (2) identify peptide antigens within the Her-2/neu folate binding protein (FBP) and TAG proteins that give rise to ovarian reactive CTL. A total of twelve ovarian cancer lines have been characterized for their expression of class I MHC molecules and tumor antigens. Three TAG-derived epitopes including two HLA-A2-restricted epitopes (SLGWLFLLL and LLLRLECNV) and one HLA-B7-restricted epitope (LPAQEGAPT) were identified. T cell lines are being established from the TAL of ovarian cancer patients. In preliminary experiments two of these lines appear to recognize the FBP-derived peptide FLLSLALML and the mesothelin-derived peptide FLLFSLGWV. The significance of these results are that they provide new antigens for use in therapeutic vaccine trials for the treatment of ovarian cancer. Furthermore they provide the reagents necessary to assess the immunologic impact of such trials.

DTIC

Antigens; Cancer; Folic Acid; Immune Systems; Lymphocytes; Ovaries; Peptides; Toxins and Antitoxins

20070010955 University of South Florida, Tampa, FL USA

Aurora-A Oncogene in Human Ovarian Cancer

Cheng, Jin Q; Nov 2006; 17 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-05-1-0021

Report No.(s): AD-A462676; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA462676>

During past year, we have demonstrated that Aurora-A protects ovarian cancer cells from apoptosis induced by chemotherapeutic agent and activates Akt pathway in a p53-dependent manner. Ectopic expression of Aurora-A renders cells resistant to cisplatin (CDDP), etoposide and paclitaxel-induced apoptosis and stimulates Akt1 and Akt2 activity in wild-type p53 but not p53-null ovarian cancer cells. Aurora-A inhibits cytochrome C release and Bax conformational change induced by CDDP. Knockdown of Aurora-A by RNAi sensitizes cells to CDDP-induced apoptosis and decreases phospho-Akt level in wild-type p53 cells. Reintroduction of p53 decreases Akt1 and Akt2 activation and restores CDDP sensitivity in p53-null but not p53-null-Aurora-A cells. Inhibition of Akt by small molecule inhibitor, API-2, overcomes the effects of Aurora-A on cell survival and Bax mitochondrial translocation. In addition, we have identified several Aurora-A inhibitors by screening ChemDiv library. Moreover, we generated MISIIR-Aurora-A and MMTV-Aurora-A transgenic mice. While MISIIR-Aurora-A mice failed to develop ovarian tumor, MMTV-Aurora-A mice exhibited ductal carcinoma in situ.

DTIC

Auroras; Cancer; Enzymes; Inhibitors; Oncogenes; Ovaries; Phosphorus; Proteins

20070010956 Texas Univ., Houston, TX USA

The Role of Stat3 Activation During Prostate Cancer Progression

Blando, Jorge; DiGiovanni, John; Nov 2006; 16 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-06-1-0045

Report No.(s): AD-A462677; No Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA462677>

The purpose of this proposal is to detect the role of Stat3 activation during prostate cancer progression. A multifaceted approach is being used to accomplish the proposed research goals. Significant progress was made in support of Task 1 in that we were able to overexpress activated Stat3 (Stat3C) in two human prostate cell lines. Both lines were characterized and at least one line (MDAPLa 2b) exhibits molecular alterations consistent with Stat3 activation. In support of Task 2, we have begun characterization of the Pb.Stat3C transgenic line and the preliminary histopathological findings indicate that expression of activated Stat 3 may confer a neoplastic phenotype. The proposed bigenic cross (Pb.Stat3C x BK5.IGF-1) has also been initiated as well as an alternate strategy due to the limited fertility of the BK5.IGF-1 transgenic line and the apparent

compromise in viability of the bigenic offspring. Our results to date have been promising and should further our understanding of the role of Stat3 activation in prostate cancer progression.

DTIC

Cancer; Histology; Pathology; Prostate Gland

20070010957 California Univ., San Francisco, CA USA

Reduction of Racial Disparities in Prostate Cancer

Daniels, Nicholas; Dec 2006; 21 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-05-1-0113

Report No.(s): AD-A462678; No Copyright; Avail.: CASI: [A03](#), Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA462678>

Chronic prostatitis/chronic pelvic pain syndrome (CP/CPPS) is a major cause of illness and the association with past urinary tract infections is unclear. We surveyed a racially, ethnically and socioeconomically diverse, community-based sample of adults aged 30-79 years in Boston, Massachusetts. This report gives estimates from the 2301 men in the BACH survey: 700 Black, 766 Hispanic, and 835 White. Symptoms of chronic prostatitis any perineal and/or ejaculatory pain and a pain score of 4 or greater were derived from the NIH Chronic Prostatitis Symptom Index and were used to identify men with symptoms suggesting CP/CPPS. The overall prevalence of symptoms suggestive of CP/CPPS is 6.3%. The number of urinary tract infections, particularly more than three, was associated with these symptoms suggestive of CP/CPPS (P<0.01). There is a strong association between current symptoms of CP/CPPS and a history of urinary tract infections, particularly of multiple infections. The causality between chronic UTIs and CP/CPPS needs to be clarified by further study.

DTIC

Cancer; Prostate Gland

20070010958 British Columbia Cancer Agency, Vancouver, British Columbia Canada

Eliciting Autoimmunity to Ovarian Tumors in Mice by Genetic Disruption of T Cell Tolerance Mechanisms

Nelson, Brad H; Aug 2006; 15 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAMD17-01-1-0733

Report No.(s): AD-A462679; No Copyright; Avail.: CASI: [A03](#), Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA462679>

We have developed a mouse model for ovarian cancer that allows monitoring of tumor-specific T cell clones as they encounter ovarian tumors in vivo. We 'tagged' the neu oncogene with two defined T cell epitopes so as to confer recognition by available T cell receptor (TCR) transgenic T cells. When expressed in the murine ovarian tumor cell line ID8, epitope-tagged neu (designated neuOT1/OT2) induces the formation of aggressive ovarian adenocarcinomas that express the epitope tag and hence are recognizable by adoptively transferred TCR transgenic T cells. We successfully made the neuOT1/OT2 expression construct and stably expressed it in an aggressive subclone of the ID8 cell line, designated ID8-G7, which was derived by serial in vivo passage of the original ID8 line. When injected intraperitoneally into syngenic mice, ID8-G7 cells expressing neuOT1/OT-II give rise within one month to disseminated ovarian cancer with extensive ascites (Aim 1). CD8+ (OT-I) T cells specific for neuOT1/OT-II proliferate extensively after adoptive transfer into tumour-bearing hosts and, remarkably, induce complete tumour regression within 10 days in a dose-dependent manner (Aim 2). In the next year, we will test whether the dose-dependency of this response can be mitigated by use of autoimmune-prone Cbl-b-deficient CD8+ T cells (Aim 3).

DTIC

Cancer; Diseases; Genetics; Immunity; Mice; Ovaries; Tumors

20070010959 Duke Univ., Durham, NC USA

The Role of HDAC6 in Prostate Cancer

Gao, Yasheng; Yao, Tao Pang; Oct 2006; 16 pp.; In English

Contract(s)/Grant(s): W81XWH-05-1-0573

Report No.(s): AD-A462680; No Copyright; Avail.: CASI: [A03](#), Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA462680>

Regulation of the stability and activity of androgen receptor by Hsp90 provides a scientific basis for current chemotherapy of prostate cancer with Hsp90 inhibitors. However, how Hsp90 activity is regulated is still not fully understood. In this current research, we have investigated the role of HDAC6 in prostate cancer development and progression through regulation of

Hsp90 activity. We have found that Hsp90-ATP association, a reliable indication of Hsp90 activity, is down-regulated in HDAC6-deficient cells, and have provided evidence that loss of HDAC6 in cells also down-regulates protein levels of AR and other Hsp90 client proteins, probably through increased acetylation of Hsp90 and down-modulation of co-chaperone HOP. Requirement of HDAC6 for proper Hsp90 activity and AR activity is further substantiated by the fact that HDAC6-deficient LNCaP cells have slower growth and increased cell death (observation not yet documented) in medium with charcoal-stripped serum, which can not be reversed by androgen add-back. Another unique finding from this research is the identification of B-Raf, one of the key factors in Ras-Raf-MEK-ERK signaling axis, as a potential Hsp90 client protein. Once this finding is verified, it will have wide implications in understanding tumorigenesis as well as in cancer therapy as a whole.

DTIC

Cancer; Prostate Gland

20070010960 Georgetown Univ., Washington, DC USA

Internet-Based Education for Prostate Cancer Screening

Taylor, Kathryn L; Dec 2006; 62 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-06-1-0182

Report No.(s): AD-A462681; No Copyright; Avail.: CASI: A04, Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA462681>

Prostate cancer (PCa) is the leading cancer diagnosis among men and the second leading cause of male cancer death. However, screening asymptomatic men remains controversial, as early diagnosis and treatment of PCa has not yet demonstrated reduced disease-related mortality in a randomized trial. The goal of the current study is to develop and assess widely accessible, easily disseminable methods to assist men in making informed decisions about PCa screening. We will compare the efficacy of a new web-based, interactive decision support approach to our existing print-based PCa screening decision tool, among a diverse sample of male primary care patients. Abundant evidence documents the expanding role of the Internet in increasing access to and understanding of health information and the need for systematic evaluations of Internet-based interventions. To date, an Internet usage feasibility study was conducted; the print-based booklet has been significantly revised and updated; the research team has met with our team of web developers to formulate development of the Internet-based website; a list of free Internet access points has been compiled; and focus group participants have been accrued.

DTIC

Cancer; Education; Internets; Prostate Gland

20070010961 Michigan Univ., Ann Arbor, MI USA

Tissue Microarray Assessment of Novel Prostate Cancer Biomarkers AMACR and EZH2 and Immunologic Response to them in African-American and Caucasian Men

Mehra, Rohit; Apr 2006; 13 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-05-1-0173

Report No.(s): AD-A462682; No Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA462682>

Prostate cancer is a leading cause of cancer-related death in American men. Prostate cancer like other cancers is characterized by complex molecular events influenced by diverse genetic and environmental factors. The objective of the present study was to compare the expression of AMACR and EZH2 in African-American patients and Caucasian patients with prostate cancer and understand their role. We constructed 5 tissue microarrays representing 40 African-American and 159 Caucasian prostate cancer patients and performed immunohistochemistry on these arrays using antibodies to AMACR and EZH2. Protein expression was scored on these arrays for both AMACR and EZH2. We are presently analyzing the data generated from these experiments and looking into the relative levels of the two markers in prostate cancer patients from the two racial subgroups and also for any associations with survival patterns and clinico-pathologic parameters.

DTIC

Africa; Biomarkers; Cancer; Human Beings; Immunology; Males; Prostate Gland; Races (Anthropology)

20070010962 Howard Univ., Washington, DC USA

UV Exposure, Vitamin D, and Prostate Cancer Risk in African Americans

Kanaan, Yasmine; Aug 2006; 20 pp.; In English

Contract(s)/Grant(s): DAMD17-03-1-0069

Report No.(s): AD-A462684; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA462684>

African American men have the highest incidence of prostate cancer compared to other ethnic groups. This cohort also tends to present at an advanced stage with aggressive histology and increased cancer-related mortality. There is accumulating evidence that vitamin D may be an important determinant of the occurrence and progression of prostate cancer. Because the prostate cancer mortality rate increases significantly as the availability of ultraviolet (UV) radiation exposure decreases, and the synthesis of vitamin D depends on UV radiation, it was hypothesized that vitamin D deficiency is a risk factor for prostate cancer. Research suggests that vitamin D has a protective effect on prostate cancer. The goal of this study is to explore the effects of UV exposure, serum Vitamin D, and skin color on prostate cancer risk in a large case-control study of African American men \geq 40 years of age from the Washington, DC area. The aims are to recruit 76 prostate cancer cases and 152 age- and ethnicity-matched controls; assess UV exposure in patients and controls; measure modifying factors of UV exposure (i.e., skin color, serum 25-OH Vitamin D, and gene variation in Vitamin D metabolism); and (4) determine if UV exposure and modifying factors act alone or interact to affect prostate cancer risk in African American men. To date, 27 African American males with histologically diagnosed adenocarcinoma of the prostate have been identified. Subjects have a PSA greater than 2.5 ng/ml and a positive DRE. They were recruited through Howard University Hospital. Nine age- and ethnicity-matched controls have been recruited through the free screenings program at Howard University Cancer Center. For patients and controls, the authors have collected medical histories and blood samples for gene testing; serum circulating levels of 25-OH Vitamin D have been measured by enzyme immunoassay; and subjects have completed food frequency and UV exposure questionnaires.

DTIC

Africa; Calciferol; Cancer; Exposure; Genes; Prostate Gland; Risk; Ultraviolet Radiation

20070010963 Alabama Univ., Birmingham, AL USA

A Controlled Trial of Chemoprevention Using COX-2 Inhibitors in an Avian Model of Spontaneous Ovarian Carcinogenesis

Barnes, Mack N; Berry, Wallace D; Mar 2006; 8 pp.; In English

Contract(s)/Grant(s): W81XWH-04-1-0322

Report No.(s): AD-A462685; No Copyright; Avail.: CASI: A02, Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA462685>

While a strong rationale for chemoprevention of ovarian carcinoma exists, a mechanism for the comprehensive evaluation of novel compounds is severely impeded by the lack of a validated animal model of spontaneous ovarian carcinogenesis. At present, there is no verified, established model for this disease. In rodents, this type of cancer does not spontaneously develop. While studies investigating 'induced' carcinomas have been performed they are hindered by biologic differences in induced and spontaneous tumor formation. Identification of spontaneous ovarian carcinogenesis in the laying hen (*Gallus Domesticus*) may provide the answer to this dilemma. Multiple reports have demonstrated a 30-50% rate of spontaneously arising genital tract adenocarcinomas in hens of 3-6 years of age. Thus, the purpose of this study will be to utilize this animal model to evaluate the ability of a COX-2 inhibitor to reduce the incidence of spontaneous ovarian carcinogenesis in this animal model. More importantly, identification of promising agents in surrogate animal models that simulate a high risk population would significantly impact the strategy of cancer chemoprevention for ovarian carcinoma and lead to subsequent endeavors in this neglected area of study.

DTIC

Birds; Cancer; Inhibitors; Ovaries; Prevention; Tumors

20070010964 Washington State Univ., Pullman, WA USA

Proteomics Characterization of the Molecular Mechanisms of Mutant P53 Reactivation with PRIMA-1 in Breast Cancer Cells

Daoud, Sayed S; Aug 2006; 19 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-04-1-0723

Report No.(s): AD-A462688; No Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA462688>

The main purpose of the study is to identify novel protein-protein interactions in various locations of cells to establish the molecular mechanisms of mutant p53 reactivation with PRIMA-1 in breast cancer cells. To achieve this goal, co-immunoprecipitation/mass spectrometry approaches are used to search for novel proteins that interact with p53 in the cytoplasmic and nuclear fractions of cells. The identity of interacting proteins are validated and confirmed by immunoblot analyses and protein translocation is detected by confocal microscopy. Our approach has identified hsp90 as a partner protein

that is associated, in part, with the restoration of p53 transcriptional transactivation function of PRIMA-1.

DTIC

Amino Acids; Anchors (Fasteners); Biochemistry; Breast; Cancer; Mammary Glands; Membranes; Molecular Dynamics; Proteins; Proteome; Reactivity

20070010965 Dana Farber Cancer Inst., Boston, MA USA

Mouse Orthotopic Xenographs of Human Prostate Primary Tumors

Loda, Massimo; Nov 2006; 9 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-06-1-0053

Report No.(s): AD-A462689; No Copyright; Avail.: CASI: [A02](#), Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA462689>

Currently, primary human tumor material is insufficient due to small size, multifocality and difficulty of visualization at macroscopic examination. This essentially prevents extensive studies aimed at distinguishing indolent and aggressive organ-confined prostate cancers. Understanding the molecular alterations governing tumorigenesis and cancer progression is the first step necessary for the design of effective and targeted therapies. For this reason, in recent years considerable efforts have been devoted to generate clinically relevant models of prostate tumors. As a result, a number of cell lines and in vivo models have been developed. To date, however, there is no model in which all aspects of human PCa progression can be mimicked. It is important to note that the overwhelming majority of organ-confined human prostate cancers display a luminal phenotype, characterized by expression of androgen receptor (AR), PSA and luminal-type keratins. The established human cell lines most commonly utilized in prostate cancer research are derived from metastases and only few of them are androgen-sensitive. In the last 20 years a variety of methodologies have been attempted for the purpose of establishing primary epithelial cell cultures displaying a luminal phenotype reflective of the human primary prostate tumor of origin, but attempts have been largely unsuccessful. The possibility exists that small populations of contaminating nonmalignant cells (invariably present in the human tissue sample) can populate and ultimately replace transformed cells in vitro. When transformed cells are indeed obtained from prostate primary adenocarcinomas they rarely form tumors in nude mice. Finally, primary cells from prostate cancers are mostly diploid and do not show relevant chromosomal alterations.

DTIC

Cancer; Medical Science; Mice; Neoplasms; Prostate Gland; Tumors

20070010966 Wisconsin Univ., Madison, WI USA

Regulation of Egr1 Target Genes by the NuRD Chromatin Remodeling Complex

Svaren, John; Dec 2006; 18 pp.; In English

Contract(s)/Grant(s): W81XWH-06-1-0167

Report No.(s): AD-A462690; No Copyright; Avail.: CASI: [A03](#), Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA462690>

Previous work had shown that the EGR1 transactivator is overexpressed in prostate cancer, while expression of its corepressor, NAB2, is reduced. Based on our recent characterization of an interaction between NAB2 and the NuRD (Nucleosome remodeling and disruption) chromatin remodeling complex, we have determined if loss of NAB2 expression results in loss of NuRD targeting to EGR1 target genes. In progress thus far, we have shown that repression of some NAB-regulated target genes in prostate cancer cells requires the NuRD chromatin remodeling complex. We have developed novel chromatin immunoprecipitation assays for the NuRD complex in prostate cells to demonstrate the colocalization of the NuRD complex on EGR1-regulated endogenous target genes. In addition, we have shown that recruitment of the NuRD complex to EGR1 target genes is dependent on NAB2. Finally, NuRD-dependent repression of NAB-regulated repression is sensitive to histone deacetylase inhibitors. These results provide the first functional description of one of the major HDAC-containing chromatin remodeling complexes in prostate cancer cells, and elucidate molecular consequences of loss of NAB2 corepressor function in prostate carcinogenesis by analyzing the mechanism of NAB2 corepressor function.

DTIC

Cancer; Chromatin; Genes; Prostate Gland; Proteins; Targets

20070010970 North Carolina Univ., Chapel Hill, NC USA

Racial Differences in Lifestyle Modification in Men with Newly-Diagnosed Prostate Cancer

Satia, Jessie A; Jul 2006; 10 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-04-1-0530

Report No.(s): AD-A462702; No Copyright; Avail.: CASI: [A02](#), Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA462702>

The purpose of this investigation is to determine whether men diagnosed with prostate cancer make changes in dietary intake, physical activity, and use of dietary supplements, and the extent to which these changes differ by race (African American versus Caucasian American). The study also seeks to determine whether alterations in dietary intake and dietary supplement use among prostate cancer patients are associated with changes in oxidative DNA damage in lymphocytes and serum prostate specific antigen (PSA) levels. The project builds upon a Department of Defense-sponsored CaP Consortium titled 'Racial Differences in Prostate Cancer: Influences of Health Care and Host and Tumor Biology.' For this longitudinal study, a subset of Consortium participants in North Carolina (125 African Americans and 125 Caucasian Americans) will be recruited and followed for a period of 2 years. Data will be collected at baseline by the Consortium and at 12 months and 24 months postdiagnosis using similar methodology. Institutional Review Board approval has been obtained from both the funding agency (i.e., the DoD) and from the University of North Carolina. Study staff have been hired and trained. Participant enrollment and data collection will begin in September 2006. An abstract describing the study design was presented at the 2006 Experimental Biology Annual Conference.

DTIC

Africa; Cancer; Diets; Human Beings; Males; Prostate Gland; Races (Anthropology)

20070011074 Texas Univ., Dallas, TX USA

Simultaneous Monitoring of Vascular Oxygenation and Tissue Oxygen Tension of Breast Tumors under Hyperbaric Oxygen Exposure

Xia, Mengna; Apr 2006; 24 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-04-1-0411

Report No.(s): AD-A462386; No Copyright; Avail.: CASI: [A03](#), Hardcopy

The goals of the study in the second stage is to investigate vascular oxygenation and tissue oxygen tension of breast tumor under four different hyperbaric oxygen exposures, using near-infrared spectroscopy and FOXY oxygen sensor simultaneously. Hyperbaric oxygenation results in a significant increase in the tumor oxygenation and has superior effect than normobaric oxygen in all seventeen tumors. The improvement of tumor oxygenation could be maintained for 10 to 20 minutes after the end of the hyperbaric oxygen exposure. Multiple correlations were examined between magnitudes of vascular ([HbO₂]) and tissue (pO₂) responses. Significant correlations were found between responses to normobaric oxygen/carbogen breathing using either modality, but not for responses to hyperbaric oxygen/carbogen. Vascular (R²=0.78) and tissue oxygenation (R²=0.65) also showed the correlations between responses to normobaric and hyperbaric oxygen/carbogen intervention. 15.

DTIC

Breast; Cancer; Cardiovascular System; Exposure; High Pressure; Mammary Glands; Oxygen; Oxygen Tension; Oxygenation; Tumors

20070011075 Geisinger Medical Center, Danville, PA USA

Construction of a Mitogenesis-Coupled Apoptosis Molecular Device

Yang, Wannian; Jul 2006; 14 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-05-1-0178

Report No.(s): AD-A462387; No Copyright; Avail.: CASI: [A03](#), Hardcopy

In this grant proposal, we proposed to construct Ras/Raf-based MCAMD, i.e. fuse one subunit of caspase-3 to Raf and the other subunit to Ras. Once Ras interacts with Raf in response to mitogenic signal, the two subunits of caspase-3 that are fused to Ras and Raf will be brought together to form mature active caspase-3, thus cellular apoptosis will be initiated. During eighteen months, we constructed plasmids that are required for testing MCAMD. We characterized the interaction of separated C3SS and C3LS and established a base for application of Caspase-3 in construction of MCAMD. We tested initial cellular reactions of MCAMD and found that C3SS-Ras could not co-express with Raf-RBD-C3LS, suggesting that C3SS-Ras and Raf-RBD-C3LS might form active Caspase-3 and cause a rapid cell death. However, because this research is novel and we did not have experience in construction and testing of MCAMD, we met some unexpected problems, such as weak interaction of wild type Ras with Raf-RBD that causes constitutive activation of MCAMD and makes that MCAMD cannot sense mitogenic signaling. Future studies will include: (a) to overcome signaling switch problem of the MCAMD; (b) to assay caspase-3 activity and apoptosis upon co-transfection of tetracycline-inducible expression of C3SS-RasWT and Raf-RBD-C3LS; and (c) to test MCAMD in prostate cancer cells.

DTIC

Apoptosis; Cancer; Construction; Mitosis; Prostate Gland

20070011076 Oregon Health Sciences Univ., Portland, OR USA

IGF-Regulated Genes in Prostate Cancer

Roberts, Jr, Charles T; Feb 2006; 40 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAMD17-02-1-0122

Report No.(s): AD-A462388; No Copyright; Avail.: CASI: [A03](#), Hardcopy

In this project, we have analyzed the role of the IGF signaling system in prostate cancer initiation and progression. Our original hypothesis stated that, since the IGF system is an important factor in tumorigenesis and prostate cancer, that genes and proteins that were differentially expressed in cells that expressed different levels of the IGF-I receptor that mediates the intracellular effects of the IGFs may themselves constitute potential diagnostic factors or therapeutic targets. During the period of this award, we have analyzed differential gene expression and protein secretion in genetically engineered metastatic and nonmetastatic prostate cancer cells expressing different levels of the IGF-IR. These studies were in direct support of the original statement of work. In addition, we have: 1) defined the transcriptional regulation of the IGF-I gene; 2) reported the regulation of IGF signaling by saw palmetto; 3) described the interaction between the IGF-IR and the androgen receptor; 4) identified a novel product of the Her2 gene that regulates IGF action; and 5) reviewed the role of IGF action in prostate cancer. These findings are represented by the peer-reviewed publications summarized in this final report and provided as appendices.

DTIC

Cancer; Genes; Hormones; Hypotheses; Males; Prostate Gland

20070011079 Kimmel (Sidney) Cancer Center, San Diego, CA USA

Identification of Novel Retinoid Targets in Prostate Cancer

Piedrafito, Javier; Nov 2005; 8 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-05-1-0073

Report No.(s): AD-A462421; No Copyright; Avail.: CASI: [A02](#), Hardcopy

Retinoids have shown promises for the chemoprevention and treatment of cancer. However, except for the efficient treatment of acute promyelocytic leukemia by all-trans retinoic acid, most natural and synthetic retinoids have failed in clinical trials because of toxicity and limited activity. Novel synthetic retinoid-related molecules represent promising leads for the chemoprevention and treatment of prostate cancer. Our goal is to understand the mechanism of action of these analogs at the molecular level, which seems to be independent of the nuclear retinoid receptors. Using a Genetic Suppressor Elements selection approach we aim to identify genes that mediate retinoid function. We have established the experimental conditions to infect PC3 cells with retroviruses expressing a GSE library, which will be used to select cells that survive a killing dose of two synthetic retinoids.

DTIC

Cancer; Prostate Gland; Targets

20070011080 California Univ., San Francisco, CA USA

Inhibitors for Androgen Receptor Activation Surfaces

Fletcherick, Robert J; Sep 2006; 45 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-05-1-0545

Report No.(s): AD-A462434; No Copyright; Avail.: CASI: [A03](#), Hardcopy

The androgen receptor (AR) is a proven therapeutic target for treating prostate cancer. Known therapeutics target the ligand binding domain (LBD) at the exact place where dihydrotestosterone (DHT) binds. Upon binding DHT, AR reorganizes to form new interaction surfaces such as the AF2 surface that attracts coregulators. AF2 has been proposed as a second therapeutic target as coactivator recruitment is a key step for AR function. We developed two screening methods to find compounds that bind to AF2. Our method has proved successful with the thyroid receptor. In solution, a competition assay reports coactivator displacement and 3D screening by X-ray crystallography visualizes the compounds on the receptor. Two classes of compounds have been identified that bind to AF2: the first class bind weakly and do not compete with coactivator binding (2-methylindole, and two protein kinase inhibitors), while the second class have micromolar affinity and compete with coactivator binding (TRIAC, and three aspirin derivatives). Screening revealed a significant and undiscovered cryptic surface site that we call binding function 3 (BF3), which might be implicated in AR regulation. These are the first compounds reported to block AR protein-protein interactions and might serve as starting templates for more selective and effective antiandrogens.

DTIC

Cancer; Crystallography; Hormones; Inhibitors; Males; Prostate Gland; Proteins

20070011081 Vermont Univ., Burlington, VT USA

Tissue Factor Plasma Analysis

Cooley, Sarah A; Mann, Kenneth G; Nov 2006; 32 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-06-2-0036

Report No.(s): AD-A462446; No Copyright; Avail.: CASI: [A03](#), Hardcopy

This progress report describes the assays, protocols and results related to a collaborative research initiative between Dr. Mann's research laboratories (coagulation research laboratory and Antibody Core Facility, Department of Biochemistry, University of Vermont, Burlington, Vermont) and Dr. Park's clinical research involving trauma and acutely burned patients (U. S. Army Institute of Surgical research, Fort Sam Houston, Texas). The major areas of research involved assessment of the role of soluble and membrane-bound tissue factor (TF) in the overall responses of trauma and burned patients to interventions and to determine whether TF concentrations in blood and/or on cell over time can predict the risks for developing Multi-Organ Dysfunction syndrome (MODS) or Adult Respiratory Distress Syndrome (ARDS). Dr. Mann's laboratory has determined the TF antigen concentrations in plasmas from 149 trauma and burned patients. Each patient had several plasma samples that had been collected at various times following hospitalization. These samples include baseline (the day of hospitalization), day 1, day 3, day 5, day 7, and plasma samples drawn in between hospitalization days and the discharge days (in most cases up to 42 days). The total numbers of plasmas tested were 514. For each sample duplicate determinations were performed. The TF activity was also determined for 514 plasmas and when TF activity was detected, anti-TF monoclonal antibody (mAb) was used to verify the observation. If active TF was found in plasma, anti-TF mAb should inhibit the activity. These data were provided to Dr. Park for further analyses of the correlation of the TF antigen and activity with clinical data obtained by Dr. Park's team.

DTIC

Antibodies; Blood Plasma; Factor Analysis; Medical Science; Plasmas (Physics)

20070011082 Johns Hopkins Univ., Baltimore, MD USA

Proton MR Spectroscopic Imaging in NF1

Barker, Peter B; Phil, D; Jul 2006; 12 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAMD17-01-1-0713

Report No.(s): AD-A462479; No Copyright; Avail.: CASI: [A03](#), Hardcopy

Neurofibromatosis Type 1 (NF-1) is the most common autosomal dominant genetic disorder, affecting the skin, central (CNS) and peripheral nervous systems. Children with NF-1 have an increased risk of developing significant learning disability (LD), cognitive impairment, and optic or brain stem gliomas. Cerebral magnetic resonance imaging (MRI) in NF-1 reveals regions of high signal intensity (often called unidentified bright objects, or UBOs). The pathophysiology of UBOs is poorly understood, and it is controversial to what extent they are involved in cognitive impairment. The aims of this proposal are to characterize the underlying metabolic abnormalities in NF-1 with proton MR spectroscopic imaging (MRSI). We have developed a rapid, quantitative MR spectroscopic imaging (MRSI) protocol for the evaluation of cerebral metabolite levels in NF-1. Metabolite levels will be determined both in UBOs and other brain regions, both in order to improve understanding of the etiology of UBOs, and to understand the relationship between regional brain metabolism and LD. 60 subjects with NF1 and 60 control subjects will be evaluated with proton MRSI and detailed neuropsychological testing. Ultimately, proton MRSI may be a useful test for identifying children with NF-1 at risk of developing LD, and also help in distinguishing UBOs from other, malignant lesions which require therapeutic intervention.

DTIC

Abnormalities; Central Nervous System; Disorders; Imaging Techniques; Magnetic Resonance; Magnetic Resonance Spectroscopy; Mental Health; Protons; Spectroscopy

20070011083 Washington Univ., Saint Louis, MO USA

The Role of a Novel Topological Form of the Prion Protein in Prion Disease

Stewart, Richard S; Jul 2005; 26 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAMD17-03-1-0531

Report No.(s): AD-A462482; No Copyright; Avail.: CASI: [A03](#), Hardcopy

Most (but not all) cases of prion disease are associated with a conformationally altered form of the prion protein (PrP) known as PrP^{Sc}. Several lines of evidence indicate that while PrP^{Sc} is the infectious molecule, it may not be the proximate cause of toxicity in prion disease. Several other candidates for such a toxic species have been proposed, including an altered topological form of PrP known as CtmPrP. Lines of transgenic mice engineered to express CtmPrP develop a spontaneous prion-like disease. Thus, extending our knowledge of the biology of CtmPrP will likely lead to important clues about how all

prion diseases induce neurotoxicity. We have characterized the cell biology of CtmPrP in detail in cultured neurons, and show that its cellular trafficking differs from normal PrP. We have also learned that CtmPrP is much less toxic when expressed on a PrP null genetic background; this result has important implications for the mechanism of toxicity in prion disease. We have attempted to establish a cell culture model for CtmPrP-dependent toxicity to further define the mechanism of cell injury.

DTIC

Diseases; Proteins

20070011084 National Rehabilitation Hospital, Washington, DC USA

NRH Neuroscience Research Center

Dromerick, Alexander W; Heaton, Edward; Jun 2006; 188 pp.; In English

Contract(s)/Grant(s): DAMD17-02-2-0032

Report No.(s): AD-A462483; No Copyright; Avail.: CASI: [A09](#), Hardcopy

The NRH Neuroscience Research Center (NRC) mission is to promote and accomplish rehabilitation-related basic and applied neuroscience research. AS part of this mission, the NRC: (1) develops new clinical interventions for patients with neurologically based impairments, (2) evaluates the effectiveness of new and existing rehabilitation-related interventions, (3) enhances our understanding of the neurophysiological and neuropsychological basis of impairment and disability, and (4) develops new methods to assess human function and performance. In order to be successful with our mission, the NRC is comprised of five research areas. They are as follows: a) High Resolution and Neuromotor Assessment; b) Mechanisms Underlying Recovery from Neurological Illness and Injury; c) Treatment of Neurological Diseases and Injury; d) Pilot Projects; and e) Annual Conference and Expert Panel Projects. Year 4 progress is discussed in detail in this report.

DTIC

Neurology; Neurophysiology

20070011086 Eastern Virginia Medical School, Norfolk, VA USA

Identification and Characterization of Prostate Cancer Associated Protein Biomarkers Using High-Throughput Mass Spectrometry

Malik, Gunjan; Sep 2006; 56 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-06-1-0111

Report No.(s): AD-A462488; No Copyright; Avail.: CASI: [A04](#), Hardcopy

Prostate cancer (PCa) remains to be the most common non-skin cancer in the US. Currently available screening tests for PCa including prostate specific antigen (PSA) test, digital rectal examination (DRE) and prostate biopsy, call for more accurate and non-invasive techniques to detect, diagnose, and stratify the disease based on molecular markers present in the body fluids. There has been an impressive emergence of mass spectrometry based technologies applied toward the study of such biomolecular markers of disease states. Our focus on utilization of such techniques towards prostate cancer will promise a better health and future for PCa patients. We have devised strategies to isolate and identify protein biomarkers from PCa patients in the clinical gray-area where PSA fails to detect cancer. Identification of such cancer biomarkers will assist in development of better non-invasive diagnostic tools for prostate cancer and may also lead to better therapeutic targets.

DTIC

Biomarkers; Cancer; Mass Spectroscopy; Prostate Gland; Proteins

20070011094 Health Research, Inc., Buffalo, NY USA

Hypoxia and Prx1 in Malignant Progression of Prostate Cancer

Park, Young-Mee; Sep 2006; 78 pp.; In English

Contract(s)/Grant(s): W81XWH-05-1-0572

Report No.(s): AD-A462545; No Copyright; Avail.: CASI: [A05](#), Hardcopy

Hypoxia has been proposed to function as a micro-environmental pressure to select for a subset of cancer cells with an increased ability to survive and proliferate. The activation of Nrf2 and the up-regulation of prx1 expression by changes of oxygenation are likely to contribute to the malignant progression of cancer and to modify the treatment response of cancer cells. The information provided in the current study suggests that the Nrf2-Prx1 axis may serve as a fruitful target for cancer prognosis and therapy. Identifying the key regulatory components and understanding the molecular basis of prx1 gene regulation by Nrf2 are critical to the development of intervention strategies. Future research will be aimed at finding out whether Nrf2-Prx1 activation can be suppressed by genetic and/or pharmacological approaches and whether suppressing the Nrf2-Prx1 axis will inhibit the malignant progression or reverse treatment resistance in pre-clinical models. We provide the

first evidence that suggests hypoxia increases AR function in human prostate cancer cells and Prx1 enhances the hypoxia-mediated AR activation. Delineating the molecular mechanisms by which hypoxia affects AR function will provide insight into the treatment resistance and malignant progression of prostate cancer cells. Novel therapeutic approaches should be developed to prevent hypoxia and/or its consequences to enhance the efficacy of androgen deprivation therapy a treatment that has not been Improved significantly since its introduction over 50 years ago.

DTIC

Cancer; Hypoxia; Prostate Gland

20070011097 College of William and Mary, Williamsburg, VA USA

In Vivo Molecular Imaging of Mammary Tumorigenesis in Murine Model Systems

Saha, Margaret S; Aug 2006; 23 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-05-1-0480

Report No.(s): AD-A462553; No Copyright; Avail.: CASI: [A03](#), Hardcopy

The development of accurate diagnostic tools and effective breast cancer treatments requires the ability to detect the presence of pre-cancerous, cancerous, and metastatic tissue and to identify the particular subtype or class of tumor. It is equally imperative to develop the capability of performing a molecular diagnosis non-invasively, employing in vivo imaging technologies in order to follow the tumor progression over time. This project entails an interdisciplinary approach which employs a gamma-ray-camera detector system to follow, during tumorigenesis, the uptake of NaI through the Na⁺/I⁻ symporter, and the binding characteristics and localization of vascular endothelial growth factor, epidermal growth factor, and estradiol in mouse models of breast cancer. Using the MMTV model for mammary tumor development, we have found that I- 125 labeled sodium iodide provides a valuable tag for imaging mammary tumors at several different stages of their development. Moreover, it is also able to provide an image of the heterogeneity among tumors and within a given tumor, making it potentially useful as a strategy for non-invasively imaging and classifying mammary tumors for purposes of prognosis.

DTIC

Breast; Cancer; Estrogens; Hormones; Imaging Techniques; In Vivo Methods and Tests; Mammary Glands; Rodents

20070011103 Rutgers - The State Univ., Piscataway, NJ USA

Role of MicroRNA Genes in Breast Cancer Progression

Padgett, Richard W; Aug 2006; 10 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-05-1-0483

Report No.(s): AD-A462585; No Copyright; Avail.: CASI: [A02](#), Hardcopy

In this proposal, we asked if miRNA expression is altered as cells progress through the different stages of cancer. Through our microarray experiments, we have shown that many miRNAs are differentially regulated as cells progress through cancer stages. A general trend in miRNA expression emerges from this work. As cells progress toward a metastatic state, more miRNAs are down regulated, rather than up regulated. This suggests that many cellular proteins are up regulated in these cells, and this could be involved in promoting tumor growth. We propose that the mouse is a good model system for the study of breast cancer, since several miRNAs are similarly regulated in both mouse and human. Finally, we are beginning to gain insights into the mechanism of how miRNAs are involved in cell growth--studies show that some regulated miRNAs control cell death. The mis-regulation of cell death could allow cells to escape normal regulatory mechanisms for removing tumorous cells.

DTIC

Breast; Cancer; Genes; Mammary Glands; Ribonucleic Acids

20070011104 Melbourne Univ., Victoria, Australia

The Role of Stefin A in Breast Metastasis

Parker, Belinda S; Jul 2006; 24 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-05-1-0444

Report No.(s): AD-A462586; No Copyright; Avail.: CASI: [A03](#), Hardcopy

Metastatic breast cancer is a life threatening disease with limited treatment options. Molecular markers that can either predict accurately if a patient is likely to develop metastatic disease or be used as therapeutic targets are lacking. To address this, we have used a clinically relevant murine model of spontaneous metastasis to lung and bone, to identify candidate genes involved in metastatic progression. By microarray profiling and immunohistochemistry, we found enhanced expression of the

cathepsin inhibitor Stefin A in epithelial cells isolated from primary tumors and their matched spontaneous metastases in lung and bone. In the human disease, patients lacking primary tumor expression of Stefin A had improved disease free survival and expression of Stefin A was enhanced in lung and bone metastases. As an endogenous inhibitor, we proposed that Stefin A is a marker of enhanced cathepsin activity in metastatic tumors. To explore this, we measured cathepsin activity using protease specific fluorescent substrates and found increased activity of cathepsin B in highly metastatic primary tumors. Stefin A and cathepsin B co-localise at the invasive fronts of primary tumors and in lung and bone metastases in the murine model and in human breast cancer. This study implicates cathepsins and their inhibitor Stefin A in breast cancer metastasis and provides evidence that Stefin A has prognostic value in breast cancer.

DTIC

Breast; Cancer; Mammary Glands; Metastasis

20070011105 Melbourne Univ., Victoria, Australia

Molecular Epidemiology of Ovarian Cancer

Bowtell, David; Jul 2006; 27 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAMD17-01-1-0729

Report No.(s): AD-A462587; No Copyright; Avail.: CASI: [A03](#), Hardcopy

The aim of this Program is to study the association between epidemiologic risk factors, low-risk genes, and histologic and novel molecular subtypes of ovarian cancer. In December 2002, we received final approval from the Human Subject Research Review Board (HSRRB) to start recruitment at 13 of the proposed study sites and have since received approval to recruit at a further 2 sites. We have established a network of research nurses across the country and recruitment is now progressing well at 15 different sites. Recruitment of cases for the study began in January 2003 and control recruitment began in May 2003. Full population-based recruitment of cases ceased for women diagnosed after 30 June 2005 but collection of biospecimens and limited epidemiological data continued at key centres until June 2006. We have recruited a total of 1707 women with ovarian cancer (with an additional 296 women recruited since 1 July 2005 for the biospecimens extension) and 1073 control women. The recruitment, sample and data collection and processing systems have worked well and we are continuously monitoring our performance against our targets as outlined in the reports from Core Components A (Epidemiology) and B (Biospecimens).

DTIC

Cancer; Epidemiology; Ovaries

20070011106 Chicago Univ., Chicago, IL USA

The Role of MKK4 in the Metastatic Colonization of Ovarian Cancer

Yamada, S D; May 2006; 10 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAMD17-03-1-0169

Report No.(s): AD-A462588; No Copyright; Avail.: CASI: [A02](#), Hardcopy

Mitogen activated protein kinase 4 (MKK4) a member of the stress activated protein kinase signaling pathway acts as a metastasis suppressor protein in ovarian cancer. Introduction of MKK4 into a highly metastatic human ovarian cancer cell line reduces the number of overt metastases by 90% and prolongs animal survival by 70%. Our specific aims in this proposal included determining the mechanism by which MKK4 mediated metastasis suppression and determining whether introduction of MKK4 a potent activator of the JNK pathway in conjunction with chemotherapeutic agents known to activate JNK would potentiate MKK4s effects on survival and JNK activation. Our key findings during the period of the proposal included the following: 1) MKK4 mediates metastasis suppression via the p38 pathway 2) MKK4 does not mediate metastasis suppression via the JNK pathway 3) MKK4 kinase activity is required for MKK4 induced metastasis suppression. In the past year our findings have included 4) MKK4 expression does not augment the effects of either cisplatin or paclitaxel on metastases in vivo. 5) There do not appear to be any differences in JNK or p38 activation levels in metastases taken from mice injected with MKK4 and treated with chemotherapy (cisplatin or paclitaxel) over chemotherapy alone.

DTIC

Cancer; Chemotherapy; Drugs; Enzymes; Metastasis; Ovaries; Phosphorus; Proteins

20070011112 Thomas Jefferson Univ., Philadelphia, PA USA

Levels of Distress in Women With a Family History of Ovarian Cancer

Kash, Kathryn; Sep 2005; 11 pp.; In English

Contract(s)/Grant(s): DAMD17-00-1-0571

Report No.(s): AD-A462707; No Copyright; Avail.: CASI: [A03](#), Hardcopy

The overall goal of this study is to determine the levels of distress in women with a family history of ovarian cancer and to identify the mediating factors between risk of developing ovarian cancer and distress. The proposed study will use 180 first-degree relatives (FDR) of women diagnosed with ovarian cancer in a cross-sectional design. Information about the ovarian cancer index case provides will be used to identify maternal relatives (mothers, sisters or daughters). Women will be queried about their objective and subjective risk status, their knowledge of ovarian cancer and risk factors, their uncertainty about ovarian cancer, levels of anxiety and depression, their personality traits of mastery, tolerance for ambiguity, and optimism, and their interest in genetic testing. With the results generated by this study, specific interventions may be designed and tested to improve adjustment of women at high risk for ovarian cancer.

DTIC

Cancer; Females; Ovaries

20070011117 New Jersey Medical School, New Brunswick, NJ USA

Spirituality-Based Intervention for African American Women with Breast Cancer. Addendum

Brown, Diane R; Sep 2006; 27 pp.; In English

Contract(s)/Grant(s): DAMD17-00-1-0494

Report No.(s): AD-A462716; No Copyright; Avail.: CASI: [A03](#), Hardcopy

Because social support has been shown to have value in decreasing morbidity and possibly in increasing length of survival in cancer patients, the objective of the study are: 1) to utilize a network of oncology services, churches, and community organizations to recruit African American women diagnosed with breast cancer for project participation; 2) to implement the spiritual-based intervention; 3) to assess the efficacy of the intervention to positively impact treatment-related outcomes; and 4) to refine the intervention for broader dissemination. The intervention involves an experimental/control group design approach. The experimental support group (Intervention group) will receive the Spiritual-based support intervention. There will be two control groups; control group A will include participants in a traditional support group model and control group B will include individuals who receive the standard care consisting of no additional structured support. An Advisory Committee comprised of breast cancer survivors and local clergy will provide guidance to project implementation. Data will be gathered through a pre-test at baseline (T1), a post test at the conclusion of the 7 months intervention (T2), and at a three month follow up at the end of the support group sessions (T3).

DTIC

Africa; Breast; Cancer; Females; Mammary Glands; Therapy

20070011119 Duke Univ., Durham, NC USA

Reaper-Induced Apoptosis

Perry, Jennifer; Aug 2005; 6 pp.; In English

Contract(s)/Grant(s): DAMD17-01-1-0230

Report No.(s): AD-A462723; No Copyright; Avail.: CASI: [A02](#), Hardcopy

Reaper is a central regulator of apoptosis in the fly, *Drosophila melanogaster*. At the start of this proposal our laboratory identified what was believed to be a pro-apoptotic human homolog of Reaper. This was of extreme interest as no true Reaper homolog had been identified in any organism. Accordingly, we proposed in the original statement of work to investigate the ability of the isolated gene to a) induce apoptosis upon overexpression and b) contribute to radiation induced apoptosis. We then proposed to investigate expression of this protein in response to p53 in breast cancer cells and to monitor control of hrp production and activity.

DTIC

Apoptosis; Breast; Cancer; Drosophila; Mammary Glands

20070011122 Institute for Cancer Research, Philadelphia, PA USA

Evaluation of a Culturally Targeted, Personalized Mail-Home Brochure Directed to Partners of at-Risk Men to Facilitate Prostate Cancer Risk Assessment

Miller, Suzanne M; Nov 2006; 8 pp.; In English

Contract(s)/Grant(s): W81XWH-06-1-0099

Report No.(s): AD-A462729; No Copyright; Avail.: CASI: [A02](#), Hardcopy

Prostate cancer is the second leading cause of cancer death in men. Like other forms, prostate cancer exists in both sporadic and hereditary forms. A family history of prostate cancer and African-American ethnicity are two key factors that have been found to place men at increased risk for developing the disease. However, at-risk men exhibit low levels of prostate

cancer risk-related knowledge, despite their increased risk as a group. Prostate cancer risk assessment provides an opportunity to weigh available information and make decisions about screening options; it also provides a window of opportunity to offer concrete instruction in specific prevention behaviors. While there is controversy over the benefits and liabilities associated with prostate cancer screening, there is agreement that at-risk men need to understand the issues related to prostate cancer risk management. Family members can help facilitate health-related behavior and may serve as an important, but underutilized, gateway into the health care system. Thus, guided by the Cognitive-Social Health Information Processing (C-SHIP) model, the current study will evaluate the impact of a communication message intervention tailored to the partners of at-risk men enrolling in prostate cancer risk assessment to facilitate screening adherence.

DTIC

Africa; Assessments; Cancer; Human Beings; Males; Prostate Gland; Risk

20070011123 Louisiana State Univ., Shreveport, LA USA

Dendritic Cell-Based Genetic Immunotherapy for Ovarian Cancer

Mathis, James M; Dec 2005; 15 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-05-1-0055

Report No.(s): AD-A462730; No Copyright; Avail.: CASI: [A03](#), Hardcopy

Adenovirus (Ad)-mediated transduction of dendritic cells (DCs) is inefficient because of the lack of the primary Ad receptor, CAR. CD40 is a surface marker expressed by DCs that plays a crucial role in their maturation and subsequent stimulation of T cells. DC infection with Ad targeted to the CD40 results in increased gene transfer. Cells transduced with CD40-targeted Ad5-SV40-TAg vector showed increased expression of transgene and expression of costimulatory molecules at 48 hours post-infection compared to cells transduced with untargeted Ad5-SV40-TAg vector. We demonstrated that CD40-targeted gene transfer promotes DC maturation with induction of a complex signaling cascade accompanied by characteristic changes in cytokine production. These results demonstrate that DCs can be successfully transduced using a CD40 targeted adenoviral vector and that transduced DCs show activation.

DTIC

Cancer; Gene Therapy; Genetics; Ovaries

20070011128 University of Pittsburgh Medical Center, PA USA

A New Paradigm for African American Breast Cancer Involving Stem Cell Differentiation in a Novel Cell Culture System

Latimer, Jean J; Oct 2006; 32 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-05-1-0581

Report No.(s): AD-A462736; No Copyright; Avail.: CASI: [A03](#), Hardcopy

Our laboratory has published a novel culture system for Human Mammary Epithelial Cells (HMEC), both normal and malignant. This system allows for unusually long-term establishment of normal primary cultures that begin as three-dimensional 'mammospheres,' which subsequently differentiate into complex organotypic branching ducts and lobules that demonstrate Epithelial Specific Antibody (ESA) staining, lumen, polarized nuclei, desmosomes along the lateral surfaces of the cells, and microvilli on the apical surfaces. We hypothesize that since we have demonstrated de novo formation of multicellular organotypic epithelial ductal and lobular structures, that our cultures must contain multipotent stem cells. We have established primary HMEC cultures from 35/35 breast reduction mammoplasty tissues. These tissues included: 19 pre-menopausal, 9 post-menopausal and 7 peri-menopausal (ages 45-55) subjects. Six out of 35 of the subjects from whom this tissue came, were African American and matched in socioeconomic status with the white women (middle class). We found: 1. The more children a woman had, the less likely her breast tissue was to form ductal structures in vitro consistent with the idea that lactational differentiation decreases the number of pluripotent stem cells in the breast. 2. Pre-menopausal breast tissue was more likely to form ductal structures in culture than post-menopausal tissue. 3. Race was shown to contribute as a modifying factor in the ability to form ductal architecture in culture, with AA tissue demonstrating more of an ability to spontaneously differentiate than white tissue.

DTIC

Africa; Breast; Cancer; Cells (Biology); Culture Techniques; Mammary Glands; Stem Cells; Tissue Culturing

20070011134 Washington Univ., Seattle, WA USA

The Effects of Low to Moderate Intensity Aerobic Exercise on Fatigue in Breast Cancer Patients Following Clinical Treatment

Kemble, Katherine L; Sep 2006; 111 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAMD17-03-1-0645

Report No.(s): AD-A462745; No Copyright; Avail.: CASI: [A06](#), Hardcopy

To test the effects of a low to moderate intensity exercise on fatigue and overall QOL, both physiologically and psychologically in women who completed breast cancer treatment. Methods: Twenty-two women, ages 43-79, who had completed treatment for breast cancer, were randomly assigned to an exercise (n= 12) or control group (n = 10). The exercise group participated in a low-moderate intensity (30-50% heart rate reserve) aerobic exercise program 3 times a week for ten weeks. The control group did not participate in the exercise program. Physical functioning was measured by assessing peak aerobic capacity with a treadmill protocol. Both groups recorded their weekly level of fatigue using the Schwartz Cancer Fatigue Scale (SCFS) and Linear Analogue Self-Assessment (LASA). Results: Peak aerobic capacity increased in the exercise group 32%, which was significant, between (p = .0012) and within (p = .005) in the groups. The control group showed a decrease of 4.8%. Body fat decreased significantly within the exercise group over time (p = .0001). Sit and reach increased significantly within the exercise group 10% over time (p = .004). Body mass index decreased in the exercise group and this difference neared significance within the exercise group over time (p = .06). Fatigue reported with the SCFS decreased 55% in the exercise group and increased in the control group. This change was statistically significant between the groups (p = .0003) and within the groups (p = .01). The decrease in depression in the exercise group (89%) neared significance (p = .052) and the difference between the two groups was significant (p = .04). Anxiety decreased significantly in the exercise group 86% (p = .03) and significantly different between the groups (p = .01). Confusion decreased significantly (p = .04) and anger decreased significantly (p = .02) between the exercise group compared to the control group. Energy increased 69% within the exercise group significantly (p = .0005).

DTIC

Aerobes; Breast; Cancer; Mammary Glands; Patients; Physical Exercise

20070011137 Alabama Univ., Birmingham, AL USA

Enhancement of Tumor Immunotherapy by Blockade of a Prostate Tumor Derived Immunosuppressive Factor

Hui, Xu; Aug 2006; 12 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-04-1-0185

Report No.(s): AD-A462748; No Copyright; Avail.: CASI: [A03](#), Hardcopy

Slit2 is a soluble protein that has been demonstrated to regulate cell migration and inhibit inflammatory reactions. Recent studies suggest that Slit2 may play a role in tumor development. However conflict results have been reported about the expression level of Slit2 in normal and tumor tissues and the effect of Slit2 on development. The current studies in this report have for the first time demonstrated that forced expression of Slit2 in tumors suppresses the growth of human prostate tumor Du145 fibrosarcoma HT1080 and epidermoid tumor A431 cells in an anchorage independent way. Further experiments indicate that Slit2 inhibits tumor growth and reduces metastasis of HT1080 tumors in lungs of nude mice. Additionally in situ detection of transcriptional level indicates that Slit2 is down regulated in human tumor samples compared to normal tissues that mostly express Slit2 mRNA. Since all three tumor cell lines in the current studies express Robo4 a receptor for Slit2 the suppressive effect of Slit2 on tumors is likely mediated by the interaction of Slit2 with the receptor. These data imply that Slit2 is a tumor suppressor which is down regulated during tumor development. The effect of Slit2 on tumorigenesis is largely unexplored and further studies are required to define the mechanism for Slit2 mediated suppression of tumors.

DTIC

Augmentation; Cancer; Prostate Gland; Tumors

20070011138 Minnesota Univ., Minneapolis, MN USA

Effect of Daily Migraine Prevention on Health Care Utilization in an Insured Patient Population

Devine, Joshua W; Hadsall, R S; Schommer, J C; Cline, R R; Vimig, B A; Jan 25, 2007; 28 pp.; In English

Report No.(s): AD-A462749; CI07-0018; No Copyright; Avail.: CASI: [A03](#), Hardcopy

The economic benefits of daily migraine prevention have been subject to ongoing debate. This study was undertaken to determine if the initiation of prevention had an observable affect on ambulatory health care utilization compared to acute migraine treatment alone. Administrative claims data from the Military Health System were used to conduct a retrospective, longitudinal cohort study of 3,762-patients with migraine. New users of daily migraine prevention were matched to a reference group of non users using propensity score methods. This matched sample was then used to evaluate the effect of prevention

on ambulatory health care expenditures. The study results showed that exposure to daily migraine prevention led to lower rates of utilization relative to what new patients would have consumed in the absence of treatment. The results suggest that additional economic benefits could be realized by increasing the appropriate use of daily migraine prevention.

DTIC

Headache; Health; Patients; Populations; Prevention; Public Health

20070011139 New Mexico Univ., Albuquerque, NM USA

Prognostic Value of Allelic Imbalance in Prostate Biopsy

Griffith, Jeffrey K; Sep 2006; 12 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-04-1-0831

Report No.(s): AD-A462750; No Copyright; Avail.: CASI: [A03](#), Hardcopy

Purpose: The novel Concept that is being tested in this project is that allelic imbalance (AI) in tissue obtained at prostate biopsy can serve as a sensitive and independent marker for staging and predicting disease recurrence in prostate cancer. Scope: The two Aims of the project are to(i)determine whether the number of sites of Alin biopsy predicts pathological staging following prostatectomy and (ii) to determine the independence, positive and negative predictive values, sensitivity of AI in biopsy tissues as a prognostic marker for prostate cancer. Major Findings: The number of sites of AI has been measured in DNA from 131 prostatectomy tissues, 102 tumor adjacent, histologically normal prostate tissues, 75 biopsy specimens with a positive diagnosis of prostate cancer, 22 tumor adjacent, histologically normal biopsy specimens and II normal prostate tissues from men without disease. The results demonstratethat AI is increased (i)in tumor and tumor-adjacent prostate tissues relative to normal prostate tissues, (ii) as a function of Gleason Sum and (iii)in recurrent prostate tumors. Significance: Allelic imbalance in prostate cancer tissues may provide a novel diagnostic and prognostic marker.

DTIC

Cancer; Prostate Gland

20070011141 Mayo Foundation, Rochester, MN USA

Functional Analysis of Chk2-Kiaa0170 Interaction

Lou, Zhenkun; Sep 2006; 32 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAMD17-03-1-0610

Report No.(s): AD-A462752; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Chk2 is a critical regulator of DNA damage repair checkpoint controls. Mutations in Chk2 confer an increased risk of breast cancer. However, the regulation of Chk2-mediated pathways is still not clear. We previously identified Kiaa0170 (later renamed MDC1, Mediator of DNA Damage Checkpoint Protein 1), interacts with Chk2 after DNA damage. We hypothesized that MDC1 is a key regulator of Chk2-dependent pathways, and is directly involved in DNA repair and cell cycle control. Dysfunction of MDC1-Chk2 pathway could be a key event in tumorigenesis. During funding period, we mapped the interaction sites responsible for the Chk2-MDC1 interaction (Task 1). We also show that MDC1 regulates Chk2-dependent cell cycle checkpoint and radiation-induced apoptosis (Task 2). Finally we generated MDC1 knockout mice and provide evidence at the organismal level that MDC1 is a critical regulator of the DNA damage response pathway and genomic stability (revised Task 3). MDC1 mice also show increased tumor incidence, suggesting that MDC1, like Chk2, is a potential tumor suppressor. Our work provide novel insight into the mechanism of the DNA damage response pathway and tumor suppression.

DTIC

Breast; Cancer; Deoxyribonucleic Acid; Functional Analysis; Mammary Glands

20070011143 Northwestern Univ., Evanston, IL USA

Design and Development of Peptides from the Anti-Angiogenic Pigment Epithelial-Derived Factor for the Therapy of Prostate Cancer

Mirochnik, Yelena; Dec 1, 2006; 18 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-06-1-0103

Report No.(s): AD-A462755; No Copyright; Avail.: Defense Technical Information Center (DTIC)

To create PEDF based therapy for hormone-refractory CaP we have proposed to generate short synthetic peptides corresponding to the 34-mer anti-angiogenic epitope of PEDF. The 3D structure of the 34-mer peptide was analyzed using Protean software in terms of relative hydrophobicity charge distribution and antigenic index. Three synthetic peptides covering the 34-mer fragment were generated and tested for the ability to reproduce anti-angiogenic effect of PEDF. All peptides (14, 18 and 23-mer) inhibited FGF-induced endothelial cell migration. Dose-response curves were generated and the potency of

the peptides compared to native PEDF and the 34-mer. Neither of the peptides showed signs of toxicity at the doses tested. Although all peptides showed anti-angiogenic activity in migration assay only 18 and 23-mer induced apoptosis in endothelial cells. 18-mer peptide also blocked neovascularization induced by FGF as demonstrated in corneal assay. This peptide will be further tested in vivo in mouse model for ability to inhibit prostate tumor growth.

DTIC

Angiogenesis; Antigens; Cancer; Peptides; Pigments; Prostate Gland; Therapy

20070011149 Minnesota Univ., Minneapolis, MN USA

Professional Implications of the Expansion of Retail-Based Clinics into Community Pharmacies

Devine, Joshua W; Jan 25, 2007; 14 pp.; In English

Report No.(s): AD-A462765; C107-0019; No Copyright; Avail.: CASI: [A03](#), Hardcopy

To describe challenges and opportunities associated with the emergence of retail-based health clinics in community pharmacies. Summary: Retail-based clinics have emerged as a convenient, low cost treatment option for many patients. These clinics, which are staffed by physicians' assistants or nurse practitioners, often are located directly within community pharmacies offering rapid diagnosis and treatment for a limited number of health problems. With plans for significant expansion, these clinics offer the profession of pharmacy with a number of challenges. Particularly, allocating space in community pharmacies for retail-based clinics could place pharmacists at a disadvantage to other providers as they pursue ancillary health care activities. These clinics also represent an opportunity for pharmacists to position themselves as a legitimized health care provider who is reimbursed for the consultative services they perform. Because most retail-based clinic conditions are easily diagnosed and have well established treatment protocols, pharmacists would be well positioned to provide these services under collaborative practice arrangements. This could ultimately provide the infrastructure necessary to offer other types of patient services, including Medication Therapy Management (MTM). Conclusion: As retail-based clinics continue to proliferate, pharmacy should carefully consider surrendering space in community pharmacies to other health care practitioners. Retail-based clinics present pharmacists with an opportunity to provide many of the additional health care services we have so vigorously argued for.

DTIC

Clinical Medicine; Medical Services

20070011151 North Carolina Univ., Chapel Hill, NC USA

The Role of Neuropeptide Y (NPY) in Uncontrolled Alcohol Drinking and Relapse Behavior Resulting from Exposure to Stressful Events

Thiele, Todd E; Knapp, Darin J; Breese, George; McCown, Thomas J; Jan 2007; 37 pp.; In English

Contract(s)/Grant(s): W81XWH-06-1-0158

Report No.(s): AD-A462768; No Copyright; Avail.: CASI: [A03](#), Hardcopy

There is high co-morbidity between post-traumatic stress disorder (PTSD) and alcohol dependence, indicating that exposure to stressful events increases the risk of alcoholism. Thus, identifying pharmacological targets with potential therapeutic value in treating PTSD-associated alcoholism is critical. An interesting candidate is neuropeptide Y (NPY). Recent evidence suggests that low NPY levels promote high alcohol consumption, and it has been established the NPY protects against stress and anxiety. The overall goal of this grant is to determine the role of NPY (and related neuropeptides) in modulating stress-induced increases of alcohol consumption using mouse models. The specific projects for the current funding year determined the following: (1) if overexpression of brain NPY with a recombinant adeno-associated virus (rAAV) vector is protective against increased alcohol consumption, and (2) if mutant mice lacking normal production of NPY show enhanced sensitivity to stress-induced increases of ethanol consumption. Results indicate that overexpression of brain NPY protects against high alcohol drinking in mice, and that a lack of NPY in mutant mice increases sensitivity to stress-induced alcohol self-administration. The findings provide evidence that NPY signaling protects against the effects of stress on excessive alcohol self-administration. Thus, NPY may have therapeutic value in treating alcoholism triggered by PTSD. Additional research shows that another stress-related neuropeptide, CRF, modulates stress-induced increases of ethanol drinking in mice, and also modulates increases of ethanol drinking resulting from ethanol abstinence. These results have important implications for possible pharmacological medical treatment of stress-related alcoholism and alcohol relapse. Pharmacological targets aimed at the NPY and CRF systems may prove to be effective in treating alcoholism resulting from exposure to traumatic events and stemming from PTSD.

DTIC

Alcohols; Disorders; Drinking; Exposure; Injuries; Mental Health; Neurotransmitters; Peptides

20070011152 Wayne State Univ., Detroit, MI USA

Physical Performance Characteristics of Military Aircraft Maintenance Personnel Resistant to Work-Related Musculoskeletal Disorders of the Hand and Wrist

Pekarek, Deanna S; Jan 2006; 67 pp.; In English

Report No.(s): AD-A462769; CI07-0024; No Copyright; Avail.: CASI: [A04](#), Hardcopy

Work related musculoskeletal disorders (WMSD), the largest portion of reported and compensated work-related diseases, represent at least one-third of all reported occupational diseases in the USA, Nordic countries, and Japan. WMSDs are responsible for more work absenteeism and disability than any other disease category in the USA, Canada, Sweden, Finland, and England (Punnett & Wegman, 2004). Service industries accounted for 71% of all WMSDs with lost workdays in 2003 for the USA (US). Trade, transportation, and utilities; education and health services; and repair and maintenance are common service industries (Bureau of Labor Statistics [BLS], 2005). Within the USA Air Force (USAF), electrical and mechanical repair technicians comprised the largest occupation category in the USAF or 21% of the enlisted workforce ('Air Force enlisted demographics', 2006 June). Aircraft maintenance was the duty area resulting in the largest number of lost workdays for the USAF from fiscal years 1993 through 2002 (Copley, Burnham, & Shim, 2003).

DTIC

Diseases; Maintenance; Musculoskeletal System; Occupational Diseases; Personnel; Wrist

20070011153 Minnesota Univ., Minneapolis, MN USA

A Model DoD Systems Approach for Tobacco Cessation

Lando, Harry; Oct 2006; 11 pp.; In English

Contract(s)/Grant(s): DAMD17-00-1-0586

Report No.(s): AD-A462770; No Copyright; Avail.: CASI: [A03](#), Hardcopy

Military personnel have a smoking rate of approximately 30%, and recent evidence indicates that this rate is no longer decreasing. Given the costs of smoking in terms of health care expenditures and decreased troop readiness, more must be done to decrease smoking in the military. The primary objective of the study is to evaluate whether implementation of a specialized intervention program based on the recommendations of the DoD Tobacco Cessation Policy Working Group and the VHA/DoD Clinical Practice Guidelines for tobacco interventions will result in lower smoking rates among active duty personnel and TRICARE Prime beneficiaries (i.e., individuals who receive their medical care primarily from military installations). The project intervention combines state-of-the-art components from community trials with empirically supported clinical interventions to form a unique, comprehensive tobacco control program for military installations. Specifically, it focuses on three areas of intervention: expanding pharmacotherapy as a benefit, providing training to both medical and nonmedical personnel regarding brief interventions with tobacco users, and using a social marketing approach to develop a targeted media campaign to reduce tobacco use among junior enlisted personnel.

DTIC

Education; Military Personnel; Pharmacology; Smoke; Tobacco

20070011154 Pittsburgh Univ., Pittsburgh, PA USA

Integrated Development of Serum Molecular Markers for Early Diagnosis of Breast Cancer

Lokshin, Anna; Sep 2006; 65 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAMD17-03-1-0696

Report No.(s): AD-A462774; No Copyright; Avail.: CASI: [A04](#), Hardcopy

We have identified two panels of SEREX antigens associated with breast cancer in pre- and post-menopausal women. Suspended bead arrays were generated using Luminex microspheres. Serum samples from patients with breast cancer, patients with benign breast lesions and healthy volunteers were collected and concentrations of serum breast cancer biomarkers samples were determined. Novel ADEPT bioinformatics algorithm was utilized to analyze the results. In the postmenopausal group, a 23-biomarker panel was selected using the projection pursuit technique correctly classifying 84% of the test set observations, with a sensitivity of 85% at a specificity of 83%. In the premenopausal group, a 20-biomarker panel was identified providing sensitivity of 88% at a specificity of 89% increasing that of mammography for this population. Parallel analysis of these samples using SELDI-TOF MS technology in combinations with BI-RADS scores allowed for correct classification of 80% of patients. The presented data demonstrate that simultaneous testing of a panel of breast cancer-associated serum antigens identified by SEREX using suspended bead array technology allows establishing comprehensive antigenic profiles with high predictive power for breast cancer.

DTIC

Blood; Breast; Cancer; Diagnosis; Mammary Glands; Markers; Serums

20070011155 National Marrow Donor Program, Minneapolis, MN USA

HLA Typing for Bone Marrow Transplantation

Coppo, Patricia A; Davis, Judy W; Spellman, Steve M; Jan 31, 2007; 4 pp.; In English

Contract(s)/Grant(s): N00014-05-1-0310

Report No.(s): AD-A462775; No Copyright; Avail.: CASI: [A01](#), Hardcopy

Task 1 : Evaluate optimal short term storage parameters for stimulated and unstimulated leukapheresis (donor lymphocytes) and bone marrow products, including the type of storage media and the cell concentration, in addition to temperature and duration of storage before processing or infusion. Task 2: The NMDP has developed an algorithm that 'predicts' high resolution HLA typing results on donor samples that exist in the Registry with only low or intermediate results reported. Perform validation of the NMDP algorithm by selecting donors randomly from our Registry that have low or intermediate DRBI typing results and using the algorithm to predict the high resolution results and test the ability of the algorithm to predict KIR ligand mismatching in the absence of existing HLA-C locus results.

DTIC

Bone Marrow; Immunology; Transplantation

20070011156 Rochester Univ., NY USA

Chemotherapy Agents and the Inhibition of Neuronal Birthing in the Brain - The Cause of 'Chemo Brain'

Gross, Robert A; Nov 2005; 8 pp.; In English

Contract(s)/Grant(s): DAMD17-03-1-0277

Report No.(s): AD-A462776; No Copyright; Avail.: CASI: [A02](#), Hardcopy

Patients undergoing chemotherapy can experience a decline in cognitive abilities. While well described from a clinical perspective, little is known of the neurological substrate for this difficulty, commonly known as 'chemo brain.' We hypothesize that the cognitive difficulties experienced by patients undergoing chemotherapy are the result of impaired neurogenesis, especially in the hippocampus. We further hypothesize that agents that do not cross the blood-brain barrier will not show reduced rates of neurogenesis, in contrast to agents that readily cross into the central nervous system (CNS). Our objective is to compare the effect of drugs that enter the CNS (Cytosan and 5-FU) with agents that do not (Adriamycin and Taxol) with respect to their ability to impair the birthing of new neurons in the hippocampus of adult mice. By testing whether chemotherapeutic agents that enter the CNS can reduce neurogenesis, we hope to develop an animal model of 'chemo brain' that will allow further studies. Furthermore, if we can show that inhibition of neurogenesis is a correlate of behavioral decline after chemotherapy, we will have provided evidence that modification of chemotherapeutic regimens - specifically, using strategies to prevent CNS entry of drugs - would be of great importance in improving the quality of life in cancer patients.

DTIC

Abilities; Blood-Brain Barrier; Brain; Cancer; Central Nervous System; Chemotherapy; Cognition; Drugs; Mental Performance; Neurophysiology

20070011157 Cold Spring Harbor Lab., New York, NY USA

Biological Effects of Activating Distinct ErbB Receptor Dimers in Polarized Growth Arrested Epithelia

Nolan, Marissa; Sep 2006; 59 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAMD17-03-1-0193

Report No.(s): AD-A462777; No Copyright; Avail.: CASI: [A04](#), Hardcopy

ErbB family of receptor tyrosine kinases have been implicated in human breast cancers. In particular ErbB2 is over expressed in 25-35% of all breast cancers. We can selectively activate a particular receptor using a chimeric system and synthetic ligand. We combine this system with a three-dimensional cell culture system which allow cells to grow into mammary acini like structures in vitro. We have shown that activation of ErbB2 induces a change in cell polarity and re-initiates proliferation in 3D structures. Using these systems we have investigated how activation of ErbB2 disrupts epithelial cell polarity and disrupts proliferation control. In particular we studied how the Par complex and Rho family of small GTPases regulate ErbB2-induced transformation of human mammary epithelial cells. We have shown that activated ErbB2 recruits Par6 and disrupts the par complex. We have also shown that interfering with the functional complex by expressing a Par6 mutant prevents ErbB2 from fully transforming mammary epithelial cells. In our efforts to understand the effect of deregulating the function of Par protein complex we made the unexpected observation that overexpression of Par6 induced growth-factor independent proliferation of mammary epithelial cells. Understanding how these proteins affect proliferation and cell polarity and their relationship to ErbB2 will identify diagnostic markers and drug targets to treat breast cancer.

DTIC

Activation; Biological Effects; Breast; Cancer; Dimers; Ligands; Mammary Glands; Tyrosine

20070011158 Louisiana Univ., Monroe, LA USA

Role of Myelofibrosis in Hematotoxicity of Munition RDX Environmental Degradation Product MNX

Meyer, Sharon A; Sep 2006; 10 pp.; In English

Contract(s)/Grant(s): W81XWH-05-1-0537

Report No.(s): AD-A462778; No Copyright; Avail.: CASI: [A02](#), Hardcopy

The purpose of this research is to determine mechanisms through which hexahydro-1-nitroso-3,5-dinitro-1,3,5-triazine (MNX), environmental degradation product of high energetic munition hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX), causes persistent anemia in the rat. We have hypothesized MNX targets hematopoietic stem cells and, like other myelosuppressive chemicals, will be fibrogenic to the bone marrow. Findings of this period are: 1) additional MNX suppressive effects on peripheral blood cells of myeloid lineage and similar effects of RDX and 2) suppression of bone marrow erythroid and myeloid stem cells of bone marrow by both MNX and RDX. Myeloid development appears more sensitive than erythroid, especially to RDX. These results suggest that MNX- and RDX toxicity in the rat appears to mimic some clinical manifestations of the myeloproliferative disorder, idiopathic myelofibrosis, and thus may offer a model for study of disease progression and intervention strategies. With respect to remediation of RDX-contaminated sites, collectively these data argue that risk of adverse hematological effects from exposure are lessened upon natural remediation to nitro reduced products.

DTIC

Anemias; Degradation; RDX

20070011160 Roswell Park Memorial Inst., Buffalo, NY USA

High Throughput Screen to Identify Novel Drugs That Inhibit Prostate Cancer Metastasis

Gelman, Irwin H; Oct 2006; 14 pp.; In English

Contract(s)/Grant(s): W81XWH-04-1-0893

Report No.(s): AD-A462781; No Copyright; Avail.: CASI: [A03](#), Hardcopy

We have proposed to develop indicator cell lines that would allow for the high throughput screening (HTS) for compounds that potentially inhibit prostate cancer (CaP) metastasis. The cell lines are based on stably expressing a construct containing the promoter of SSeCKS/ gravin/AKAP12- a metastasis-suppressor gene downregulated in CaP progression-linked to a green fluorescence protein (GFP), plus a control reporter, in metastatic CaP cells, and then screening for compounds that induce GFP. We also proposed to characterize the pathways controlling SSeCKS expression in CaP progression. UPDATE: Our data indicate that SSeCKS re-expression can be induced in CaP cell lines using inhibitors of histone deacetylation (TSA) but not by inhibitors of methylation (5-aza-C). We have now produced stable indicator C4-2 cells with GFP expression inducible by TSA and by retinoids. We have also characterized the cis- and trans-acting factors of the human SSeCKS promoter required for transcriptional suppression in CaP cells.

DTIC

Cancer; Drugs; Metastasis; Prostate Gland

20070011162 Army Center for Environmental Health Research, Fort Detrick, MD USA

A Novel Amphibian Tier 2 Testing Protocol: A 30-Week Exposure of Xenopus Tropicalis to the Antiandrogen Flutamide

Knechtges, Paul L; Sprando, Robert L; Porter, Karen L; Brennan, Linda M; Miller, Mark F; Kumsher, David M; Dennis, William E; Brown, Charles C; Clegg Paul L Knechtges Robert L Sprando Karen L Potter , Eric D; Jan 2007; 11 pp.; In English

Contract(s)/Grant(s): EPA-IAG-DW-21-93962001-2

Report No.(s): AD-A462783; No Copyright; Avail.: CASI: [A03](#), Hardcopy

In 1996, the U.S. Congress mandated the development of a screening program for endocrine-disrupting chemicals (EDCs) using validated test systems. Subsequently, the Endocrine Disruptor Screening and Testing Advisory Committee recommended the development of a standardized amphibian assay for tier 2 testing of EDCs. For that reason, a tier 2 testing protocol using *Xenopus (Silurana) tropicalis* and a 30-week, flow-through exposure to the antiandrogen flutamide from stage 46 tadpoles through sexually mature adult frogs were developed and evaluated in this pilot study. The endpoints for this study included measurements of frog body lengths and weights, liver weights, ovary/egg mass weights, testicular and ovarian histopathology, plasma vitellogenin levels, and notes on any abnormalities observed at necropsy. Increasing exposure concentrations to flutamide caused significant increases in frogs with no recognizable gonadal tissue and increased body and liver weights in male frogs, whereas the body lengths and weights decreased significantly in female frogs. Important issues must be resolved before a tier 2 amphibian assay can be further developed and validated, including the establishment of baseline values in the controls for the parameters under study; the maintenance, measurement, and timing of exposure concentrations; and the

development of additional biomolecular markers of effect. This study demonstrated the feasibility of conducting long-term EDC exposure studies using *X. tropicalis*.

DTIC

Contaminants; Environmental Tests; Exposure; Frogs

20070011164 Baylor Coll. of Medicine, Houston, TX USA

Beta-catenin: A Potential Survival Marker of Breast Cancer Stem Cells

Rosen, Jeffrey M; Chen, Mercy S; Sep 2006; 112 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAMD17-03-1-0699

Report No.(s): AD-A462791; No Copyright; Avail.: CASI: [A06](#), Hardcopy

The Wnt/-catenin pathway has been extensively studied for its role in development and cancer. The canonical Wnt signal is transduced by -catenin, which acts as a transcriptional coactivator by associating with the Tcf/LEF family of transcription factors. It has been established that Wnt signaling regulates the self-renewal of normal stem cells in both the hematopoietic systems and the epidermis. In addition, constitutive activation of the Wnt pathway has been implicated in a number of epithelial cancers, possibly by promoting stem cell survival. However, the importance of this pathway in breast stem/progenitor cells has not yet been elucidated. Objective/Hypothesis: The central hypothesis of this study is that the Wnt/-catenin pathway plays a critical role in mammary gland stem cell survival, and as a result promotes tumorigenesis and resistance to conventional therapies.

DTIC

Breast; Cancer; Mammary Glands; Markers; Stem Cells; Survival

20070011170 Columbia Univ., New York, NY USA

Role of Notch/VEGF-Receptor 3 in Breast Tumor Angiogenesis and Lymphangiogenesis

Kitajewski, Jan K; May 2006; 11 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-04-1-0540

Report No.(s): AD-A462798; No Copyright; Avail.: CASI: [A03](#), Hardcopy

The overall objective is to define the interaction between Notch and VEGFR-3 signaling in breast cancer. We are examining a role for Notch in breast tumor vessels and attempting to block Notch and VEGFR-3 activity in breast tumors grown in mice. We proposed two aims: 1) studies of Notch/Dll4 function in murine mammary tumorigenesis and 2) studies of the inhibitory effects of a Notch antagonist (Notch decoy) in a murine mammary tumor model. In aim 1, to study the role for notch in murine mammary tumorigenesis, progress has been made in developing two new transgenic lines that will allow for conditional activation or inactivation of Notch specifically within the endothelium. The first mouse line, EFi-Notchi IC can be manipulated in a conditional fashion, as demonstrated by lethality if activated in embryonic endothelium. The second mouse line, EFi-Notch1ECDIFc, has been generated and is being further tested. We have carried out experiments to demonstrate that breast tumor xenograft growth is inhibited by the Notch decoy, an antagonist made up of the Notchi extracellular domain fused to the Fc protein, Notch1 ECDIFc. This block appears to be a result of reduced tumor angiogenesis. This strategy, now shown to inhibit mammary tumor growth in our mouse models, is proving to be a promising area for therapeutic intervention in breast cancer.

DTIC

Angiogenesis; Breast; Cancer; Mammary Glands; Notches; Tumors

20070011171 Vanderbilt Univ., Nashville, TN USA

Investigating the Role of p57Kip2 in Prostate Cancer

Jin, Ren J; Sep 2005; 11 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-04-1-0826

Report No.(s): AD-A462799; No Copyright; Avail.: CASI: [A03](#), Hardcopy

The aim of this project is to characterize the functional significance of p57Kip2, one of Cyclin-dependent kinases inhibitors (CKI) of the INK4 family, in prostate proliferation, differentiation, tumorigenesis, and progression. In the present study, we have investigated the expression of p57Kip2 in human prostate cancer cases by immunohistochemistry. The average p57Kip2 labeling index in noncancerous lesions was 47.47%. However, the labeling index significantly decreased ($p < 0.001$) in PIN (10.21%) and carcinoma (2.85%) lesions. When virus-mediated overexpression of p57Kip2 in prostate cancer cells (LNCaP), significantly suppressed the cells motility, potential for invasion, arrested the cell cycles at G0/G1 stage, and induced apoptosis. Furthermore, when the LNCaP cells stable transfected by p57Kip2 expression vector were recombined with rat

urogenital mesenchyme (rUGM) and subsequently grafted into a male athymic mouse host using tissue recombinant techniques, the LNCaP tumors transformed into well differentiated squamous tumors and showed increased keratin synthesis or no tumor formation in athymic mice. In addition, the p57Kip2 knockout mouse prostate developed significantly hyperproliferation and hyperplasia at two and four month after grafted underneath the renal capsules of athymic immunodeficient mice. These results suggest that decreased expression of p57Kip2 occurs frequently in human prostate cancer even early in PIN lesion and p57Kip2 overexpression contributes to the downregulation of cell proliferation. Thus, p57Kip2 is an important gene in prostate cancer tumorigenesis and progression.

DTIC

Cancer; Prostate Gland

20070011174 Johns Hopkins Univ., Baltimore, MD USA

Prostate Cancer Progression and Serum SIBLING (Small Integrin Binding N-linked Glycoprotein) Levels

Fedarko, Neal S; Oct 2006; 10 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-04-1-0844

Report No.(s): AD-A462802; No Copyright; Avail.: CASI: [A02](#), Hardcopy

We have been studying a gene family termed SIBLINGs (for small integrin binding ligand N-linked glycoproteins) whose members include bone sialoprotein (BSP), osteopontin (OPN), dentin matrix protein-I (DMPI), dentin sialophosphoprotein (DSPP) and matrix extracellular phosphoglycoprotein (MEPE). Our Specific Aims are to describe the distribution of serum-based measurements of SIBLINGs among (a) normal individuals, (b) individuals with benign prostatic disease, (c) individuals with clinically defined prostate cancer, and (d) longitudinal samples from individuals with prostate cancer before and after treatment; and to establish serum-based measurements which maximize sensitivity and specificity of SIBLINGs as markers for prostate cancer detection as well as for prostate cancer progression and response to treatment. Although the laboratory is still blinded to staging and progression data at this point in time, some significant observations can be made. The distribution of serum levels of BSP and DSPP suggest they have utility for prostate cancer detection. Whether used separately or as an adjunct to PSA screening, the preliminary data indicates that measurement of SIBLINGs will have a significant effect on current prostate cancer management.

DTIC

Cancer; Prostate Gland; Serums

20070011177 Wayne State Univ., Detroit, MI USA

Chemosensitization of Breast Cancer Cells to Chemotherapeutic Agents by 3,3'-diindolylmethane (DIM)

Rahman, KM W; Aug 2006; 31 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-05-1-0505

Report No.(s): AD-A462806; No Copyright; Avail.: CASI: [A03](#), Hardcopy

Constitutive activation of Akt or NF- κ B has been reported to play a role in de novo resistance of cancer cells to chemotherapeutic agents, which is a major cause for treatment failure in cancer chemotherapy. Previous studies have shown that 3,3'-diindolylmethane (DIM), a major in vivo acidcatalyzed condensation product of Indole-3-carbinol (I3C), is a potent inducer of apoptosis, inhibitor of tumor angiogenesis and inactivator of Akt/NF- κ B signaling in breast cancer cells. We found that DIM can inhibit Akt and NF- κ B in breast cancer cells, suggesting that DIM could sensitize the breast cancer cells to common chemotherapeutic agents. More recently, we found that DIM significantly sensitized the breast cancer cells to Taxotere and Adriamycin. However, little is known regarding the inactivation of Akt/NF- κ B leading to chemosensitization of breast cancer cells to two of the most common chemotherapeutic agents such as Adriamycin and Taxotere. Based on our preliminary results, we hypothesize that DIM will inactivate Akt and NF- κ B signaling, thereby sensitizing breast cancer cells to chemotherapeutic agents both in vitro as well as in vivo in an experimental model of breast cancer. The mechanisms for sensitizing the cells may involve down-regulation of the expression of NF- κ B and its important regulators such as MEKK1, MEK, NIK and IKK genes. We believe that our strategies to sensitize breast cancer cells to the most common chemotherapeutic agents by DIM will be a novel breakthrough for devising optimal therapies for breast cancer.

DTIC

Breast; Cancer; Chemotherapy; Drugs; Mammary Glands

20070011178 Texas Univ., Dallas, TX USA

Development of a Phase I/II Clinical Trial Using Stereotactic Body Radiation Therapy (SBRT) for the Treatment of Localized Prostate Carcinoma

Timmerman, Robert D; Jul 2006; 80 pp.; In English

Contract(s)/Grant(s): W81XWH-05-1-0438

Report No.(s): AD-A462807; No Copyright; Avail.: CASI: [A05](#), Hardcopy

Stereotactic body radiation therapy (SBRT) is a new therapeutic paradigm for treating localized tumors outside of the central nervous system and involves delivering very high doses of focused radiation using unique beam arrangements and special immobilization equipment. It has also been shown recently that many prostate cancers may be better controlled using large dose per fraction treatments such as might be delivered by SBRT. While large dose per fraction treatments are facilitated by new generation radiation delivery equipment, technology cannot independently overcome normal tissue consequences to tubular organs adjacent or within targets (e.g., the urethra and rectum for prostate cancer). As such, careful prospective clinical trials must be designed that appropriate bridge the information learned from laboratory testing, historical clinical experience, and the clinical experience with SBRT from other sites in order to test this new therapy for prostate cancer. Our goal is ultimately to carry out a prospective phase I/II trial of SBRT for treatment of localized prostate cancer such that its true efficacy and toxicity might be characterized. The objective of this application is to establish the collaborations necessary for formulating these protocols, write the protocols, assemble the clinical research infrastructure necessary for submitting the protocols, set up mechanisms for multi-center participation with our center acting as the coordinating center, recruiting, enrolling, treating and following patients, and to support the research infrastructure and clinical researchers performing these tasks.

DTIC

Cancer; Prostate Gland; Radiation Therapy

20070011179 Pennsylvania Univ., Philadelphia, PA USA

Assessment of Lymphedema Risk Following Lymph Node Dissection and Radiation Therapy for Primary Breast Cancer

Cheville, Andrea L; Sep 2006; 14 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAMD17-03-1-0622

Report No.(s): AD-A462808; No Copyright; Avail.: CASI: [A03](#), Hardcopy

Lymphedema is a common complication of primary breast cancer therapy. It is a chronic, insidiously progressive, and potentially devastating condition. Radiation increases patients lymphedema risk as conventional fields encompass functioning lymphatics. Imaging technologies may identify these lymphatics and allow tailoring of radiation fields to minimize radiation exposure while preserving regional tumor control. This study uses SPECT scanning to localize lymphatics critical for arm drainage after surgical removal of axillary lymph nodes. The study has established the feasibility of fusing SPECT images with high resolution CT scans used in radiation simulation. Furthermore the study has demonstrate that fusing allows precise quantification of radiation dosimetry delivered to lymph nodes critical for arm drainage. The study will test the hypothesis that increased arm volume correlates with high levels of radiation dosimetry. The fact that higher doses of radiation and larger radiation ports are associated with an increased incidence of lymphedema (volume \geq 150ml.), particularly severe lymphedema (volume \geq 400ml.), supports this hypothesis. The proposed study realizes the BCRP goals by elucidating a novel means of refining breast cancer treatment to minimize patients' risk of developing the most prevalent and dreaded complication of conventional therapy, lymphedema.

DTIC

Breast; Cancer; Dissection; Lymphatic System; Mammary Glands; Radiation Therapy; Risk

20070011180 Northern California Inst. for Research and Education, San Francisco, CA USA

CYP1B1 Polymorphism as a Risk Factor for Race-Related Prostate Cancer

Tanaka, Yuichiro; Jun 2006; 11 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-04-1-0579

Report No.(s): AD-A462809; No Copyright; Avail.: CASI: [A03](#), Hardcopy

When comparing races, the incidence and mortality rate of prostate cancer are higher in African Americans than in Caucasians and Asians. Cytochrome P450 (CYP) 1B1 converts estrogens to the 4-hydroxy-catechol-estrogens. Studies show this catechol-estrogen is mutagenic and may lead to prostate cancer. Recently, the authors showed that CYP1B1 polymorphisms present a higher risk for prostate cancer; however, studies of CYP1B1 are lacking in race-related prostate cancer. There are at least 4 polymorphisms that have been identified on the CYP1B1 gene that result in a structural change

in the enzyme, and they are at the following locations: codons 48, 119, 432, and 453. The goal of this project is to investigate whether polymorphisms of the CYP1B1 gene are a risk factor for race-related prostate cancer. Two hypotheses were tested: (1) that the CYP1B1 gene is hyper-activated during malignant transformation of race-related prostate cells, and (2) that single nucleotide polymorphisms (SNPs) of the CYP1B1 gene have a higher risk for race-related prostate cancer and correlate with a hyper-activated CYP1B1 gene. The authors used 77 benign prostatic hyperplasia (BPH) and 96 prostate cancer (PC) samples from African American and Caucasian patients that were collected earlier. To test the first hypothesis, they performed immunohistochemical analysis to determine CYP1B1 protein expression in the BPH and PC samples. Preliminary results show that the CYP1B1 protein is localized to the cytoplasm of PC cells, and that the intensity of CYP1B1 staining is much higher in the PC than the BPH samples. To test the second hypothesis, single nucleotide polymorphisms (SNPs) at three codons (119, 432, and 453) of CYP1B1 were evaluated to determine if they are risk factors for race-related PC. Racial differences were observed in allele frequencies. The variants at codons 119 ($P < 0.05$) and 432 ($P < 0.001$) were greater among Blacks, whereas the 453 variant ($P < 0.001$) was predominant in Whites.

DTIC

Africa; Cancer; Cytochromes; Genes; Oxidase; Polymorphism; Prostate Gland; Races (Anthropology); Risk

20070011181 Colorado Univ., Aurora, CO USA

Magnetic Resonance Spectroscopy (MRS) of Prostatic Fluids for Early Detection of Prostate Cancer

Crawford, E D; Oct 2005; 20 pp.; In English

Contract(s)/Grant(s): W81XWH-04-1-0858

Report No.(s): AD-A462810; No Copyright; Avail.: CASI: [A03](#), Hardcopy

The prostate gland its tissues and fluids have unique metabolic profiles due to specific physiological functions. In this study proton nuclear magnetic resonance spectroscopy (1H-NMRS) is used to analyze potential metabolic markers of prostate cancer (PCa) in human expressed prostatic secretions (EPS). To date metabolic profiles of EPS from 52 men with PCa and from 26 healthy controls have been analyzed. The metabolites analyzed included citrate spermine myo-inositol lactate alanine phosphocholine glutamine acetate and hydroxybutyrate. Absolute concentrations have been quantified using a novel method developed by our Co-Investigator. The results to date indicate that citrate myo-inositol and spermine are potentially important markers of PCa. Further the absolute concentrations of these metabolites in EPS appear to be independent of age increasing the potential utility of these markers due to elimination of age as a confounding variable. Ongoing activities include the prospective validation of these promising results and analysis to determine if these metabolic markers can distinguish between aggressive tumors and those less aggressive.

DTIC

Cancer; Detection; Magnetic Resonance; Magnetic Resonance Spectroscopy; Metabolism; Prostate Gland

20070011182 McGill Univ., Montreal, Quebec Canada

Contribution of Protein Tyrosine Phosphatases to the Ontogeny and Progression of Chronic Myeloid Leukemia

Tremblay, Michel; Apr 2006; 9 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-04-1-0837

Report No.(s): AD-A462811; No Copyright; Avail.: CASI: [A02](#), Hardcopy

The JAK and STAT families of signal transduction molecules play a critical role in the pathogenesis of chronic myeloid leukemias (CML). Inappropriate STAT1 and STAT5 activation have been observed in the Philadelphia chromosome-positive CML cell lines K562 and BV17, yet low levels of JAK1 tyrosine phosphorylation were observed suggesting that BCR/Abl directly tyrosine phosphorylates and activates STATs. The protein tyrosine phosphatases TC-PTP and PTP1B are negative regulators of JAK/STAT signaling molecules and it is possible that these two PTPs could impede the ability of CML cells to survive and proliferate in response to p210 BCR-Abl. We examined the role of TC-PTP and PTP1b in contributing to the CML phenotype and found that in some CML cell lines the levels of TC-PTP and PTP1b is increased suggesting that they may be the potential caused of the reduced phosphorylation of the JAK kinases in CML.

DTIC

Activation; Enzymes; Janus; Leukemias; Ontogeny; Proteins; Transducers; Tyrosine

20070011183 California Univ., San Francisco, CA USA

Phase I/II Trial of Epothilone Analog BMS-247550, Mitoxantrone, and Prednisone in HRPC Patients Previously Treated with Chemotherapy

Rosenberg, Jonathan E; Jul 2006; 58 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-05-1-0403

Report No.(s): AD-A462812; No Copyright; Avail.: CASI: [A04](#), Hardcopy

This grant report includes a summary of the accomplishment of the statement of work, in addition to the complete protocol, consent, and Contracts and Grants office confirmation of submission of a grant to support the clinical trial. The clinical trial covered by this grant has been activated and is accruing patients.

DTIC

Cancer; Chemotherapy; Hormones; Patients; Prostate Gland; Refractories

20070011184 Mount Sinai School of Medicine, New York, NY USA

Construction of a Vesicular Stomatitis Virus Expressing Both a Fusogenic Glycoprotein and IL-12: A Novel Vector for Prostate Cancer Therapy

Hall, Simon J; Jan 2006; 9 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-04-1-0147

Report No.(s): AD-A462813; No Copyright; Avail.: CASI: [A02](#), Hardcopy

Vesicular Stomatitis Virus (VSV) infection of malignant cells results in oncolysis, sparing normal cells due to inherent differences in the interferon response pathway. In this study, we explored enhancing VSV-G by engineering it to express the fusogenic glycoprotein from the Newcastle Disease Virus (VSV-F) to induce inter-cellular membrane fusion producing syncytia, which are incompatible with cell survival. Studies initially compared effects of VSV and VSV-F in vitro in prostate cancer cells lines, noting differential effects at different cell densities and the induction of apoptosis. Studies then compared effects of VSV vs VSV-F in an orthoptic mouse model of prostate cancer, focusing on tumor size at set time points and survival. As the confluence of cells in the wells became greater, VSV-F showed more rapid cell kill than VSV-G (p<0.001). VSV-G mediated growth suppression by inducing apoptosis; this effect was slightly attenuated in VSV-F. In both single and serial viral injections VSV-F resulted in significant survival enhancement over control and VSV-G. Interestingly, repetitive injections of VSV-G were no better than a single injection. Mechanistic studies suggested that some prostate cancer cell lines do not have as attenuated IFN response pathways, which can be overcome by the high levels of IFN found within injected tumors. Through the induction of the fusogenic protein, VSV-F maintains superior growth control of only moderately IFN responsive cell lines, most likely through an induced immune response.

DTIC

Cancer; Construction; Diseases; Prostate Gland; Proteins; Therapy; Viruses

20070011185 Virginia Univ., Charlottesville, VA USA

High Resolution Anatomic and Elastographic Transrectal Ultrasound for Improved Diagnosis of Prostate Cancer

Hossack, John A; Feb 2006; 108 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-04-1-0240

Report No.(s): AD-A462816; No Copyright; Avail.: CASI: [A06](#), Hardcopy

In this work we improve upon conventional Digital Rectal Examination (DRE) and PSA blood test by using ultrasound elasticity imaging. A latex sheath over the transrectal ultrasound probe is slightly inflated with water to provide a source of moderate pressure. The elasticity image is generated by cross-correlating successive raw radio frequency image data sets for incrementally increasing pressure. Strain, and consequently elasticity, can be calculated from the displacement image. Our second objective is to use a new freehand 3D acquisition approach to obtain 3D image data sets. This approach uses a slightly modified transducer and an image motion tracking technique. Preliminary phantom based results are presented in this report. Excellent progress has been made with respect to the Statement of Work and first three of four total Specific Aims. A transducer has been specified and is on order. As promised, this transducer is designed to possess unsurpassed prostate scanning resolution by virtue of its exceptionally high frequency up to 14 MHz. Prototype phantoms and complete ultrasound test instrumentation has been assembled. Preliminary ultrasound image speckle reduction work has been performed. Preliminary, dimensionally accurate, 3D prostate phantom images have been produced.

DTIC

Anatomy; Cancer; Diagnosis; High Resolution; Prostate Gland; Ultrasonics

20070011186 Baylor Coll. of Medicine, Houston, TX USA

Fibroblast Growth Factor Receptor-4 and Prostate Cancer Progression

Ittmann, Michael M; Oct 2006; 22 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-04-1-0843

Report No.(s): AD-A462818; No Copyright; Avail.: CASI: [A03](#), Hardcopy

We have found that the FGFR-4 Arg388 allele is strongly associated with the occurrence of prostate cancer and with

metastasis and PSA recurrence in men undergoing radical prostatectomy. We will test the role of FGFR-4 in prostate cancer metastasis using autochthonous and orthotopic mouse models of cancer. We will also identify changes in gene expression due to the presence of the FGFR-4 Arg388 allele that lead to the metastatic phenotype. To this end we have established and carried out the characterization of transgenic mice with prostatic specific expression of FGFR-4 Arg388 and G1y388; constructed a FGFR-4 siRNA lentivirus and a PC3 and LNCaP siRNA cell lines and identified Ehm2 as an FGFR-4 Arg388 regulated gene and characterized its role in prostate cancer. These key reagents will allow us to evaluate the effects of FGFR-4 on prostate cancer progression in vivo. Further studies of FGFR-4 Arg388 regulated gene expression in prostate cancer tissues are underway.

DTIC

Cancer; Fibroblasts; Prostate Gland

20070011187 Rochester Univ., NY USA

Potiation of Prostate Cancer Radiotherapy using Combined Antiangiogenic and Antitumor Therapies

Fenton, Bruce M; Oct 2006; 24 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-04-1-0827

Report No.(s): AD-A462819; No Copyright; Avail.: CASI: [A03](#), Hardcopy

The focus of this grant period was to delineate the effects of monotherapies or combinations of radiotherapy and AG-013736 (a multiple angiogenic receptor inhibitor) on vascular maturity and function, based on perfusion and hypoxia indices as well as pericyte coverage. In 3 major experiments, 250 tumors were frozen for immunohistochemical staining and image analysis. Almost complete growth inhibition was observed for the combined therapy. Total and perfused vessel counts were significantly decreased, but overall hypoxia was also increased in comparison to volume-matched controls. Although pericyte coverage increased with therapy, dissociated PDGFR+ cells also increased. These findings could be explained by either selective vessel ablation or pericyte recruitment, but clearly indicate that a 'normalization' of vessels into a more efficiently functioning network is not occurring in response to these specific combined treatments. Ongoing studies are expanding these studies into PC-3 tumor models, and specifically evaluating the effects of alternative scheduling.

DTIC

Angiogenesis; Cancer; Neoplasms; Prostate Gland; Radiation Therapy; Therapy

20070011188 North Carolina Univ., Chapel Hill, NC USA

Development of Biologically Based Therapies for Basal-Like Tumors

Hoadley, Katherine A; Apr 2007; 61 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-05-1-0288

Report No.(s): AD-A462820; No Copyright; Avail.: CASI: [A04](#), Hardcopy

The basal-like subtype of breast cancer is both estrogen receptor and HER2 negative and therefore is not effectively treated by hormonal therapy or trastuzumab. The purpose of this research is to identify treatment options for this subset of breast cancer patients. Breast cell lines of basal-like and luminal origin were treated with five different chemotherapeutics to determine sensitivity levels. The basal-like cell lines were more sensitive to carboplatin than luminal lines. Next, we focused on identifying a biologic therapy targeting the basal-like subtype. HER1/EGFR is expressed in approximately 50% of the basal-like tumors while not expressed in the luminal tumors. The basal-like cell lines showed an increased sensitivity to several EGFR inhibitors compared to the luminal lines. Combinations of two EGFR were synergistic with carboplatin. This work is support for a clinical trial at UNO, which will treat basal-like breast cancer patients with a HER1 inhibitor with or without carboplatin. An EGFR activation signature was identified and shown to predict poor outcome in two breast tumor data sets. In basal-like tumors, there may be many mechanisms for activation of this pathway but many appear to be downstream of EGFR in the RAS-MEK-ERK pathway. This work shows that basal-like may need to be further stratified to identify successful treatment regimens.

DTIC

Breast; Cancer; Mammary Glands; Neoplasms; Therapy; Tumors

20070011189 New Jersey Medical School, Piscataway, NJ USA

MMP-8, A Breast Cancer Bone Metastasis Suppressor Gene

Selvamurugan, Nagarajan; Aug 2006; 33 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-04-1-0687

Report No.(s): AD-A462821; No Copyright; Avail.: CASI: [A03](#), Hardcopy

In order to study the role of MMP-8 on inhibition of cancer growth and progression, we initiated our work to clone the human MMP-8 cDNA and express it in vitro. The MMP-8 cDNA with a V5 epitope tag was cloned downstream into the CMV promoter vector. The construct was verified by sequencing. But the expression level of MMP-8 was not detected by Western blot analysis. The molecular mechanisms of how TGF-Beta1 mediates stimulation of invasion and formation of bone metastasis have yet to be completely determined. ATF-3 (activating transcription factor-3) was strongly stimulated and its level was sustained by TGF-Beta1 in highly invasive and bone metastatic breast cancer cells. We have identified for the first time that cyclin A1 and MMP-13 are ATF-3 target genes. ATF-3 also regulates Runx2 (a bone specific transcription factor) in human breast cancer cells and that may provide a molecular phenotype for ATF-3 to regulate its target genes associated with bone metastasis.

DTIC

Bones; Breast; Cancer; Genes; Mammary Glands; Metastasis; Suppressors

20070011194 Wisconsin Univ., Madison, WI USA

Human CD1d-Restricted Natural Killer T (NKT) Cell Cytotoxicity Against Myeloid Cells

Chen, Xiuxu; Gumperz, Jenny E; Apr 2006; 56 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-04-1-0813

Report No.(s): AD-A462826; No Copyright; Avail.: CASI: [A04](#), Hardcopy

CD1d-restricted natural killer T cells (NKT cells) are a unique subpopulation of T lymphocytes that have been shown to be able to promote potent anti-tumor responses in a number of different murine (mouse) cancer models. Little is known about whether they may play a role in preventing or controlling human cancers and in particular there is little information about whether they can function to kill cancer cells as they arise in vivo (in the body). However it is clear that in vitro (in the test tube) NKT cells have the capacity to kill other cells that have a molecule called CD1d on their cell surface. One of the main human cell types that have CD1d on the cell surface are cells of the myeloid lineage. Thus we believe that NKT cells may have special potential for treating CML because they may be able to kill these tumor cells and it may be possible to devise a protocol to specifically stimulate the NKT cells to kill CML tumor cells as they begin to proliferate.

DTIC

Lymphocytes; Neoplasms

20070011195 Baylor Coll. of Medicine, Houston, TX USA

Genetic Screens in Yeast to Identify BRCA1 Modifiers

Plon, Sharon E; Dec 2005; 19 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAMD17-03-1-0464

Report No.(s): AD-A462828; No Copyright; Avail.: CASI: [A03](#), Hardcopy

Mutations in the BRCA1 checkpoint gene results in aneuploidy and an increased risk of breast cancer. The yeast RAD9 protein has similar functions and sequence motifs as BRCA1 and we proposed to identify haploinsufficient mutations at a second locus that alters the chromosome loss rate of our rad9^{-/-} diploid strains. We created a rad9-delta/delta strain both a qualitative (sectoring colonies) and quantitative assay (canavanine resistance) sensitive enough to detect the increase of heterozygous mutations on chromosome loss rates. We analyzed 30,000 insertional mutants and obtained 400 independent insertions that reproducibly alter CF loss rate. By FA, 40% of this group show statistically significant increase (3-10 fold) in mutation rate. We identified the insertion site for 300 mutants and gene ontology analysis of the 225 independent insertions reveals a statistically significant over-representation for Cell Cycle process and Chromosome location and under-representation of the Protein Synthesis process. Recreation of precise gene deletions in wild-type and rad9-delta/delta backgrounds verifies the instability phenotype and distinguishes heterozygous mutations that are specific modifiers of rad9 mutant strains from those that cause genomic instability independently.

DTIC

Cancer; Genes; Genetics; Yeast

20070011197 Wyoming Univ., Laramie, WY USA

Epidemiology of Chronic Wasting Disease: PrP(res) Detection, Shedding, and Environmental Contamination

Lewis, Randolph V; Aug 2006; 22 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAMD17-03-1-0542

Report No.(s): AD-A462831; No Copyright; Avail.: CASI: [A03](#), Hardcopy

Chronic wasting disease (CWD) of deer and elk is unique among the transmissible spongiform encephalopathies. Our

longterm goal is to better understand the epidemiology of CWD and thus develop strategies for management and control. The specific goals of these studies are to develop sensitive assays for PrPres as a marker for infectivity, and use these techniques to monitor the dynamics and modes of shedding of PrPres from orally infected mule and white-tailed deer and elk. Finally these techniques will be applied to investigating the nature of environmental contamination that may be associated with CWD transmission. Protease resistant prion protein from brains of CWD affected deer and elk (PrPres) and cellular PrPc were purified and used in a variety of detection assays. PrPres was detected using antibody based techniques which although substantially more sensitive than any current assay still need improvement. Deer and elk have been infected orally to determine CWD shedding in vivo. In addition, in support of investigations of environmental contamination by the CWD agent, we have mapped areas of high, moderate, and low CWD contamination at two CWD endemic facilities and collected samples for assay to determine levels of the prion protein.

DTIC

Contamination; Deer; Detection; Diseases; Epidemiology; Nervous System

20070011198 University of Southern Mississippi, Hattiesburg, MS USA

Production of a DNA Vaccine Specific for the 64 kDa Protective Antigen of *Erysipelothrix rhusiopathiae*

Middlebrooks, Bobby L; Feb 8, 2007; 5 pp.; In English

Contract(s)/Grant(s): N00014-04-1-0206; GR01840

Report No.(s): AD-A462832; No Copyright; Avail.: CASI: [A01](#), Hardcopy

The gene for the protective antigen of *E. rhusiopathiae* will be inserted into a eukaryotic vector both for the production of a DNA vaccine and for large scale production of the recombinant protein (in vitro). The DNA vaccine will be tested in cetacean cell lines for its ability to transfect the cells. The recombinant protein will be used to improve the existing ELISA for determining the antibody titers in cetacean serum samples to *E. rhusiopathiae*.

DTIC

Antigens; Deoxyribonucleic Acid; Marine Mammals; Vaccines

20070011199 Pittsburgh Univ., Pittsburgh, PA USA

Measles Virus Nucleocapsid (MVNP) Gene Expression and RANK Receptor Signaling in Osteoclast Precursors, Osteoclast Inhibitors Peptide Therapy for Pagets Disease

Reddy, Sakamuri V; Oct 2006; 36 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAMD17-03-1-0763

Report No.(s): AD-A462833; No Copyright; Avail.: CASI: [A03](#), Hardcopy

Paget's disease (PD) of bone occurs in 3-4% of population over the age of 50. We have identified expression of measles virus nucleocapsid transcripts in osteoclast (OCL) precursors and that MVNP expression induces pagetic phenotype in osteoclasts with increased bone resorption activity as seen in patients with Paget's disease. We previously cloned and identified osteoclast inhibitory peptide-I (OIP-1/hSca) which inhibits osteoclast formation and bone resorption. We hypothesize that MVNP expression in osteoclast precursors modulates RANK receptor signaling leading to Pagetic OCL development OIP-1 blocks these signaling events and inhibits MVNP induced osteoclastogenesis and elevated bone resorption activity. We demonstrated that MVNP increases TNF- α induced OCL differentiation and activation by increasing NF- κ B signaling through increased expression of p62, and IKK- γ and increased MAPK signaling. Our results also suggest that MVNP's effects on TNF- α signaling contribute to the increased OCL formation in PD. Furthermore, expression of MVNP gene in OCL in vivo induces a pagetic-like phenotype. RANKL stimulation of OIP-1 mice derived bone marrow cells resulted in significantly decreased osteoclast formation. Furthermore, OIP-1 transgenic mouse bones demonstrated an osteopetrotic phenotype. These data suggest that OIP-1 is an important physiologic regulator of osteoclast development and bone resorption in vivo and may have therapeutic utility to control excess bone turnover in patients with Paget's disease.

DTIC

Bone Demineralization; Diseases; Gene Expression; Inhibitors; Peptides; Therapy; Viruses

20070011200 Arizona Univ., Tucson, AZ USA

Specific Inhibition of HER-2/neu Transcription Initiation

Ebbinghaus, Scot W; Jul 2006; 25 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-04-1-0560

Report No.(s): AD-A462834; No Copyright; Avail.: CASI: [A03](#), Hardcopy

A polypurine tract (PPT) containing multiple GGA repeats in the HER-2/neu promoter is important to control HER-2/neu

transcription. We investigated the ability of the PPT to form a G-quadruplex-related secondary structure using biochemical techniques and screened a small family of potential G-quadruplex ligands that could stabilize FPT secondary structure formation in solution. Telomestatin and a lead compound in the fluoroquinolone class stabilize the HER-2/neu FPT secondary structure in solution and reduce HER-2/neu expression in breast cancer cells. We conclude the HER-2/neu promoter can form a stable secondary structure known as a tetrad:heptad in solution. Further studies are needed to fully characterize the secondary structure and link the effects of compounds on HER-2/neu expression to their direct interaction with the HER-2/neu promoter using reporter cell lines that are currently under construction. We also identified a second potential therapeutic target in the HIF-1 α gene promoter capable of forming a G-quadruplex structure that can also bind to G-quadruplex ligands and serve as a basis of developing small molecule inhibitors of gene transcription for the treatment of breast cancer.

DTIC

Biochemistry; Breast; Cancer; Mammary Glands; Therapy

20070011201 California Univ., Davis, CA USA

Improving Blood Monitoring of Enzymes as Biomarkers of Risk from Anticholinergic Pesticides and Chemical Warfare Agents

Wilson, Barry W; Oct 2005; 13 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAMD17-01-1-0772

Report No.(s): AD-A462836; No Copyright; Avail.: CASI: [A03](#), Hardcopy

Blood biomarkers are an important way to monitor exposure to anticholinergic pesticides and chemical warfare agents and to establish whether some personnel are at greater risk than others from exposure. Many clinical and research laboratories use the colorimetric Ellman assay based on the hydrolysis of acetylthiocholine. CHPPM (US Army Center for Health Promotion and Preventive Medicine) uses a slower delta pH method based on that of Michel to monitor 16,000 DOD personnel each year. Two different approaches of ours yielded conversion factors for expressing delta pH AChE in terms of Ellman assay units. We also converted the normal range of AChE activities from the CHPPM delta pH assay to Ellman units generating important benchmarks for clinical laboratory determinations in the absence of baseline data. Future work includes determining conversion factors for the Test Mate cholinesterase measurements to the delta pH and Ellman methods and examining the feasibility of monitoring serum BChE and PON1 activities in collaboration with the CRL laboratory of CHPPM.

DTIC

Anticholinergics; Biomarkers; Blood; Chemical Warfare; Enzymes; Pesticides; Risk

20070011202 General Hospital Corp., Boston, MA USA

Early Detection of Breast Cancer by Fluorescence Molecular Tomography

Ntziachristos, Vasilis; Jul 2006; 25 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-04-1-0239

Report No.(s): AD-A462837; No Copyright; Avail.: CASI: [A03](#), Hardcopy

Early detection of breast tumors continues to be a significant diagnostic challenge and thus remains the focus of attention of a number of medical research groups. Molecular targeting approaches have tremendous potential for early-detection because they rely on elucidation of abnormal gene-expression, rather than on discovery of retarded anatomical changes inflicted by growing tumors upon their microenvironment. Originally, we proposed an investigation of whether highly-sensitive fluorescence molecular tomography (FMT) could be used to detect breast cancer at its earliest and smallest stages via the detection of injected, protease-activatable molecular probes. We enter year 3 with the goals of the previous 2 years fully achieved. We have now not only constructed and fully optimized the proposed FMT imaging system using phantoms, but have also completed extensive in-vivo imaging studies ahead of schedule. Similarly, we have made significant progress toward the goals for aim 3 and year 3, in regard to the translation of our findings to a clinical setting, by researching the construction of appropriate breast-like phantoms.

DTIC

Breast; Cancer; Detection; Mammary Glands; Neoplasms; Tomography

20070011203 Colorado Univ., Aurora, CO USA

NSAIDS and the Osteogenic Response to Mechanical Stress in Premenopausal Women

Kohrt, Wendy M; Schwartz, Robert S; Oct 2006; 13 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAMD17-01-1-0805

Report No.(s): AD-A462838; No Copyright; Avail.: CASI: [A03](#), Hardcopy

This is a study of the effects of ibuprofen, a non-steroidal anti-inflammatory drug (NSAID), on the osteogenic response to 9 months of exercise training in healthy, premenopausal women, aged 21 to 40 years (N=102). The hypotheses are: H1a: taking short-acting NSAIDS before exercise will diminish increases in bone mineral density (BMD) in response to exercise training H1b: taking short-acting NSAIDS after exercise will not diminish the increases in BMD in response to exercise training Participants take either ibuprofen (400mg) or placebo capsules before and after each exercise session. Women are randomized to three treatment arms: 1) NSAID before exercise, placebo after exercise (NSAID/placebo; n=34); 2) placebo before exercise, NSAID after exercise (placebo/NSAID; n=34); and 3) placebo before exercise, placebo after exercise (placebo/placebo; n=34). One hundred thirteen women completed baseline testing and were randomized to treatment. Final follow-up testing was completed approximately 7 months ago and most sample analysis has been completed. Re-analysis of some samples and review of the database continues for quality assurance. Manuscript preparation is underway. These studies could lead to the development of new strategies to reduce the incidence of, and treatment for, stress fractures that occur in response to vigorous physical activity.

DTIC

Bones; Cytogenesis; Females; Osteogenesis

20070011204 California Univ., San Francisco, CA USA

A Novel Mouse Model for Genetic Validation of Therapeutic Targets in Breast Cancer

Evans, Gerardi; Jun 2006; 10 pp.; In English

Contract(s)/Grant(s): W81XWH-04-1-0508

Report No.(s): AD-A462839; No Copyright; Avail.: CASI: [A02](#), Hardcopy

Identifying the optimal molecular targets for effective and specific treatment of breast carcinoma is limited by our ignorance of which molecular pathways or network nodes are critical for the initiation, evolution and, above all, maintenance of breast cancers. Our overarching hypothesis is that although tumors appear genetically complex, they most probably are dependent upon a very much more limited repertoire of mutations for their maintenance. To test this hypothesis, we proposed to construct a novel type of mouse cancer model in which endogenous genes encoding critical signaling molecules are modified so that their expression can be toggled on and off at will by the action of ligand-dependent heterologous repressors. Using such heterologous repressor targeting (HRT), we will directly ascertain the requirement for such signaling molecules in normal breast epithelial development and maintenance and for mutant forms of such molecules in driving and maintaining breast cancers. Our initial focus within the BCRP proposal is on c-myc and e2f3 genes, both of which encode pleiotropic transcription factors whose deregulated activities are causally implicated in breast (and other) cancers.

DTIC

Breast; Cancer; Genetics; Mammary Glands; Mice; Molecules; Targets; Therapy

20070011207 Boston Univ., Boston, MA USA

Do EBV Encoded Small RNAs Interfere with Tumor Suppressor APC in EBV Associated Breast Cancers

Ghosh, Sajal K; Aug 2006; 16 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-04-1-0734

Report No.(s): AD-A462843; No Copyright; Avail.: CASI: [A03](#), Hardcopy

Epstein Barr virus (EBV) infection in human is associated with variety of malignant diseases including Burkitt's Lymphoma (BL), nasopharyngeal carcinoma Hodgkin's disease and lymphoproliferative disorders and significant portions of breast cancers. EBV infection causes acute infectious mononucleosis but ultimately establishes persistent lifetime latent infection. In all latently infected cells EBV expresses two small non-polyadenylated RNAs (EBERs). Recent studies have shown that EBERs alone provide tumorigenic potential. We have identified that EBERs (which possess extensive secondary structure) has strong nucleotide sequence homology to the coding exon of kinesin superfamily of motor protein Kif3C. Kinesin is an essential member of the multiprotein beta-catenin degradation complex which includes tumor suppressor adenomatous polyposis coli (APC) and GSK3 beta. Beta-catenin, an activator of Wnt signaling pathway is activated in many breast cancers. Here we demonstrate that EBER expression in mammary epithelial cell line BT549 induce elevated level of beta-catenin protein and upregulation of its dependent genes. We also show that in epithelial cells EBER RNA is processed into 19 base small RNA which is homologous to a 3'-noncoding region of Kif30 mRNA. Further we demonstrate that Kif30 mRNA is also down-regulated in epithelial cells following EBER expression. Our pilot study thus provides intriguing data that suggests EBER mediated beta-catenin deregulation in epithelial malignancies which possibly takes place via tiny-RNA production from EBERs.

DTIC

Breast; Cancer; Mammary Glands; Neoplasms; Suppressors; Tumors

20070011209 Georgia Inst. of Tech., Atlanta, GA USA

Rapid, Room-Temperature Formation of Crystalline Calcium Molybdate Phosphor Microparticles via Peptide-Induced Precipitation

Ahmad, Gul; Dickerson, Matthew B; Church, Benjamin C; Cai, Ye; Jones, Sharon E; Naik, Rajesh R; King, Jeffrey S; Summers, Christopher J; Kroger, Nils; Sandhage, Kenneth H; Jan 2006; 6 pp.; In English

Report No.(s): AD-A462845; No Copyright; Avail.: CASI: [A02](#), Hardcopy

Nature provides numerous examples of organisms that synthesize intricate mineral structures (biominerals) with micro- to nanoscale features through the use of specific biomolecules.[1] While such control over mineral formation under ambient conditions exceeds current man-made assembly technologies, the known biominerals (only about 60 different minerals have been identified to date) do not possess compositions that are particularly attractive for many man-made devices.[2] Nonetheless, nature's exquisite control over biomineral formation has inspired the search for biomolecules capable of directing the assembly of non-natural inorganic materials. Peptides that exhibit specific affinities for synthetic materials (e.g., ZnO, Cr₂O₃, GeO₂, Ag, GaAs) have been identified by several authors through bacteriophage or cell surface display (biopanning) methods.[3] However, the use of such display methods to identify specific peptides that induce the formation of crystalline multicomponent metal oxide compounds (i.e., materials widely used in functional devices) at room temperature and ambient pressure has not been reported in the literature. In this work, a phage display method has been used to identify peptides that bind to, and promote the direct and rapid room-temperature formation of CaO MoO₃ (powellite) microparticles from aqueous precursor solutions.

DTIC

Biochemistry; Calcium; Crystallinity; Microparticles; Molybdates; Peptides; Phosphors; Room Temperature

20070011210 Texas Univ., Houston, TX USA

Derivation of Targeted Phage Vectors for Gene Therapy of Prostate Cancer

Krasnykh, Victor; Mar 2006; 13 pp.; In English

Contract(s)/Grant(s): DAMD17-02-1-0002

Report No.(s): AD-A462846; No Copyright; Avail.: CASI: [A03](#), Hardcopy

The subject of these studies is the development of targeted vector for selective infection and killing of prostate cancer cells. The resultant vector is to be administered to prostate cancer patients to find, infect and destroy tumor cells. Targeting of the vector to prostate tumors is to be accomplished via incorporation into its capsid of ligands, which selectively bind to prostate specific membrane antigen (PSMA). Research accomplishments: (i) two targets, recombinant sPSMA protein and 293/PSMA cells, have been developed for identification of PSMA-specific peptides; (ii) a panel of monoclonal anti-PSMA antibodies has been derived; (iii) a single chain (scFv) version of one of these mAbs has been incorporated into a filamentous phage; (iv) an ELISA-based screening procedure has been established; (v) two scFv-targeted phage vectors each expressing either GFP or HSV tk.

DTIC

Bacteriophages; Cancer; Diseases; Gene Therapy; Prostate Gland; Vector Analysis

20070011211 Organisatie voor Toegepast Natuurwetenschappelijk Onderzoek, Rijswijk, Netherlands

Sleep and Alertness Management II: Effects on Sleep Pattern and Sleep Quality in Marmosets (slaap- en alertheidsmanagement II: effecten op slaapritme en slaapkwaliteit in marmosetapen)

Philippens, I H; Vanwersch, R A; Jongasma, M J; Bouwman, B M; Busker, R W; Oct 2006; 29 pp.; In English; Original contains color illustrations

Report No.(s): AD-A462850; TNO-DV-2006-A269; No Copyright; Avail.: CASI: [A03](#), Hardcopy

In this study, the marmoset monkey model was validated using nocturnal electroencephalogram measurements for evaluating effects on sleep quality. In order to test whether the proposed sleep inducing drugs affect the quality of sleep and/or disrupt the normal sleep cycle/architecture, the effects of the short acting hypnotic drugs temazepam, zolpidem and zaleplon on sleep were determined in the marmoset monkey. The results showed that the marmoset monkey model is a valid model for the research of sleep. Furthermore, no large differences between the effects of the tested sleep inducing drugs on the quality of sleep could be observed. All three drugs tended to affect the quality of sleep in a positive way, but also induced some 'rebound-effects'. All drugs, but temazepam especially, resulted in some carry-over effects,- i.e. after awakening animals tended to fall asleep again. On the other hand, after temazepam sleep spindles were observed often. These spindles lower the chance of awakening as a result of sensory input like noise. This was in agreement with the finding that after temazepam less frequent waking was observed. Furthermore, there some indications that zolpidem has undesired effects in women. This

might indicate that for the management of sleep in a military setting the sleep inducing drugs temazepam and zaleplon might both be useful, with the preference for temazepam.

DTIC

Alertness; Electroencephalography; Measurement; Monkeys; Neurophysiology; Pattern Recognition; Sleep; Sleep Deprivation

20070011212 Virginia Univ., Charlottesville, VA USA

Preclinical Evaluation of Serine/Threonine Kinase Inhibitors Against Prostate Cancer Metastases

Guise, Theresa; Nov 2005; 28 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-04-1-0920

Report No.(s): AD-A462851; No Copyright; Avail.: CASI: [A03](#), Hardcopy

A central tenet of the field of bone metastases is that the bone microenvironment supplies factors, such as TGF-beta, stimulating prostate cancer cell signaling and altering their phenotype. TGF-beta signaling in cancer is however complex and can lead to the activation of numerous genes. We have identified many of these genes by microarray analysis and have validated the gene reported here. Of these, PMEPA1 as the most highly upregulated gene. We have cloned the PMEPA1 promoter and full-length gene and have begun promoter analysis of the TGF-beta response element. We are in the process of overexpressing PMEPA1 in prostate cancer lines. In vivo experiments are in progress to determine the effect of a TGF-beta RI kinase inhibitor, SD-208, on the development and progression of prostate cancer metastases to bone due to PC-3, LuCAP and C42B prostate cancers.

DTIC

Amino Acids; Bones; Cancer; Enzyme Activity; Metastasis; Prostate Gland

20070011213 Oregon Health Sciences Univ., Portland, OR USA

Development of a Novel Vector for Multiple CDC Category A Pathogens

Nelson, Jay A; Wong, Scott W; Jarvis, Michael A; Apr 2006; 14 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-05-1-0046

Report No.(s): AD-A462853; No Copyright; Avail.: CASI: [A03](#), Hardcopy

The long-term goal of this project is to develop and evaluate human cytomegalovirus (HCMV) as an effective large capacity persistent vaccine vector to provide protective immunity for multiple bioterrorist agents and emerging diseases. The aim of the current proposal was to determine the potential utility of HCMV as vaccine vector for ODO category A agents using rhesus cytomegalovirus (RhCMV) vaccine vectors in combination with the monkeypox (MPV)- rhesus macaque (RM) model. RhCMV is highly homologous to HCMV and the MPV:RM model recapitulates all aspects of smallpox infection of humans. Specific Aim 1 was to generate a panel of RhCMV/MPV vectors expressing MPV antigens A29L A35R Mi Rand B6R in either the wild type RhCMV vector or in a vector lacking MHC immunomodulatory genes. Vectors have been constructed genetically characterized and electroporated into RhCMV permissive cells to reconstitute recombinant viruses. MPV antigen expression of vectors is currently being confirmed. Specific Aims 2 and 3 were to establish the pathobiology of WT MPV infection in RMs and to monitor the immunological consequences of WT MPV infection. To date four RMs have been experimentally inoculated intra-bronchially with MPV Zaire strain. Two with 2 x 10⁷ plaque forming units (PFU) and two with 2 x 10⁵ PFU to define a lethal dose by this route of infection and to characterize the virus/host interactions. A summation of the ongoing studies is provided. Together completion of these three specific aims will form the foundation for future studies designed to determine the efficacy of the RhCMV/MPV vectors at inducing a protective immune response to MPV challenge in RMs.

DTIC

Pathogens; Viruses

20070011214 North Carolina Univ., Asheville, NC USA

Engineered Muscle Actuators: Cells and Tissues

Dennis, Robert G; Herr, Hugh; Parker, Kevin K; Larkin, Lisa; Arruda, Ellen; Baar, Keith; Jan 10, 2007; 25 pp.; In English

Contract(s)/Grant(s): FA9550-05-1-0015

Report No.(s): AD-A462854; No Copyright; Avail.: CASI: [A03](#), Hardcopy

We report the completion of Phase II of a technological development program for the production of living muscle mechanical actuators for robotic and prosthetic applications. Our primary objectives were to engineer living skeletal muscle actuators in culture using integrated bioreactors to guide tissue development and to maintain tissue contractility, to achieve 50% of adult phenotype muscular contractility, and then to install the engineered muscles into a centimeter-scale hybrid

swimming robotic platform. Outcomes by milestone: (1) Develop integrated tissue culture bioreactor systems: completed all but bulk perfusion (2) Develop appropriate tissue interfaces in culture: full success, muscle-tendon & nerve (3) Achieve 50% of adult muscle functional capacity: excellent progress but not 50% (4) Swimming robotic platform with muscle: 50% success due to inadequate muscle performance Overall, this project resulted in many planned and collateral technological advances, including sub-cm scale cardiac muscle powered swimming actuators, functional tendon and nerve tissue interfaces, integrated rapid manufactured tissue bioreactors and improved contractility.

DTIC

Actuators; Bioreactors; Muscles

20070011215 North Carolina Univ., Chapel Hill, NC USA

Non-Classical NF-kappaB Forms and Bcl-3 in Breast Cancer Development and Resistance to Cancer Therapy

Baldwin, Albert S; Jun 2006; 32 pp.; In English

Contract(s)/Grant(s): DAMD17-03-1-0401

Report No.(s): AD-A462855; No Copyright; Avail.: CASI: [A03](#), Hardcopy

Breast cancer development is typified by the overexpression of growth factors and growth factor receptors, expression of cell cycle markers such as cyclin D1 and c-myc, expression of chemokines such as RANTES, and development of resistance to cancer therapies. We and others have provided evidence that the transcription factor NF-kappaB and associated activities are expressed/activated in human breast cancer. Specifically we found that the NF-kB2/p52 NF-kappaB subunit and Bcl-3 are expressed in a significant number of breast tumors. Our goals were to: (i) identify genes regulated by Her-2/neu and Bcl-3 that may be relevant to the progression of the disease, (ii) determine the mechanism whereby Bcl-3 blocks cancer-therapy induce apoptosis, and (iii) determine if Bcl-3 and the associated NF-kappaB subunit p52 are required for the development of experimental breast tumors in animal models. Our published results indicate that Bcl-3 expression suppresses p53 activation and promotes resistance to cancer therapies. Preliminary data indicate that Her-2/neu expression activates NF-kB through an Akt and IKK-dependent manner, and promotes phosphorylation of estrogen receptor (a potentially important mechanism for tamoxifen resistance and enhanced responses to estrogens).

DTIC

Breast; Cancer; Mammary Glands; Therapy

20070011216 Park Nicollet Inst, Saint Louis, MN USA

Predictors of Lymphedema Following Breast Cancer Surgery

Swenson, Karen K; Sep 2006; 12 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAMD17-03-1-0738

Report No.(s): AD-A462856; No Copyright; Avail.: CASI: [A03](#), Hardcopy

Surgery for breast cancer includes removal of the breast tumor along with axillary lymph nodes. Unfortunately, a relatively common side effect following axillary lymph node dissection (ALND) is upper-extremity lymphedema. The purpose of this study is to identify risk factors for lymphedema among women with breast cancer surgery. Specific aims include identifying risk factors for lymphedema and comparing quality of life (QOL) for women who have and do not have lymphedema. A casecontrol study will be conducted with 200 participants. Cases will be identified in the physical therapy or cancer centers. Controls will be identified using the oncology registry and include patients with breast cancer surgery who have not developed lymphedema. Risk factors and severity of lymphedema will be assessed with the Measure of Arm Symptom Survey (MASS), a patient-competed survey. QOL will be collected with the SF-36. Treatment risk factors will be obtained from the oncology registry. This study will determine which factors are important in lymphedema development.

DTIC

Breast; Cancer; Dissection; Lymphatic System; Mammary Glands; Predictions; Surgery; Therapy

20070011218 West Virginia Univ., Morgantown, WV USA

Bone Marrow Function in Development of Childhood Asthma

Hogan, Mary B; Oct 2006; 22 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAMD17-02-1-0203

Report No.(s): AD-A462858; No Copyright; Avail.: CASI: [A03](#), Hardcopy

Asthma is the most common reason for hospitalization of children in military hospitals. In children with asthma, exposure to allergen results in pulmonary damage due to invasion of eosinophils. Eosinophils are inflammatory cells with limited life spans, and must be continually renewed from the bone marrow. We adapted an animal model of asthma to study the effect of

allergen exposure on eosinophil progenitor cells (CFU-eo). These studies have revealed that CFU-eo are elevated in the bone marrow of asthmatic mice following allergen exposure. Cytokines such as IL-5, SCF, IL-4 and leukotrienes influence eosinophil production during onset of asthma and these cytokines originate from bone marrow stromal cells. We have determined that both stromal cells and T cells have a contributory role in both normal and accelerated eosinophil production noted in asthma. In addition, inflammatory mediators released from the lung alter stromal cell support of eosinophilopoiesis and may contribute to the chronic inflammation associate with long term asthma.

DTIC

Asthma; Bone Marrow; Children; Lymphocytes

20070011220 Kansas Univ., Kansas City, KS USA

Inhibition of Androgen-Independent Growth of Prostate Cancer by siRNA-Mediated Androgen Receptor Gene Silencing

Li, Benyi; Feb 2006; 52 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-04-1-0214

Report No.(s): AD-A462862; No Copyright; Avail.: CASI: [A04](#), Hardcopy

In current period, We first used a signal intra-tumoral injection of different amount of AAV particles to define a proper dosage for efficient virus distribution and knockdown of AR expression. The defined dose was 5.0×10^6 AAV particles per 100 mm^3 of tumor volume. Next, we used this dose to treat prostate cancer xenografts. We found that intra-tumoral injection of the ARHP8 but not GFP AAVs abolished tumor growth in LNCaP- and C4-2-derived xenografts in both castrated and shamoperated mice. Immunostaining results confirmed that the AR expression was dramatically down-regulated in AAV.ARHP8-injected tumors. In addition, a significant increase of apoptosis index (TUNEL assay) and dramatic decrease of proliferation index (BrdU incorporation assay) were found in AAV.ARHP8-injected tumors compared to the GFP control. These results demonstrated that the AR is critical for androgen-dependent survival and tumor growth in prostate cancer. Next year, we will repeat these experiments using two more prostate cancer cell line-derived xenografts.

DTIC

Cancer; Prostate Gland

20070011222 University Coll., London, UK

Elastic Scattering Spectroscopy for the Detection of Pre-Cancer and Early Cancer of the Breast

Brown, Stephen G; Jun 2006; 63 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-04-1-0589

Report No.(s): AD-A462864; No Copyright; Avail.: CASI: [A04](#), Hardcopy

Elastic scattering spectroscopy (ESS) interrogates tissue with short pulses of white light, obtaining diagnostic information from immediate spectral analysis of light scattered back. From data pairs correlating spectra with conventional histology at individual points, we developed diagnostic algorithms to detect cancer by spectral analysis. Pixels containing less than 20% cancer were detected in mastectomy specimens. In initial testing on axillary nodes, some cancers were missed due to inadequate sampling. This was addressed by scanning the cut surface of excised sentinel nodes (400 pixels/cm^2) to create an optical image which improved sensitivity to 77.8% with 97.5% specificity. This is comparable to touch imprint cytology, an established technique for rapid assessment of nodes, but with no need for tissue processing or for a pathologist's opinion. Greater sensitivity should be possible by scanning more layers of nodes (ESS interrogates 0.3-0.5mm into tissue). Preliminary studies suggest that ESS may also be able to diagnose lesions seen at ductoscopy (where biopsy is not feasible) and detect aneuploidy, an important prognostic factor. These results justify further prospective studies. The technique is simple in concept, uses low cost equipment and has considerable potential for the immediate detection of cancer in vivo or ex vivo in many tissues.

DTIC

Breast; Cancer; Detection; Elastic Scattering; Mammary Glands; Optical Measurement; Spectroscopy

20070011223 Texas Univ. Health Science Center, San Antonio, TX USA

Anti-Androgen Receptor RNA Enzyme as a Novel Therapeutic Agent for Prostate Cancer In Vivo

Chen, Shuo; Aug 2006; 15 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-04-1-0253

Report No.(s): AD-A462865; No Copyright; Avail.: CASI: [A03](#), Hardcopy

Prostate cancer is the second leading cause of cancer death among men in the western world. Androgen plays a crucial

role in the development and growth of normal prostate gland and prostate cancer. Action of androgen is mediated by an androgen receptor (AR) and the AR exerts androgen-regulated gene expression. Standard therapy relies on androgen ablation to remove or block the action of androgens. This therapy results in a regression of the tumor because most primary tumor cells depend on androgens for growth and programmed cell death. However, most prostate cancers eventually relapse as their tumors progress to androgen-refractory. Studies have indicated that the AR gene amplification and mutations are involved in androgen-refractory tumors. Therefore, blockage of the AR gene expression may provide a new approach to the management of the AR-dependent cancer. We have developed anti-AR RNA enzymes that are able to selectively and specially interact with the AR mRNA and cleave the AR mRNA in vitro. Unlike conventional chemotherapy, the enzymes would have lesser side effects because the compounds selectively destroy only the AR gene. This study proposed is to determine specific efficacy of these enzymes in vivo.

DTIC

Cancer; Enzymes; In Vivo Methods and Tests; Prostate Gland; Ribonucleic Acids; Therapy

20070011224 Baylor Coll. of Medicine, Houston, TX USA

Mechanisms Down-Regulating Sprouty1, a Growth Inhibitor in Prostate Cancer

Kwabi-Addo, Bernard; Oct 2006; 62 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-04-1-0878

Report No.(s): AD-A462867; No Copyright; Avail.: CASI: [A04](#), Hardcopy

The Sprouty gene family negatively regulates growth factor-induced receptor tyrosine kinase signaling with a potential tumor suppressor function in cancer. I have demonstrated that Sprouty1 is down-regulated in human prostate cancer (PCa). The purpose of the present study is to characterize the molecular mechanisms regulating Sprouty1 expression in the human PCa. Results. I have carried out deletion analysis coupled with reporter gene assays to characterize Sprouty1 promoter activity. Electrophoretic mobility shift assays, chromatin immunoprecipitation and TranSignal protein-DNA array were used to demonstrate binding interaction of Transcription factors (TFs) with Sprouty1 promoter. I have also carried out DNA methylation analysis on 20 matched normal prostate tissues and tumor prostate tissues (at least 70% of tissue is carcinoma) in the 5 untranslated region of Sprouty1. The results of deletion analysis demonstrated a strong promoter activity in the proximal 0.3-kb region of Sprouty1 promoter. Several potential binding sites for transcription factors (TFs) such as: AP-1/2, CREB, EGR1, GATA1, and SP1 were found within this region. In addition, TranSignal protein-DNA array analysis showed differential activation of a number of transcription factors (TFs) in the normal and prostate cancer cell lines with the consensus binding sites of Sprouty1 promoter. Gene knockdown of one such TF family: GATA (2 and 4) induced Sprouty1 expression demonstrating transcriptional repression by this TF. I did not observe any significant methylation of the Sprouty1 promoter region in the normal or the tumor samples analyzed. CONCLUSION. My studies suggest that Sprouty1 is not regulated in human prostate cancer by epigenetic mechanisms. Transcriptional repression may therefore represent a key mechanism for down-regulation of Sprouty1 expression in prostate cancer.

DTIC

Cancer; Inhibitors; Prostate Gland

20070011225 Montana Univ., Missoula, MT USA

Elucidation of Prion Protein Conformational Changes Associated with Infectivity by Fluorescence Spectroscopy

McGuirl, Michele; Jun 2006; 31 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAMD17-03-1-0342

Report No.(s): AD-A462868; No Copyright; Avail.: CASI: [A03](#), Hardcopy

Prion diseases are fatal neurodegenerative diseases of mammals. They are characterized by the conversion of normal prion protein (PrP) to a misfolded conformational state that accumulates as plaques in the brain. The diagnosis of prion diseases relies on the ability to differentiate between normal PrP and its misfolded, infectious form. This is difficult to accomplish by traditional testing methods, since it requires discerning between conformational states of a protein that is present in both normal and diseased tissue, rather than identifying the appearance of a new protein associated with infection. We wish to design a reporter PrP substrate that may be monitored by fluorescence spectroscopy. After the conversion of normal-PrP to its infectious state, some amino acid residues of PrP will undergo a change in their local solvent environment. We propose to identify these residues by monitoring the fluorescence emission spectrum of a series of mutant 7-AzaTrp-substituted PrP proteins. The 7-AzaTrp fluorescence emission spectrum is both unique compared with normal Trp and exquisitely sensitive to its local environment. This could lead to the development of a rapid, sensitive, and inexpensive technique to detect

infectious PrP, based on its ability to bind 7-AzaTrp-substituted PrP, and convert it to the misfolded form.

DTIC

Emission Spectra; Fluorescence; Proteins; Spectroscopy

20070011226 National Marrow Donor Program, Minneapolis, MN USA

Quarterly Performance/Technical Report

Coppo, Patricia A; Dec 2006; 20 pp.; In English; Original contains color illustrations

Report No.(s): AD-A462870; N00014-05-1-0859; No Copyright; Avail.: CASI: [A03](#), Hardcopy

1. Contingency Preparedness: Collect information from transplant centers, build awareness of the Transplant Center Contingency Planning Committee and educate the transplant community about the critical importance of establishing a nationwide contingency response plan. 2. Rapid Identification of Matched Donors : Increase operational efficiencies that accelerate the search process and increase patient access are key to preparedness in a contingency event. 3. Immunogenetic Studies: Increase understanding of the immunologic factors important in HSC transplantation. 4. Clinical Research in Transplantations: Create a platform that facilitates multicenter collaboration and data management.

DTIC

Stem Cells; Transplantation

20070011228 Michigan Univ., Ann Arbor, MI USA

Role of the XIAP/AIF Axis in the Development and Progression of Prostate Cancer

Wilkinson, John C; Oct 2006; 14 pp.; In English

Contract(s)/Grant(s): W81XWH-04-1-0854

Report No.(s): AD-A462873; No Copyright; Avail.: CASI: [A03](#), Hardcopy

In the past year significant progress has been made towards completing tasks both outlined in and extending beyond the original Statement of Work. The physical association between XIAP and AIF was determined to be highly dependant upon the ubiquitination status of AIF and XIAP-mediated ubiquitination of AIF was shown not to result in AIF degradation. It was determined that the XIAP antagonist Smac/DIABLO completely disrupted the association between XIAP and AIF in a manner that correlated with an increase in AIF ubiquitination. AIF was determined to be a substrate for cleavage by the serine protease and XIAP antagonist Omi/HtrA2 yet the absence of Omi/HtrA2 did not affect the cytoplasmic release of AIF following apoptosis induction. Interestingly the release of cytochrome c following cell death induction was shown to be delayed in cells deficient in Omi/HtrA2. Finally AIF was found to associate with the XIAP homologues cIAP-1 and cIAP-2 suggesting that AIF may be a general purpose IAP binding protein. These findings represent significant progress in further characterizing the interaction between AIF and the inhibitor of apoptosis (IAP) family and continue to form the basis for understanding how AIF and the IAP family contribute to the pathogenesis of prostate cancer.

DTIC

Apoptosis; Cancer; Enzymes; Peptides; Prostate Gland

20070011229 Pittsburgh Univ., Pittsburgh, PA USA

Development and Evaluation of Stereographic Display for Lung Cancer Screening

Wang, Xiao H; Good, Walter F; Fuhrman, Carl R; Rockett, Howard E; Gur, David; Dec 2006; 34 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-05-1-0101

Report No.(s): AD-A462882; No Copyright; Avail.: CASI: [A03](#), Hardcopy

The main purpose of this project is to investigate the feasibility and efficacy of using a stereo display workstation for lung cancer screening on CT images. The tasks included in this project are development and evaluation of stereo image projection and display for chest CT images observer performance evaluation for the stereo display and stereo feature analysis and comparison to the conventionally used display methods for lung cancer detection. In the previous report period we have built a stereo display workstation for chest CT images and conducted a pilot observer performance study. In this annual report period we have continued the study based on the projected tasks as listed below. 1. Analyzing the results from the pilot study: we applied Free-response Receiver Operating Characteristic (FROC) statistic method to analyze the data from the pilot study for lung nodule detection and classification. Results indicate that the stereo display achieved the best performance followed by the slice-by-slice display and the conventional MIP display gave the worst performance although there is no statistically significant difference between the three display modes. Subjective assessment indicates that the stereo display was well accepted by the radiologists. Efficiency measurement indicates that the radiologists spent the least interpretation time with the

stereo display when compared to the other two display modes. Further analysis of the radiologists' interpretation patterns indicates that novelty and training effect substantially influenced the radiologists' interpretation behavior and performance. The conclusion from the preliminary results is that we have observed a potential role of stereo display for improving radiologists' performance in medical detection and diagnosis and also observed some factors likely affecting the performance with new display such as novelty training effect and confidence with the new technology including the stereo display.

DTIC

Cancer; Display Devices; Lungs; Stereoscopy

20070011232 Northwestern Univ., Evanston, IL USA

Preparation for a Clinical Trial Using Adoptive Transfer of Tumor-Reactive TGF_Beta-Insensitive CD8+ T Cells for Treatment of Prostate Cancer

Lee, Chung; Kuzel, Timothy; Meagher, Richard; Yang, Ximing; Smith, Norm; Zhang, Qiang; Jul 2006; 28 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-05-1-0450

Report No.(s): AD-A462885; No Copyright; Avail.: CASI: [A03](#), Hardcopy

Prostate cancer is the most common form of malignancy and is the second leading cause of cancer mortality in American men. While the medical field is able to treat locally confined prostate cancer metastatic diseases remain to be a major medical challenge. Treatment of advanced stage tumors usually requires a systemic approach. However conventional therapeutic approaches are only palliative at best. Therefore new approaches are urgently needed for patients with advanced metastatic prostate cancer. The present proposal describes a novel immunotherapy program based on our understanding of the action of TGF-beta. Results of our pre-clinical studies have demonstrated that adoptive transfer of tumor-reactive TGF-beta-insensitive CD8+ T cells to hosts bearing mouse prostate tumors resulted in a complete rejection of established tumors. We observed that these CD8+ T cells were able to infiltrate into the tumor parenchyma, secrete relevant cytokines and mediate apoptosis in tumor cells. These observations are encouraging. We propose to quickly translate this technology into a clinical setting for the treatment of patients with advanced prostate cancer. In the present application we propose to perform all preparations so that all requirements for a clinical trial will be in place.

DTIC

Cancer; Prostate Gland; Reactivity; Tumors

20070011233 TRUE Research Foundation, San Antonio, TX USA

Hepatitis C. Virus Infection: Mechanisms of Disease Progression

Sjogren, Maria H; Huntley, Brooke; Oct 2006; 9 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAMD17-00-1-0719

Report No.(s): AD-A462886; No Copyright; Avail.: CASI: [A02](#), Hardcopy

An estimated 4.1 million individuals in the USA are chronically infected with the hepatitis C virus. Annually 8,000 to 10,000 of these subjects will die of liver-related complications and approximately 1,000 will require liver transplantation. The U.S. military has rates of HCV infection similar to the general U.S. population (1.6%). However, it is a younger population and its natural history of HCV infection has not been studied. Therefore, the clinical outcome of HCV-infected military subjects and risk factors contributing to disease progression are largely unknown. Such knowledge is essential for decisions regarding optimal management and prevention of the disease. This study focuses on active duty military subjects infected with HCV, who will be enrolled and observed prospectively over 4 years. The principal hypothesis is that in active duty members infected with HCV genotype-1, liver disease progresses more rapidly than in subjects infected with HCV nongenotype-1. The effect of other factors that might influence histologic progression of liver disease, including age, race, rank, deployment, alcohol consumption, and HCV RNA level will be assessed. Liver biopsies are to be performed at initiation if needed and at the completion of the study to observe for disease progression. Lab evaluation of virologic and biochemical indicators of the disease and detailed information about risk factors and quality of life will be collected by questionnaire every 6 months. Currently, 95 subjects have been enrolled and 65 subjects are being followed. It is too early to report any conclusions in terms of disease progression and potential contributing factors to disease progression specific to this population, as only 19 subjects (15%) have completed the study. However, trends concerning the decision to treat will be discussed. Therefore, the majority of the data presented in this report will be confined to descriptive statistics of the sample to date.

DTIC

Demography; Epidemiology; Hepatitis; Risk; Viral Diseases

20070011234 Mount Sinai School of Medicine, New York, NY USA

Diversity, Replication, Pathogenicity and Cell Biology of Crimean Congo Hemorrhagic Fever Virus

Garcia-Sastre, Adolfo; Oct 2006; 15 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-04-1-0876

Report No.(s): AD-A462887; No Copyright; Avail.: CASI: [A03](#), Hardcopy

This research project is a result of a collaboration between three research groups aimed at elucidating basic replication processes of CCHFV with the expected outcome of providing basic research reagents and establishing the foundation of knowledge necessary for discovery of vaccines and antiviral therapeutics for Crimean Congo hemorrhagic fever. Our major findings during the second year of support are the following: We have mapped domains in the N and L proteins of CCHFV responsible for protein-protein interactions and RNA-protein interactions. We have identified a novel activity associated with the N-terminal of the L protein, that is responsible for deconjugation of ubiquitin and ISG15 conjugates, that could be a target for antiviral development and for attenuation. We have detected and NSm protein produced after cleavage of the glycoprotein precursor in virus infected cells. The NSm is stable and transported to the Golgi. We have optimized the techniques to propagate CCHFV in tissue culture and generated high titer stocks. Our results provide novel insights on the molecular biology of this understudied highly pathogenic human virus.

DTIC

Africa; Cells (Biology); Fever; Hemorrhages; Pathogenesis; Viruses

20070011235 Sir Mortimer B. Davis Jewish General Hospital, Montreal, Quebec Canada

Disruption of Brca2-Rad51 Complex in Breast Cancer Cells: Therapeutic Implications

Aloyz, Raquel S; Sep 2006; 11 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-04-1-0702

Report No.(s): AD-A462888; No Copyright; Avail.: CASI: [A03](#), Hardcopy

BRCA2-Rad51 interaction is required for the Rad51-related DNA repair pathway. Thus, inhibition of their interaction is expected to sensitize tumor cells to certain DNA damaging agents. A panel of 14080 natural compounds from the Chinese National Center for Drug Screening has been partially screened using a yeast two-hybrid system utilizing specific Rad51/BRCA2 constructs. Growth of the Rad51/BRCA2 yeast strain in different media lead us to the selection of 20 candidate inhibitors for BRCA2-Rad51 interaction. We are actually testing if these compounds sensitize breast cancer cell lines to cisplatin. One of the compounds at the concentrations attainable increases the toxicity of cisplatin in a BRCA1 deficient breast cancer cell line.

DTIC

Breast; Cancer; Mammary Glands; Therapy

20070011236 Texas Univ., San Antonio, TX USA

MOLECULAR CHARACTERIZATION of VIBRIO CHOLERAEE GENES FLGO and FLGP

Morris, David C; Dec 2006; 69 pp.; In English

Report No.(s): AD-A462889; CI07-0014; No Copyright; Avail.: CASI: [A04](#), Hardcopy

Vibrio cholerae, a human pathogen and causative agent of the human diarrheal disease cholera, is a highly motile bacterium by virtue of a single, sheathed, polar flagellum. Motility has been inferred to play an important role in virulence and two genes were previously identified by our lab that appeared to be regulated by the flagellar regulatory protein FlrC, VC2207 and the gene immediately downstream VC2206 (annotated as flgO and flgP, respectively). In an effort to determine the roles of FlgO and FlgP, in frame chromosomal deletions were constructed in the coding sequences of flgO and flgP of V. cholerae. A deletion removing the entire coding sequence for FlgO (DELTAflgO) was constructed in wild-type (KKV598) and the same done for FlgP (DELTAflgP). Our results demonstrate that FlgO is a secreted protein that plays a role in transcription of Class IV flagellins, is required for a motile phenotype and does not play a significant role in colonization of the infant mouse small intestine. FlgP is an outer membrane lipoprotein that is required for a motile phenotype, and plays a significant role in colonization of the infant mouse small intestine.

DTIC

Bacteria; Cholera; Genes

20070011242 Mount Sinai School of Medicine, New York, NY USA

Transcriptional Regulation by KLF6, A Novel Tumor Suppressor Gene in Prostate Cancer, Through Interaction with HATS and HDACS

Friedman, Scott L; Mar 2006; 79 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAMD17-03-1-0100

Report No.(s): AD-A462918; No Copyright; Avail.: CASI: [A05](#), Hardcopy

KLF6 is a zinc finger transcription factor mutated in more than 50% of sporadic prostate cancers. Our studies have explored the role of acetylation of KLF6 and how its abrogation by mutation in human cancer may contribute to its dysregulation and emergence of prostate cancer. The KLF6 tumor suppressor protein normally inhibits cell growth by upregulating p21 (WAF1/CIP1) independent of p53 whereas most tumor derived mutations are no longer growth suppressive (Narla et al Science 294:2563,2001). We have demonstrated by chromatin that transactivation of p21 by KLF6 occurs through its direct recruitment to the p21 promoter and requires acetylation by histone acetyltransferase activity. Based on these data we have extended findings to uncover additional cancers in which KLF6 is dysregulated and have defined a novel pathway of KLF6 dysregulation through generation of dominant negative alternative splice forms that are overexpressed in many cancers. These data suggest that multiple mechanisms including loss of acetylation contribution to KLF6 dysregulation that contributes to carcinogenesis in prostate and other cancers.

DTIC

Cancer; Genes; Prostate Gland; Tumor Suppressor Genes

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*.

20070009877 NASA Johnson Space Center, Houston, TX, USA

Using Latent Sleepiness to Evaluate an Important Effect of Promethazine

Feiveson, Alan H.; Hayat, Matthew; Vksman, Zalman; Putcha, Laksmi; [2007]; 1 pp.; In English; Joint Statistical Meetings, 29 Jul. - 2 aug. 2007, Sal Lake City, UT, USA; Copyright; Avail.: Other Sources; Abstract Only

Astronauts often use promethazine (PMZ) to counteract space motion sickness; however PMZ may cause drowsiness, which might impair cognitive function. In a NASA ground study, subjects received PMZ and their cognitive performance was then monitored over time. Subjects also reported sleepiness using the Karolinska Sleepiness Score (KSS), which ranges from 1 - 9. A problem arises when using KSS to establish an association between true sleepiness and performance because KSS scores tend to overly concentrate on the values 3 (fairly awake) and 7 (moderately tired). Therefore, we defined a latent sleepiness measure as a continuous random variable describing a subject's actual, but unobserved true state of sleepiness through time. The latent sleepiness and observed KSS are associated through a conditional probability model, which when coupled with demographic factors, predicts performance.

Author

Aerospace Medicine; Alertness; Promethazine; Sleep; Sleep Deprivation

20070009935 NASA Johnson Space Center, Houston, TX, USA

NASA Strategy to Safely Live and Work in the Space Radiation Environment

Cucinotta, Francis A.; Wu, Honglu; Corbin, Barbara J.; Sulzman, Frank M.; Krenek, Sam; [2007]; 1 pp.; In English; 16th Humans in Space Symposium of the IAA, 20-24 May 2007, Paris, France; No Copyright; Avail.: Other Sources; Abstract Only

In space, astronauts are constantly bombarded with energetic particles. The goal of the National Aeronautics and Space Agency and the NASA Space Radiation Project is to ensure that astronauts can safely live and work in the space radiation environment. The space radiation environment poses both acute and chronic risks to crew health and safety, but unlike some other aspects of space travel, space radiation exposure has clinically relevant implications for the lifetime of the crew. Among the identified radiation risks are cancer, acute and late CNS damage, chronic and degenerative tissue disease, and acute radiation syndrome. The term 'safely' means that risks are sufficiently understood such that acceptable limits on mission, post-mission and multi-mission consequences can be defined. The NASA Space Radiation Project strategy has several elements. The first element is to use a peer-reviewed research program to increase our mechanistic knowledge and genetic

capabilities to develop tools for individual risk projection, thereby reducing our dependency on epidemiological data and population-based risk assessment. The second element is to use the NASA Space Radiation Laboratory to provide a ground-based facility to study the health effects/mechanisms of damage from space radiation exposure and the development and validation of biological models of risk, as well as methods for extrapolation to human risk. The third element is a risk modeling effort that integrates the results from research efforts into models of human risk to reduce uncertainties in predicting the identified radiation risks. To understand the biological basis for risk, we must also understand the physical aspects of the crew environment. Thus, the fourth element develops computer algorithms to predict radiation transport properties, evaluate integrated shielding technologies and provide design optimization recommendations for the design of human space systems. Understanding the risks and determining methods to mitigate the risks are keys to a successful radiation protection strategy.

Author

Radiation Protection; Aerospace Environments; Safety; Spacecrews; Radiation Dosage; Extraterrestrial Radiation; Energetic Particles; Astronauts; Aerospace Medicine

20070009944 NASA Johnson Space Center, Houston, TX, USA

Artificial Gravity-Bone Loss Research Plan

Leblanc, Adrian; Smith, Scott M.; Shackelford, Linda; Spector, Elisabeth; Evans, Harlan; [2007]; 1 pp.; In English; International Gravitational Physiology Meeting, 8-13 Apr. 2007, San Antonio, TX, USA; Copyright; Avail.: Other Sources; Abstract Only

One of the most intractable physiological problems of long duration stays in microgravity is the loss of bone mass from critical bone regions particularly in regions rich in trabecular bone. DXA data from 18 cosmonauts showed significant monthly BMD losses in the lumbar spine, femur neck, trochanter and pelvis of 1.1%, 1.2%, 1.6%, 1.4% respectively. Among astronauts and cosmonauts who participated in long-duration flights aboard Mir and ISS, 43% have shown a 10% loss in at least one skeletal site. Recent publications have shown even greater decrements in trabecular mass of the proximal hip and consequent decreases in strength of 25-30%. Recovery occurs over several years, but is accompanied by architectural changes the significance of which is not understood at this time. Therefore, a robust countermeasure is clearly needed if space flight is to move forward beyond earth orbit as outlined in the NASA vision. However, proper evaluation of AG as an effective countermeasure requires verification of the attenuation of bone loss in these critical regions which represent less than 5% of the overall skeleton. However, with the short duration of this pilot study, obtaining statistically significant effects on bone mass was not possible. However, there are a number of published studies that have demonstrated bone biochemical changes after as little as a few weeks of disuse demonstrating that the initiation of the cascade of events that lead to detectable loss in bone mass begins very early after the onset of weightlessness or disuse. Therefore demonstrating significant effects on biochemical markers would indicate potential benefit and rationale to continue the evaluation of AG with longer duration studies. The bone related objectives of this initial pilot study were to: determine if daily exposure to AG would impact bone biochemistry and secondly provide the baseline bone mass and structural data for future longer duration studies. The bone plan evolved in consultation with the peer review Committee and consisted of the following suite of measurements. Bone mass/trabecular structure: DXA of the whole body and sub-regional analysis; Regional DXA scans of the calcaneus, proximal hip, wrist and spine; pQCT of the tibia; Micro MRI imaging of the trabecular structure of the distal tibia. Bone Biochemistry: Resorption/formation markers; Calcium excretion/calcium balance/calcium kinetics; Hormonal regulators of bone metabolism. There were no statistically significant changes in the bone mass or trabecular structure measurements. The biochemistry measures however do indicate a positive systemic effect and will be presented in the next paper. While these initial pilot study results show promise, longer duration experiments will be needed to document efficacy on regional bone mass.

Author

Artificial Gravity; Biochemistry; Bone Demineralization; Bone Mineral Content; Aerospace Medicine; Physiology; Research and Development

20070009946 NASA Johnson Space Center, Houston, TX, USA

Myotonometry as a Surrogate Measure of Muscle Strength

Ang, B. S.; Feeback, D. L.; Leonard, C. T.; Sykes, J.; Kruger, E.; Clarke, M. S. F.; [2007]; 1 pp.; In English; International Gravitational Physiology Meeting, 8-13 Apr. 2007, San Antonio, TX, USA; Copyright; Avail.: Other Sources; Abstract Only

Space flight-induced muscle atrophy/neuromuscular degradation and the consequent decrements in crew-member performance are of increasing concern as mission duration lengthens, and planetary exploration after extended space flight is planned. Pre- to post-flight strength measures have demonstrated that specific countermeasures, such as resistive exercise, are

effective at countering microgravity-induced muscle atrophy and preventing decrements in muscle strength. However, in-flight assessment/monitoring of exercise countermeasure effectiveness will be essential during exploration class missions due to their duration. The ability to modify an exercise countermeasure prescription based on such real-time information will allow each individual crew member to perform the optimal amount and type of exercise countermeasure to maintain performance. In addition, such measures can be used to determine if a crew member is physically capable of performing a particular mission-related task during exploration class missions. The challenges faced in acquiring such data are those common to all space operations, namely the requirement for light-weight, low power, mechanically reliable technologies that make valid measurements in microgravity, in this case of muscle strength/neuromuscular function. Here we describe a simple, light-weight, low power, non-invasive device, known as the Myotonometer, that measures tissue stiffness as an indirect measure of muscle contractile state and muscle force production. Repeat myotonometer measurements made at the same location on the surface of the rectis femoris muscle (as determined using a 3D locator device, SEM plus or minus 0.34 mm) were shown to be reproducible over time at both maximal voluntary contraction (MVC) and at rest in a total of 17 sedentary subjects assessed three times over a period of seven days. In addition, graded voluntary isometric force production (i.e. 20%, 40%, 60%, 80% & 100% of MVC) during knee extension was shown to be significantly (p less than 0.01) correlated with contemporaneous myotonometer measurements made on the rectis femoris muscle in a total of 16 healthy subjects (8 males, 8 females). Further-more, this device has been operationally tested during parabolic flight demonstrating its suitability for use in a microgravity environment. Our data indicates that the Myotonometer is a viable surrogate measure of muscle contractile state/force and of muscle strength/force production. Additional studies are required to assess the suitability of this technique for assessing these measures in de-conditioned subjects such as crew-members.

Author

Atrophy; Neuromuscular Transmission; Microgravity; Muscular Function; Muscular Strength; Physiology; Biodegradation

20070009949 NASA Johnson Space Center, Houston, TX, USA

Adaptive Responses in Eye-Head-Hand Coordination Following Exposures to a Virtual Environment as a Possible Space Flight Analog

Harm, Deborah L.; Taylor, L. C.; Bloomberg, J. J.; [2007]; 1 pp.; In English; 28th Annual International Gravitational Physiology Conference, 8-13 Apr. 2006, San Antonio, TX, USA; Copyright; Avail.: Other Sources; Abstract Only

Virtual environments (VE) offer unique training opportunities, particularly for training astronauts and preadapting them to the novel sensory conditions of microgravity. Sensorimotor aftereffects of VEs are often quite similar to adaptive sensorimotor responses observed in astronauts during and/or following space flight. The purpose of this research was to compare disturbances in sensorimotor coordination produced by dome virtual environment display and to examine the effects of exposure duration, and repeated exposures to VR systems. The current study examined disturbances in eye-head-hand (EHH) and eye-head coordination. Preliminary results will be presented. Eleven subjects have participated in the study to date. One training session was completed in order to achieve stable performance on the EHH coordination and VE tasks. Three experimental sessions were performed each separated by one day. Subjects performed a navigation and pick and place task in a dome immersive display VE for 30 or 60 min. The subjects were asked to move objects from one set of 15 pedestals to the other set across a virtual square room through a random pathway as quickly and accurately as possible. EHH coordination was measured before, immediately after, and at 1 hr, 2 hr, 4 hr and 6 hr following exposure to VR. EHH coordination was measured as position errors and reaction time in a pointing task that included multiple horizontal and vertical LED targets. Repeated measures ANOVAs were used to analyze the data. In general, we observed significant increases in position errors for both horizontal and vertical targets. The largest decrements were observed immediately following exposure to VR and showed a fairly rapid recovery across test sessions, but not across days. Subjects generally showed faster RTs across days. Individuals recovered from the detrimental effects of exposure to the VE on position errors within 1-2 hours. The fact that subjects did not significantly improve across days suggests that in order to achieve dual adaptation of EHH coordination may require more than three training sessions. These findings provide some direction for developing training schedules for VE users that facilitate adaptation, support the idea that preflight training of astronauts may serve as useful countermeasure for the sensorimotor effects of space flight, and support the idea that VEs may serve as an analog for sensorimotor effects of spaceflight.

Author

Eye (Anatomy); Head (Anatomy); Hand (Anatomy); Coordination; Virtual Reality; Sensorimotor Performance; Analogs; Adaptive Control; Exposure; Manned Space Flight; Gravitational Physiology

20070009988 NASA Johnson Space Center, Houston, TX, USA

Bisphosphonate Treatment: Risk Management in Long Duration Spaceflight

Fogarty, Jennifer A.; Aunon, Serena M.; [2007]; 1 pp.; In English; International Academy of Astronautics: Human in Space Symposium, 20-24 May 2007, Beijing, China; Copyright; Avail.: CASI: [A01](#), Hardcopy

Bisphosphonates are a class of pharmaceuticals used to treat diverse bone disorders such as osteoporosis, Paget's disease, and multiple myeloma. They constitute a class of drugs which adhere to bony surfaces and interfere with the resorptive activity of osteoclasts. They also represent a potential countermeasure towards the loss of bone mass experienced by astronauts during spaceflight. Recently, the medical literature has revealed cases of osteonecrosis of the jaw in individuals receiving intravenous bisphosphonate therapy with a smaller number of cases occurring in individuals receiving the oral form of the medication. Risk management for long duration missions requires consideration of mission success and lifetime health care of astronauts. We performed MEDLINE and PubMed searches (1966 December 2006) using the following keywords: osteonecrosis, jaw, bisphosphonates. Additional references were obtained from the citations of the retrieved articles. Injectable bisphosphonates such as pamidronate and zoledronic acid have been highlighted recently in the literature due to a possible link with osteonecrosis of the jaw. The mechanism of action remains unclear but may be linked to physiologic microdamage in the jawbones resulting from suppression of bone metabolism. The most predisposing factors appear to be the type and dose of bisphosphonate used, a history of dental surgery, trauma, and/or dental infection. In addition, patients diagnosed with a malignancy such as breast cancer or multiple myeloma, who have been on intravenous bisphosphonate therapy for several months seem to be at increased risk. The use of oral bisphosphonates appears to place patients more at risk from acute events such as gastrointestinal tract injury or perforation. Although some studies report little to no increase in GI events compared to placebo, we must remember that in microgravity, astronauts may be unable to comply with medication instructions. They may have difficulty remaining upright for the required 30-45 minutes post-ingestion. We are currently unaware if this inability to comply with instructions on the package insert may lead to an increased risk for GI events. There is a potential long-term complication that resides with both forms of bisphosphonate therapy. In order to repair normally occurring physiologic microdamage to bone, both osteoclastic resorption and osteoblastic bone deposition must be functional. Controversy exists in the literature regarding whether prolonged use of bisphosphonates may lead to the suppression of bone turnover and accumulation of microdamage. Bisphosphonates are a powerful class of drugs that suppress bone turnover, but may cause serious adverse clinical events such as gastrointestinal tract injury or osteonecrosis of the jaw. Unfortunately, little to no data exists currently which may help us provide answers regarding the risks of their use in a healthy astronaut cohort. While controversy exists in the literature regarding their mechanism and long-term consequences, the potential mission impact or lifetime health care impact of an adverse clinical event resulting from bisphosphonate therapy must be considered.

Author

Risk; Long Duration Space Flight; Pharmacology; Bones; Infectious Diseases; Aerospace Medicine; Physiology

20070009992 NASA Johnson Space Center, Houston, TX, USA

Neuro-Motor Responses to Daily Centrifugation in Bed-Rested Subjects

Reschke, Millard F.; Somers, Jeffery T.; Kravek, Jody; Fisher, Elizabeth; Ford, George; Paloski, William H.; [2007]; 1 pp.; In English; 28th Annual International Gravitational Physiology Meeting, 8-13 Apr. 2007, San Antonio, TX, USA; Copyright; Avail.: Other Sources; Abstract Only

It is well known from numerous space flight studies that exposure to micro-g produces both morphological and neural adaptations in the major postural muscles. However, the characteristics and mechanism of these changes, particularly when it may involve the central nervous system are not defined. Furthermore, it is not known what role unloading of the muscular system may have on central changes in sensorimotor function or if centrifugation along the +Gz direction (long body axis) can mitigate both the peripheral changes in muscle function and modification of the central changes in sensorimotor adaptation to the near weightless environment of space flight. The purpose of this specific effort was, therefore, to investigate the efficacy of artificial gravity (AG) as a method for maintaining sensorimotor function in micro-g. Eight male subjects were exposed to daily 1 hr centrifugation during a 21 day 6 degree head-down bed rest study. Seven controls were placed on the centrifuge without rotation. The radius and angular velocity of the centrifuge were adjusted such that each subject experienced a centripetal acceleration of 2.5g at the feet, and approximately 1.0g at the heart. Both the tendon (MSR) and functional stretch reflexes (FSR) were collected using an 80 lb. ft. servomotor controlled via position feedback to provide a dorsiflexion step input to elicit the MSR, and the same step input with a built in 3 sec hold to evoke the FSR. EMG data were obtained from the triceps surae. Supplementary torque, velocity and position data were collected with the EMG responses. All data were digitized and sampled at 4 kHz. Only the MSR data has been analyzed at this time, and preliminary results suggest that those subjects exposed to active centrifugation (treatment group) show only minor changes in MSR peak latency times, either as a function of time spent in bed rest or exposure to centrifugation, while the control subjects show delays in the MSR peak

latencies that are typical of bed rested subjects. There also appears to be a trend in the treatment group where centrifugation results in peak latencies that are shorter than the control group. This trend is supported by the observation that peak reflex amplitudes are larger (up to 40% in magnitude) than those of the control subjects. Furthermore, centrifugation tends, by day 21 of bed rest, to normalize the peak amplitudes to the amplitudes observed prior to bed rest or centrifugation. From a preliminary point of view, centrifugation appears to have a positive effect on the sensorimotor system, and specifically on those muscles that provide anti-gravity and postural support.

Author

Bed Rest; Centrifuging; Muscular Function; Neurology; Microgravity; Efferent Nervous Systems

20070010546 NASA Johnson Space Center, Houston, TX, USA

Artificial Gravity as a Bone Loss Countermeasure in Simulated Weightlessness

Smith, Scott M.; Zwart, S. R.; Gilman, P.; Crawford, G.; LeBlanc, A.; Heer, M.; [2007]; 1 pp.; In English; Experimental Biology, 28 Apr. 2007 - 2 May 2007, Washington, DC, USA; Copyright; Avail.: Other Sources; Abstract Only

The impact of microgravity on the human body is a significant concern for space travelers. We report here initial results from a pilot study designed to explore the utility of artificial gravity (AG) as a countermeasure to the effects of microgravity, specifically to bone loss. After an initial phase of adaptation/testing, 8 male subjects underwent 21 days of 6deg head-down bed rest to simulate the deconditioning associated with space flight. Six subjects underwent 1 h of centrifugation (AG, 1 g at the heart, 2.5 g at the feet) each day for 21 days, while 2 subjects served as untreated controls (CN). Blood and urine were collected before, during, and after bed rest for bone marker determinations. Comparing the last week of bed rest to before bed rest, urinary excretion of the bone resorption marker n-telopeptide increased 95 +/- 59% (mean SD) in CN and 33 +/- 28% in the AG group. Similar results were found for another resorption marker, helical peptide (57 +/- 0% and 35 +/- 13% for CN and AG, respectively). Bone-specific alkaline phosphatase did not change during bed rest. The study will continue with additional subjects and measures, including calcium tracer kinetic studies. These initial data demonstrate the potential effectiveness of short-radius, intermittent AG as a countermeasure to the bone deconditioning that occurs during bed rest.

Author

Microgravity; Weightlessness Simulation; Bone Demineralization; Artificial Gravity; Bed Rest; Centrifuging; Deconditioning; Human Body; Urology

20070010664 NASA Johnson Space Center, Houston, TX, USA

Sensitive Quantitative Assessment of Balance Disorders

Paloski, Willilam H.; [2007]; 1 pp.; In English; 78th Annual Scientific Meeting, 13-17 May 2007, New Orleans, LA, USA; No Copyright; Avail.: Other Sources; Abstract Only

Computerized dynamic posturography (CDP) has become a standard technique for objectively quantifying balance control performance, diagnosing the nature of functional impairments underlying balance disorders, and monitoring clinical treatment outcomes. We have long used CDP protocols to assess recovery of sensory-motor function in astronauts following space flight. The most reliable indicators of post-flight crew performance are the sensory organization tests (SOTs), particularly SOTs 5 and 6, which are sensitive to changes in availability and/or utilization of vestibular cues. We have noted, however, that some astronauts exhibiting obvious signs of balance impairment after flight are able to score within clinical norms on these tests, perhaps as a result of adopting competitive strategies or by their natural skills at substituting alternate sensory information sources. This insensitivity of the CDP protocol could underestimate of the degree of impairment and, perhaps, lead to premature release of those crewmembers to normal duties. To improve the sensitivity of the CDP protocol we have introduced static and dynamic head tilt SOT trials into our protocol. The pattern of postflight recovery quantified by the enhanced CDP protocol appears to more aptly track the re-integration of sensory-motor function, with recovery time increasing as the complexity of sensory-motor/biomechanical task increases. The new CDP protocol therefore seems more suitable for monitoring post-flight sensory-motor recovery and for indicating to crewmembers and flight surgeons fitness for return to duty and/or activities of daily living. There may be classes of patients (e.g., athletes, pilots) having motivation and/or performance characteristics similar to astronauts whose sensory-motor treatment outcomes would also be more accurately monitored using the enhanced CDP protocol. Furthermore, the enhanced protocol may be useful in early detection of age-related balance disorders.

Author

Psychomotor Performance; Biodynamics; Sensorimotor Performance; Human Performance; Posture

20070010669 NASA Johnson Space Center, Houston, TX, USA

Chromosome Aberrations in the Progeny of Human Lymphocytes Exposed to Energetic Heavy Ions

George, K.; Durante, M.; Elliott, Todd; Cucinotta, F. A.; [2007]; 1 pp.; In English; International Congress on Radiation Research, 8-12 Jul. 2007, San Francisco, CA, USA; Copyright; Avail.: Other Sources; Abstract Only

Radiation health risks can not be fully assessed and effective countermeasures can not be fully developed until the early events that lead to carcinogenesis and other types of late health effects are more clearly understood. Therefore, we exposed human peripheral blood lymphocytes to either energetic heavy ions or gamma-rays, and analyzed chromosomes in the progeny of these cells using both multi-color fluorescence banding (RxFISH) and multi-color fluorescence in situ hybridization (mFISH) techniques. Results showed that the relative biological effectiveness (RBE) of iron ions (energy 1 GeV/nucleon) for the induction of interchanges is much less for the daughters of irradiated cells than for the population originally exposed. However, the RBE is highly dependent on the chromosome aberration type. Yields of insertions, complex, and simple type chromosome exchanges were compared for each analysis technique. Telomere probe analysis verified that high-energy heavy ions induce true terminal deletions of chromosomes, and that chromosomes missing a telomere can be transmitted through the cell cycle. In addition, samples from three different blood donors were assessed to investigate possible variations in individual radiation sensitivity. High-energy heavy ions generate a substantial health risk for human space exploration, and results of these studies may help in understanding the induction of late effects from this type of radiation exposure.

Author

Chromosome Aberrations; Radiation Effects; Relative Biological Effectiveness (RBE); Radiation Dosage; Lymphocytes; Heavy Ions

20070010670 NASA Johnson Space Center, Houston, TX, USA

Risk Assessment of Radiation Exposure using Molecular Biodosimetry

Elliott, Todd F.; George, K.; Hammond, D. K.; Cucinotta, F. A.; [2007]; 1 pp.; In English; ICRR Annual Meeting, 8-12 Jul. 2007, San Francisco, CA, USA; Copyright; Avail.: Other Sources; Abstract Only

Current cytogenetic biodosimetry methods would be difficult to adapt to spaceflight operations, because they require toxic chemicals and a substantial amount of time to perform. In addition, current biodosimetry techniques are limited to whole body doses over about 10cGy. Development of new techniques that assess radiation exposure response at the molecular level could overcome these limitations and have important implications in the advancement of biodosimetry. Recent technical advances include expression profiling at the transcript and protein level to assess multiple biomarkers of exposure, which may lead to the development of a radiation biomarker panel revealing possible fingerprints of individual radiation sensitivity. So far, many biomarkers of interest have been examined in their response to ionizing radiation, such as cytokines and members of the DNA repair pathway. New technology, such as the Luminex system can analyze many biomarkers simultaneously in one sample.

Author

Radiation Effects; Ionizing Radiation; Assessments; Deoxyribonucleic Acid; Toxicity; Radiation Dosage; Biomarkers

20070011111 Ioannina Univ., Greece

Biological Effects of Electromagnetic Fields

Nov 27, 2006; 1508 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): FA8655-07-1-5026

Report No.(s): AD-A462624; No Copyright; Avail.: CASI: [A99](#), Hardcopy

The Final Proceedings for Biological Effects of Electromagnetic Fields held on 16-20 October 2006.

DTIC

Biological Effects; Electromagnetic Fields; Radiation Effects; Radiation Hazards

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*.

20070009687 Construction Technical Services, Centennial, CO, USA

Evaluation of Products that Protect Concrete and Reinforcing Steel of Bridge Decks from Winter Maintenance Products

Caires, W. S.; Peters, S. R.; Dec. 2006; 91 pp.; In English

Report No.(s): PB2007-104859; No Copyright; Avail.: National Technical Information Service (NTIS)

The Colorado Department of Transportation (CDOT) is faced with a conflicting challenge: (1) provide winter driving safety, which is enhanced by applying effective deicers such as magnesium chloride and (2) provide a durable, cost-effective transportation system, which is adversely affected by these same deicers. While nationwide research is underway on the effects of magnesium chloride, CDOT must continue deicer application, and simultaneously design, build, and maintain durable structures before this research is complete. This study was initiated to develop performance-based testing procedures to aid CDOTs concrete selection and protection process. The study was also to evaluate commercially available products developed to resist deicer deterioration in parking garages, which may extend the service life of concrete bridge decks, and lower their life-cycle costs. Two parameters were tested that are significant to bridge deck and steel deterioration: chloride intrusion (that causes corrosion in the reinforcing steel), and loss of surface abrasion resistance (wear). The results of this study indicate that surface abrasion testing can readily be implemented on both laboratory samples and on field projects, to assess the resistance of various concrete mixtures and coatings to vehicular traffic wear. The rapid chloride permeability test proved valuable to assess the resistance to chloride penetration of these same concrete mixtures and coatings. This test can also be used on laboratory and field-based samples.

NTIS

Concretes; Maintenance; Steels; Transportation; Winter

20070009867 NASA Johnson Space Center, Houston, TX, USA

NASA Space Flight Human System Standards

Tillman, Barry; Pickett, Lynn; Russo, Dane; Stroud, Ken; Connolly, Jan; Foley, Tico; January 28, 2007; 2 pp.; In English; Human Factors and Ergonomics Society 51st Annual Conference, 1-5 Oct. 2007, Santa Monica, CA, USA; Copyright; Avail.: CASI: [A01](#), Hardcopy

NASA has begun a new approach to human factors design standards. For years NASA-STD-3000, Manned Systems Integration Standards, has been a source of human factors design guidance for space systems. In order to better meet the needs of the system developers, NASA is revising its human factors standards system. NASA-STD-3000 will be replaced by two documents: set of broad human systems specifications (including both human factors and medical topics) and a human factors design handbook

Author

Human Factors Engineering; Aerospace Systems; Man Machine Systems

20070009995 NASA Johnson Space Center, Houston, TX, USA

Spacecraft Maximum Allowable Concentrations (SMACs) for C3 to C8 Aliphatic Saturated Aldehydes

Langford, Shannon D.; [2007]; 13 pp.; In English; No Copyright; Avail.: CASI: [A03](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20070009995>

Spacecraft maximum allowable concentrations (SMACs) for C3 to C8, straight-chain, aliphatic aldehydes have been previously assessed and have been documented in volume 4 of Spacecraft Maximum Allowable Concentrations for Selected Airborne Contaminants (James, 2000). These aldehydes as well as associated physical properties are shown in Table 1. The C3 to C8 aliphatic aldehydes can enter the habitable compartments and contaminate breathing air of spacecraft by several routes including incomplete oxidation of alcohols in the Environmental Control and Life Support System (ECLSS) air revitalization subsystem, as a byproduct of human metabolism, through materials off-gassing, or during food preparation. These aldehydes have been detected in the atmosphere of manned space vehicles in the past. Analysis performed by NASA of crew cabin air samples from the Russian Mir Space Station revealed the presence of C3 to C8 aldehydes at concentrations peaking at approximately 0.1 mg/cu m.

Author

Aldehydes; Manned Spacecraft; Environmental Control; Air Purification; Air Sampling; Life Support Systems; Habitability; Contaminants

20070010485 NASA Johnson Space Center, Houston, TX, USA

Exploration Life Support Overview and Benefits

Chambliss, Joe P.; [2007]; 11 pp.; In English; 2007 IEEE Aerospace Conference, 3-10 Mar. 2007, Big Sky, MT, USA; Original contains color illustrations

Contract(s)/Grant(s): WBS 516672.01.04; No Copyright; Avail.: CASI: **A03**, Hardcopy

ONLINE: <http://hdl.handle.net/2060/20070010485>

NASA's Exploration Life Support (ELS) Project is providing technology development to address air, water and waste product handling for future exploration vehicles. Existing life support technology and processes need to improve to enable exploration vehicles to meet mission goals. The weight, volume, power and thermal control required, reliability, crew time and life cycle cost are the primary targets for ELS technology development improvements. An overview of the ELS technologies being developed leads into an evaluation of the benefits the ELS technology developments offer.

Author

Life Cycle Costs; Life Support Systems; Temperature Control

20070010514 Lawrence Livermore National Lab., Livermore, CA USA

Developing Hands-On Ergonomics Lessons for Youth

Bennett, C.; Alexandre, K.; Jacobs, K.; Feb. 22, 2006; 6 pp.; In English

Report No.(s): DE2006-894009; UCRL-CONF-219210; No Copyright; Avail.: Department of Energy Information Bridge

By the time students are ready to enter the workforce they have been exposed to up to 20 years of ergonomics risk factors. As technology evolves, it provides more opportunities for intensive repetitive motion and with computers, cell phones, personal digital assistants (PDAs), and electronic games. The average student engages in fewer active physical activities, sit stationary in mismatched furniture in schools for hours and carry heavy backpacks. While long-term effects remain to be identified, increasingly ergonomists and others concerned with musculoskeletal health and wellness, see a need for early ergonomics education. This interactive session provides a hands-on approach to introducing ergonomics to students. Although different approaches may effectively introduce ergonomics at even early stages of development, this program was designed for youth at the middle to high school age. Attendees will participate in four activities designed to introduce ergonomics at an experiential level. The modules focus on grip strength, effective breathing, optimizing your chair, and backpack safety. The workshop will include presentation and worksheets designed for use by teachers with minimal ergonomics training. Feedback from the participants will be sought for further refining the usability and safety of the training package.

NTIS

Children; Human Factors Engineering; Risk; Youth

20070010925 Naval Postgraduate School, Monterey, CA USA

A Module For Employing Human Systems Integration into the Rapid Equipping Force (REF)

Higgins, Leon A; Mack, Demetrius D; Dec 2006; 179 pp.; In English; Original contains color illustrations

Report No.(s): AD-A462595; No Copyright; Avail.: CASI: **A09**, Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA462595>

The rapidly changing complexity of the Global War on Terrorism has changed the approach to equipping forward deployed military forces. Combatant Commanders conducting operations now require timely materiel solutions to enhance mission capabilities and reduce risk for individual Soldiers. To address this challenge the U.S. Army established the Rapid Equipping Force (REF) to assess emerging requirements, to propose solutions to those requirements, and to implement those solutions in an expedient time frame. Unfortunately, the REF lacks a consistent analytical methodology for developing alternative materiel solutions. To address the need for a Human Systems Integration analysis method, the authors developed an Assessment Based Rapid Acquisition HSI Analysis Tool (ABRAHAM) capable of generating tailored surveys and evaluating these surveys for unacceptable risks to Soldiers. To validate ABRAHAM's concept and content, ABRAHAM was showcased in three Department of Defense settings, the Human Factors Engineering Technical Advisory Group, the REF, and the USA Marine Corps Operational Test and Evaluation Activity. The ABRAHAM appears to fill a gap in the current library of HSI tools. Based on the feedback provided during the product showcases, there is sufficient interest and technological maturity to further develop ABRAHAM to serve both the traditional and rapid acquisition processes.

DTIC

Deployment; Human Factors Engineering; Systems Integration

20070011132 Navy Experimental Diving Unit, Panama City, FL USA

Comprehensive Performance Limits for Divers' Underwater Breathing Gear: Consequences of Adopting Diver-Focused Limits

Warkander, D E; Jan 2007; 32 pp.; In English

Contract(s)/Grant(s): TA05-12

Report No.(s): AD-A462743; NEDU-TR-07-02; No Copyright; Avail.: CASI: [A03](#), Hardcopy

An underwater breathing apparatus (UBA) imposes loads on the diver: anything from the UBA's weight to those imposed on the respiratory muscles, some of the weakest muscles in the body. The types of respiratory loads imposed by a UBA are breathing resistance, elastic loads, hydrostatic imbalance (static lung load), inertial loads and CO₂. Historically, the limits on resistive efforts have been based on the performance on the best commercially available UBAs around 1980. The limits proposed in this report are based on the diver, not the UBA, and they state how much of each respiratory load is acceptable and how the loads interact; the resistive effort (WOB/V sub T) should not exceed $WOB/V \text{ sub } T = 2.49 - 0.016 * \text{depth}$ (with depth in msw) or $WOB/V \text{ sub } T = 2.49 - 0.00485 * \text{depth}$ (with depth in fsw). The elastance should not exceed 0.7 kPa/L independent of depth and ventilation. The maximum tolerable hydrostatic imbalances, measured relative to the suprasternal notch, should be in the range of +0.4 to +2.9 kPa for a vertical diver and in the range of -0.3 to +1.7 kPa for a horizontal diver. Any CO₂ presented to the diver forces an increase respiratory minute ventilation thereby magnifying the effect of the other respiratory loads imposed by the UBA. The dead space in the UBA and the CO₂ in the inspired gas can be major influences in determining whether a UBA is acceptable. During test of CO₂ scrubber endurance, the empirically determined ratio of CO₂ flow to minute ventilation (4%) should be used. Adopting these limits will mean that some rebreathers that had been nominally not acceptable are actually acceptable. The limits make little difference in the acceptability of currently available open circuit UBAs. These physiologically based limits should be adopted for use in the U.S. Navy.

DTIC

Diving (Underwater); Respiration; Underwater Breathing Apparatus

20070011166 Army Research Inst. of Environmental Medicine, Natick, MA USA

Efficiency of Liquid Cooling Garments: Prediction and Manikin Measurement

Xu, Xiaojiang; Endrusick, Thomas; Laprise, Brad; Santee, William; Kolka, Margaret; Jun 2006; 6 pp.; In English

Report No.(s): AD-A462793; M05-52; No Copyright; Avail.: CASI: [A02](#), Hardcopy

We studied the efficiency of liquid cooling garments (LCG) and its relationship to the insulation of outer clothing perfusate inlet temperatures and environmental conditions by both theoretical analysis and thermal manikin (TM) testing.

DTIC

Liquid Cooling; Protective Clothing

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*.

20070009604 Crawford Maunu PLLC, Saint Paul, MN, USA

System and Method for Re-Ordering Memory References for Access to Memory

Dally, W. J.; Rixner, S. W.; 15 May 06; 8 pp.; In English

Contract(s)/Grant(s): DABT63-96-C-0037

Patent Info.: Filed Filed 15 May 06; US-Patent-Appl-SN-11-434-392

Report No.(s): PB2007-101455; No Copyright; Avail.: CASI: [A02](#), Hardcopy

A memory processing approach involves implementation of memory status-driven access. According to an example embodiment, addresses received at an address buffer are processed for access to a memory relative to an active location in the memory. Addresses corresponding to an active location in the memory array are processed prior to addresses that do not correspond to an active location. Data is read from the memory to a read buffer and ordered in a manner commensurate with the order of received addresses at the address buffer (e.g., thus facilitating access to the memory in an order different from that received at the address buffer while maintaining the order from the read buffer).

NTIS

Memory (Computers); Computer Systems Programs

20070009636 General Accounting Office, Washington, DC USA

Electronic Disability Claims Processing: SSA Is Proceeding with Its Accelerated Systems Initiative But Needs to Address Operational Issues

Sep. 2005; 46 pp.; In English

Report No.(s): PB2007-105663; GAO-05-97; No Copyright; Avail.: CASI: [A03](#), Hardcopy

Through an initiative known as AeDib, the Social Security Administration (SSA) is implementing a system in which medical images and other documents that have traditionally been kept in paper folders will be stored in electronic folders, enabling disability offices including SSAs 144 Office of Hearings and Appeals sites and 54 state disability determination services, to process disability claims electronically. This initiative supports a program that, in 2004, made payments of approximately \$113 billion to more than 14 million beneficiaries and their families. In March 2004, GAO recommended that SSA take steps to ensure the successful implementation of the electronic disability system. GAO was asked to assess SSAs status in implementing AeDib and the actions the agency has taken in response to GAOs prior recommendations on this initiative.

NTIS

Claiming; Disabilities; Security

20070009647 Scully Scott Murphy and Presser, PC, Garden City, NJ, USA

System and Method Using Blind Change Detection for Audio Segmentation

Chaudhari, U. V.; Kamal, M.; Ramaswamy, G. N.; 18 Aug 05; 11 pp.; In English

Contract(s)/Grant(s): H98230-04-3-0001

Patent Info.: Filed Filed 18 Aug 05; US-Patent-Appl-SN-11-206-621

Report No.(s): PB2007-101412; No Copyright; Avail.: CASI: [A03](#), Hardcopy

A system, method and computer program product for performing blind change detection audio segmentation that combines hypothesized boundaries from several segmentation algorithms to achieve the final segmentation of the audio stream. Automatic segmentation of the audio streams according to the system and method of the invention may be used for many applications like speech recognition, speaker recognition, audio data mining, online audio indexing, and information retrieval systems, where the actual boundaries of the audio segments are required.

NTIS

Change Detection; Segments; Audio Data

20070009663 Geer, Burns and Crain, Chicago, IL, USA

Methods for Efficient Solution Set Optimization

Golberg, D. E.; Sastry, K.; Pelikan, M.; 30 Jan 06; 27 pp.; In English

Contract(s)/Grant(s): AFOSR-F49620-03-1-0129; DMR-99-76550

Patent Info.: Filed Filed 30 Jan 06; US-Patent-Appl-SN-11-343-195

Report No.(s): PB2007-101410; No Copyright; Avail.: CASI: [A03](#), Hardcopy

A method for optimizing a solution set comprises the steps of generating an initial solution set, identifying a desirable portion of the initial solution set using a fitness calculator, using the desirable portion to create a surrogate fitness model that is computationally less expensive than the fitness calculator, generating new solutions, replacing at least a portion of the initial solution set with the new solutions to create a second solution set, and evaluating at least a portion of the second solution set with the fitness surrogate model to identify a second desirable portion.

NTIS

Optimization; Set Theory

20070009703 Honeywell International, Inc., Morristown, NJ, USA

Architectures for CPP Ring Shaped (RS) Devices

Katti, R. R.; 23 Mar 05; 24 pp.; In English

Contract(s)/Grant(s): DTRA01-00-C-0002

Patent Info.: Filed Filed 23 Mar 05; US-Patent-Appl-SN-11-087-414

Report No.(s): PB2007-101453; No Copyright; Avail.: CASI: [A03](#), Hardcopy

A current-perpendicular-to-plane (CPP) ring-shaped (RS) magnetoresistive random access memory (MRAM) element is provided in several embodiments including operational functionality of static read (SR) and dynamic read (DR). According to an embodiment, a memory element has one or more vias passing through a center hole in the CPP RS MRAM element.

Each end of each via is coupled with a separate write line segment that extends radially from the center hole past a perimeter of the ring-shaped element. The write lines and vias are configured to generate magnetic fields for switching a magnetization direction of one or more layers of the ring-shaped bits in the array.

NTIS

Random Access Memory; Mechanical Devices; Architecture (Computers)

20070009733 California Univ., Oakland, CA, USA

System and Method of Context-Specific Searching in an Electronic Database

Dawson, K.; 30 Jan 04; 22 pp.; In English

Patent Info.: Filed Filed 30 Jan 04; US-Patent-Appl-SN-10-768 034

Report No.(s): PB2007-102826; No Copyright; Avail.: CASI: [A03](#), Hardcopy

A user can search a database within a 'context' that can be invoked with a context term, or name. The context is pre-defined by a human expert, or curator. The context definition is used in conjunction with a search term provided by the user to efficiently obtain search results that can otherwise be difficult to attain, such as detecting characteristics of data over multiple documents or other database items to infer trends, phenomena, characteristics, or other properties of the data. A context can be a category of items where each item has a distinct name. Search results are presented using the context based on the number of co-occurrences of the search term and terms relating to the context. In a preferred embodiment, the search results are presented as a list with documents having higher co-occurrences ordered at the top of the list. Context definition sets can be created and updated as an ongoing service to a subscriber. Several processing configurations are presented. A user can search a database within a 'context' that can be invoked with a context term, or name. The context is pre-defined by a human expert, or curator. The context definition is used in conjunction with a search term provided by the user to efficiently obtain search results that can otherwise be difficult to attain, such as detecting characteristics of data over multiple documents or other database items to infer trends, phenomena, characteristics, or other properties of the data. A context can be a category of items where each item has a distinct name. Search results are presented using the context based on the number of co-occurrences of the search term and terms relating to the context. In a preferred embodiment, the search results are presented as a list with documents having higher co-occurrences ordered at the top of the list. Context definition sets can be created and updated as an ongoing service to a subscriber. Several processing configurations are presented.

NTIS

Context; Data Bases; Search Profiles

20070009747 California Univ., Oakland, CA, USA

System and Method of Context-Specific Searching in an Electronic Database

Dawson, K.; 16 Jan 04; 22 pp.; In English

Patent Info.: Filed Filed 16 Jan 04; US-Patent-Appl-SN-10-759 784

Report No.(s): PB2007-102825; No Copyright; Avail.: CASI: [A03](#), Hardcopy

A user can search a database within a 'context' that can be invoked with a context term, or name. The context is pre-defined by a human expert, or curator. The context definition is used in conjunction with a search term provided by the user to efficiently obtain search results that can otherwise be difficult to attain, such as detecting characteristics of data over multiple documents or other database items to infer trends, phenomena, characteristics, or other properties of the data. A context can be a category of items where each item has a distinct name. Search results are presented using the context based on the number of co-occurrences of the search term and terms relating to the context. In a preferred embodiment, the search results are presented as a list with documents having higher co-occurrences ordered at the top of the list. Context definition sets can be created and updated as an ongoing service to a subscriber. Several processing configurations are presented.

NTIS

Context; Data Bases; Search Profiles

20070010012 Lawrence Livermore National Lab., Livermore, CA USA

Paravirtualization for HPC Systems

Youseff, L.; Wolski, R.; Gorda, B.; Krintz, C.; Oct. 17, 2006; 15 pp.; In English

Report No.(s): DE2006-894791; UCRL-TR-225347; No Copyright; Avail.: National Technical Information Service (NTIS)

Virtualization has become increasingly popular for enabling full system isolation, load balancing, and hardware multiplexing. This wide-spread use is the result of novel techniques such as paravirtualization that make virtualization systems practical and efficient. Paravirtualizing systems export an interface that is slightly different from the underlying hardware but

that significantly streamlines and simplifies the virtualization process. In this work, we investigate the efficacy of using paravirtualizing software for performance-critical HPC kernels and applications. Such systems are not currently employed in HPC environments due to their perceived overhead. However, virtualization systems offer tremendous potential for benefiting HPC systems by facilitating application isolation, portability, operating system customization, and program migration. We present a comprehensive performance evaluation of Xen, a low-overhead, Linux-based, virtual machine monitor (VMM), for paravirtualization of HPC cluster systems at Lawrence Livermore National Lab (LLNL). We consider four categories of micro-benchmarks from the HPC Challenge (HPCC) and LLNL ASCI Purple suites to evaluate a wide range of subsystem-specific behaviors.

NTIS

Distributed Processing; Virtual Properties

20070010495 Stanford Univ., CA, USA, Pacific Northwest National Lab., Richland, WA, USA, Battelle Pacific Northwest Labs., Richland, WA, USA

End-User Evaluations of Semantic Web Technologies

McCool, R.; Cowell, A. J.; Thurman, D. A.; January 2006; 7 pp.; In English

Report No.(s): DE2006-894883; No Copyright; Avail.: Department of Energy Information Bridge

Stanford University's Knowledge Systems Laboratory (KSL) is working in partnership with Battelle Memorial Institute and IBM Watson Research Center to develop a suite of technologies for information extraction, knowledge representation & reasoning, and human-information interaction, in unison entitled 'Knowledge Associates for Novel Intelligence' (KANI). We have developed an integrated analytic environment composed of a collection of analyst associates, software components that aid the user at different stages of the information analysis process. An important part of our participatory design process has been to ensure our technologies and designs are tightly integrate with the needs and requirements of our end users, To this end, we perform a sequence of evaluations towards the end of the development process that ensure the technologies are both functional and usable. This paper reports on that process.

NTIS

Information Systems; Semantics

20070010503 Lawrence Livermore National Lab., Livermore, CA USA

Filtering Algebraic Multigrid and Adaptive Strategies

Nagel, A.; Falgout, R. D.; Wittum, G.; Feb. 08, 2006; 10 pp.; In English

Report No.(s): DE2006-893975; UCRL-PROC-218762; No Copyright; Avail.: Department of Energy Information Bridge

Solving linear systems arising from systems of partial differential equations, multigrid and multilevel methods have proven optimal complexity and efficiency properties. Due to shortcomings of geometric approaches, algebraic multigrid methods have been developed. One example is the filtering algebraic multigrid method introduced by C. Wagner. This paper proposes a variant of Wagner's method with substantially improved robustness properties. The method is used in an adaptive, self-correcting framework and tested numerically.

NTIS

Algebra; Linear Systems; Partial Differential Equations

20070010504 Lawrence Livermore National Lab., Livermore, CA USA

GPU Accelerated Smith-Waterman

Liu, Y.; Huang, W.; Johnson, J.; Vaidya, S.; Feb. 09, 2006; 10 pp.; In English

Report No.(s): DE2006-893978; UCRL-CONF-218814; No Copyright; Avail.: National Technical Information Service (NTIS)

We present a novel hardware implementation of the double affine Smith-Waterman (DASW) algorithm, which uses dynamic programming to compare and align genomic sequences such as DNA and proteins. We implement DASW on a commodity graphics card, taking advantage of the general purpose programmability of the graphics processing unit to leverage its cheap parallel processing power. The results demonstrate that our system's performance is competitive with current optimized software packages.

NTIS

Algorithms; Cards; Commodities; Dynamic Programming; Genome; Sequencing

20070010522 Fish and Richarson P.C., Minneapolis, MN, USA

Computation of Intrinsic Perceptual Saliency in Visual Environments and Applications

Koch, C.; Itti, L.; 8 May 06; 19 pp.; In English

Contract(s)/Grant(s): NSF-EEC-9402-726; ONR-N00014-95-1-0600

Patent Info.: Filed Filed 8 May 06; US-Patent-Appl-SN-11-430-684

Report No.(s): PB2007-101461; No Copyright; Avail.: CASI: [A03](#), Hardcopy

Detection of image saliency in a visual display of an image. The image is analyzed at multiple spatial scales and over multiple feature channels to determine the likely saliency of different portions of the image. One application for the system is in an advertising context. The detection may be improved by second order statistics, e.g. mean and the standard deviations of different image portions relative to other portions. Different edges may be considered as being extended edges by looking at the edges over multiple spatial scales. One set of feature channels can be optimized for use in moving images, and can detect motion or flicker. The images can be obtained over multiple spectral ranges the user can be instructed about how to maximize the saliency. This can be applied to automatically evaluate and optimize sales or advertisement displays.

NTIS

Detection; Display Devices; Perception

20070010552 Lawrence Livermore National Lab., Livermore, CA USA

Streaming Compression of Tetrahedral Volume Meshes

Isenburg, M.; Linstrom, P.; Gumhold, S.; Shewchuk, J.; Nov. 22, 2006; 9 pp.; In English

Report No.(s): DE2006-894785; UCRL-CONF-217274; No Copyright; Avail.: National Technical Information Service (NTIS)

Geometry processing algorithms have traditionally assumed that the input data is entirely in main memory and available for random access. This assumption does not scale to large data sets, as exhausting the physical memory typically leads to IO-inefficient thrashing. Recent works advocate processing geometry in a 'streaming' manner, where computation and output begin as soon as possible. Streaming is suitable for tasks that require only local neighbor information and batch process an entire data set. We describe a streaming compression scheme for tetrahedral volume meshes that encodes vertices and tetrahedra in the order they are written. To keep the memory footprint low, the compressor is informed when vertices are referenced for the last time (i.e. are finalized). The compression achieved depends on how coherent the input order is and how many tetrahedra are buffered for local reordering. For reasonably coherent orderings and a buffer of 10,000 tetrahedra, we achieve compression rates that are only 25 to 40 percent above the state-of-the-art, while requiring drastically less memory resources and less than half the processing time.

NTIS

Grid Generation (Mathematics); Tetrahedrons

20070010606 Sandia National Labs., Albuquerque, NM USA

Design of Reversible QDCA Systems

Frost-Murphy, S. E.; Ottavi, M.; Frank, M. P.; DeBenadictis, E. P.; Oct. 2006; 108 pp.; In English

Report No.(s): DE2006-895074; SAND-2006-5990; No Copyright; Avail.: National Technical Information Service (NTIS)

This work is the first to describe how to go about designing a reversible QDCA system. The design space is substantial, and there are many questions that a designer needs to answer before beginning to design. This document begins to explicate the tradeoffs and assumptions that need to be made and offers a range of approaches as starting points and examples. This design guide is an effective tool for aiding designers in creating the best quality QDCA implementation for a system.

NTIS

Automata Theory; Quantum Dots

20070010613 Choate, Hall and Stewart, Boston, MA, USA

Network Security Planning Architecture

Lipmann, R.; Scott, C.; Kratkiewicz, K.; Artz, M.; Ingols, K. W.; 11 Dec 03; 73 pp.; In English

Contract(s)/Grant(s): F1962-00-C-0002

Patent Info.: Filed Filed 11 Dec 03; US-Patent-Appl-SN-10-734 083

Report No.(s): PB2007-103152; No Copyright; Avail.: CASI: [A04](#), Hardcopy

Described are techniques used for assessing the security of a network. Pruned attack trees are generated using a forward chaining, breadth-first technique representing the attack paths of a possible attacker in the network. A vulnerability score is

determined for each network and attacker starting point using attack loss values assigned to each host and information extracted from the attack tree(s) concerning compromised hosts. Different hypothetical alternatives may be evaluated to improve security of the network and each alternative may be evaluated by recomputing the network vulnerability score and comparing the recomputed score to the original network vulnerability score. Also disclosed is a method for determining end-to-end connectivity of a network. The resulting end-to-end connectivity information is used in generating the pruned attack tree.

NTIS

Computer Networks; Patent Applications; Security

20070010618 Dilworth, Barrese, LLP, Uniondale, NY, USA, Maryland Univ., College Park, MD, USA

Method for Performing Handoff in Wireless Network

Lee, I. S.; Jang, K. H.; Shin, M. H.; Arbaugh, W. A.; Mishra, A.; 3 Dec 04; 12 pp.; In English

Contract(s)/Grant(s): 60NANBID0113

Patent Info.: Filed Filed 3 Dec 04; US-Patent-Appl-SN-11-003 211

Report No.(s): PB2007-103160; No Copyright; Avail.: CASI: [A03](#), Hardcopy

A method for minimizing handoff latencies when a handoff is performed in a wireless network. An access point (AP) or base station associated to a current wireless station (STA) allows information required for a reassociation to the STA to be propagated to handoff-capable neighboring APs or base stations. When the STA moves, a neighboring AP or base station performs the reassociation to the STA on the basis of context. When a handoff procedure is performed, the time taken to receive context of a corresponding STA is reduced, such that a fast handoff can be implemented.

NTIS

Patent Applications; Telecommunication; Wireless Communication

20070010634 Virginia Univ., Charlottesville, VA, USA

Incremental Process System and Computer Useable Medium for Extracting Logical Implications from Relational Data Based on Generators and Faces of Closed Sets

Pfaltz, J. L.; Taylor, C. M.; Jamison, R. E.; 19 Mar 03; 25 pp.; In English

Contract(s)/Grant(s): DEFG02-95ER25254

Patent Info.: Filed Filed 19 Mar 03; US-Patent-Appl-SN-10-508-278

Report No.(s): PB2007-101589; No Copyright; Avail.: CASI: [A03](#), Hardcopy

A method, system, and computer useable medium for exploring logical implications of attributes of interest based on a relational data set, R, is described. The related method, system and computer medium comprises receiving attributes and observations (12, 14, 16, 18, 20, 22, 24, 26, 28) which form the relational data set, R, creating a database correlating the attributes and observations (12, 14, 16, 18, 20, 22, 24, 26, 28), forming a lattice structure (10) from the data in the database, identifying closed sets of attributes within the lattice structure and identifying attributes that are minimal generators (30, 32, 34, 36) of the relational data.

NTIS

Computers; Relational Data Bases; Data Processing; Computer Systems Programs; Logic Programming

20070010686 Alabama Univ., Tuscaloosa, AL, USA, University Transportation Center for Alabama, Tuscaloosa, AL, USA

Transportation Networks: Data, Analysis, Methodology Development and Visualization

Hale, D. P.; Sharpe, S.; Dec. 29, 2006; 60 pp.; In English

Report No.(s): PB2007-105589; No Copyright; Avail.: CASI: [A04](#), Hardcopy

This project provides data compilation, analysis methodology and visualization methodology for the current network data assets of the Alabama Department of Transportation (ALDOT). This study finds that ALDOT is faced with a considerable number of challenges in meeting the growing demand for transportation. This project also provides a technology-enabled tool for asset management, to help define issues, and to help managers make data-driven, model-based decisions about work issues and allocation of resources.

NTIS

Network Analysis; Transportation; Transportation Networks

20070010688 Lawrence Livermore National Lab., Livermore, CA USA

Extending the Applicability of Multigrid Methods

Brannick, J.; Brezina, M.; Falgout, R.; Manteuffel, T.; McCormick, S.; Sep. 27, 2006; 12 pp.; In English
Report No.(s): DE2006-894354; UCRL-PROC-224817; No Copyright; Avail.: National Technical Information Service (NTIS)

Multigrid methods are ideal for solving the increasingly large-scale problems that arise in numerical simulations of physical phenomena because of their potential for computational costs and memory requirements that scale linearly with the degrees of freedom. Unfortunately, they have been historically limited by their applicability to elliptic-type problems and the need for special handling in their implementation. In this paper, we present an overview of several recent theoretical and algorithmic advances made by the TOPS multigrid partners and their collaborators in extending applicability of multigrid methods. Specific examples that are presented include quantum chromodynamics, radiation transport, and electromagnetics.

NTIS

Multigrid Methods; Numerical Analysis

60

COMPUTER OPERATIONS AND HARDWARE

Includes hardware for computer graphics, firmware and data processing. For components see *33 Electronics and Electrical Engineering*. For computer vision see *63 Cybernetics, Artificial Intelligence and Robotics*.

20070009690 Army Tank-Automotive and Armaments Command, Warren, MI USA

A Composite Linear and Nonlinear Approach to Full-Vehicle Simulator Control

Brudnak, Mark J; Jan 10, 2005; 13 pp.; In English; Original contains color illustrations
Report No.(s): AD-A461092; TACOM-TR-14118; No Copyright; Avail.: CASI: **A03**, Hardcopy

This paper presents an approach to full-vehicle simulator control which accounts for nonlinearities in a vehicle/simulator system. The control scheme presented is based on the estimation of the system inverse dynamics. A composite linear/nonlinear approach to inverse system identification (SYS-ID) is presented. The linear portion of the SYS-ID uses time-domain methods to estimate the impulse response of the inverse system in a least squares sense. These results are then extended by using the regularized approach to least squares estimation. The nonlinear part uses the support vector machine to approximate the nonlinear deviations from the linear model. Two approaches to using this composite model are presented. Examples of the linear SYS-ID techniques are shown for a 2x2 system.

DTIC

Control Simulation; Nonlinearity; Simulators

20070010798 Massachusetts Inst. of Tech., Cambridge, MA USA

Architectures and Applications for Scalable Quantum Information Systems

Chuang, Isaac; Jan 2007; 117 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): FA8750-01-2-0521; DARPA ORDER-L484; Proj-L484
Report No.(s): AD-A462331; No Copyright; Avail.: CASI: **A06**, Hardcopy
ONLINE: <http://hdl.handle.net/100.2/ADA462331>

The goal of this project was to understand what key interchangeable elements form a scalable, fault-tolerant quantum information systems architecture. The effort was a collaboration between computer science and physical sciences involving four groups: MIT, providing experimental quantum technology parameters and fundamental expertise in quantum information theory; UC Davis, devising fault-tolerant architecture designs and implementing numerical simulations; UC Berkeley, creating quantum cryptosystems and providing distributed applications; and U Washington, focusing on languages for quantum computation and an architectural simulator. Accomplishments of project include: design of several complete quantum architectures for large-scale, reliable quantum computers; implementation of a predictive design-tool to analyze system reliability given technology parameters and constraints; evaluation of requirements and performance of Shor's factoring algorithm on a complete benchmark quantum architecture design; and design of experimental realizations of experiments to identify crucial parameters for fault-tolerant quantum architectures.

DTIC

Architecture (Computers); Computers; Information Systems; Quantum Computation; Quantum Theory

20070010892 Link Simulation and Training, Mesz, AZ USA

Graphical User Interfaces for Digital-Image Frequency Analysis

Tai, Chi-Feng; Gaska, James P; Geri, George A; Dec 2006; 12 pp.; In English

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

Report No.(s): AD-A462496; No Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA462496>

Frequency analysis plays an important role in the area of visual research. The application described in this technical memorandum provides a graphical user interface that simplifies loading, analyzing, and storing the results of common frequency analysis tasks. The application allows the user to load image files and compute: a 2-D discrete Fourier transform (DFT) of the image, a polar transform (orientation and radial spatial frequency) of the DFT, or a 1-D modulation versus spatial frequency plot produced by averaging over specified orientations of the polar transform. The outlined analysis can also be performed on a subsection of the input image. The subsection of the input image can also be multiplied by a Gaussian window to reduce edge effects.

DTIC

Digital Systems; Frequencies; Graphical User Interface; Image Analysis; Images

20070011125 Naval Postgraduate School, Monterey, CA USA

A Performance Analysis of BGP MPLS VPN Failover Functionality

Tan, Guan C; Dec 2006; 111 pp.; In English; Original contains color illustrations

Report No.(s): AD-A462732; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Future military systems, many of which have unique timing requirements, will rely on the Global Information Grid (GIG) as the core data communication infrastructure. The GIG currently uses the Border Gateway Protocol (BGP)/Multi-Protocol Label Switching (MPLS) Virtual Private Network (VPN) technology to provide secure and robust IP-level connectivity. This technology supports the provisioning of IP connectivity by a service provider to multiple customers over a common physical IP backbone while allowing complete logical separation of customer traffic and routing information. This research focuses on evaluating and validating the performance characteristic of BGP/MPLS VPN to determine if the use of this technology can provide the necessary performance guarantees required by military applications. A set of experiments have been performed to identify the key factors that affect the time delay of a network failure and recovery. The results show that reducing the ISIS SPF interval and Hello interval could shorten the failover latency while decreasing the ISIS SPF interval and TDP Hello interval could reduce the restoration delay, hence improving the BGP/MPLS VPN failover functionality.

DTIC

Communication Networks; Military Technology; Protocol (Computers); Reliability Analysis

20070011140 Naval Research Lab., Washington, DC USA

Hardware Requirements for Secure Computer Systems: A Framework

Landwehr, Carl E; Carroll, John M; Apr 26, 1984; 11 pp.; In English

Report No.(s): AD-A462751; No Copyright; Avail.: CASI: A03, Hardcopy

This report develops a new set of criteria for evaluating computer architectures that are to support systems with security requirements. Central to these criteria is the concept of a domain, here interpreted as a set of information and authorizations for the manipulation of that information in a computer system. Architectural requirements are grouped in three categories: logical structure, the processing of logical structures, and physical structure. These criteria were developed in order to assess the utility of Navy standard computers as bases for secure embedded systems, but they are not specific to those computers.

DTIC

Architecture (Computers); Computer Information Security

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.

20070009654 Yale Univ., New Haven, CT USA

Computation in Networks of Passively Mobile Finite-State Sensors

Angluin, Dana; Aspnes, James; Diamadi, Zoe; Fischer, Michael J; Peralta, Rene; Feb 23, 2004; 13 pp.; In English

Contract(s)/Grant(s): CCR-9820888; CCR-0098078

Report No.(s): AD-A461359; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA461359>

Suppose we have equipped each bird in a particular flock with a sensor that can determine whether the bird's temperature is elevated or not, and we wish to know whether at least 5 birds in the flock have elevated temperatures. We assume that the sensors are quite limited: each sensor has a constant number of bits of memory and can respond to a global start signal, and two sensors can communicate only when they are sufficiently close to each other. In this scenario, the sensors are mobile, but have no control over how they move, that is, they are passively mobile. Initially, we assume that the underlying pattern of movement guarantees a fairness condition on the interactions: every pair of birds in the flock repeatedly come sufficiently close to each other for their sensors to communicate. Under these assumptions, there is a simple protocol ensuring that every sensor eventually contains the correct answer. At the global start signal, each sensor makes a measurement, resulting in a 1 (elevated temperature) or 0 (not elevated temperature) in a counter that can hold values from 0 to 4. When two sensors communicate, one of them sets its counter to the sum of the two counters, and the other one sets its counter to 0. If two counters ever sum to at least 5, the sensors go into a special alert state, which is then copied by every sensor that encounters it. The output of a sensor is 0 if it is not in the alert state, and 1 if it is in the alert state. If we wait a sufficient interval after we issue the global reset, we can retrieve the correct answer from any of the sensors. Now consider the question of whether at least 5% of the birds in the flock have elevated temperatures. Is there a protocol to answer this question in the same sense, without assumptions about the size of the flock? In Section 3 we show that such a protocol exists.

DTIC

Computer Networks; Finite Difference Theory; Maintainability

20070009660 Air Force Research Lab., Wright-Patterson AFB, OH USA

Affordable C2 Hardware and Software

Pitars, Marc J; Peterson, Gregory D; Jan 1999; 7 pp.; In English; Original contains color illustrations

Report No.(s): AD-A461406; No Copyright; Avail.: CASI: A02, Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA461406>

Joint Vision 2010 describes an approach about joint warfare of the future, and it depends on and highlights the contributions of air power. Accordingly, the Air Force's vision of Global Engagement flows from Joint Vision 2010. The Air Force's Strategic Plan outlines the core competencies that are necessary for Global Engagement. The capability for attaining the desired capabilities and goals of these visions depends on an adaptive, unified, dynamic aerospace C2 system. The unified C2 system will provide for the capability to dynamically assess, plan, execute, and project aerospace power in a joint environment. However, this capability must overcome the challenges of complexity and ultimately affordability, if it is to become a real system. In addition, future dynamic C2 systems must be integrated into a system of systems to be effective. This paper discusses development approaches and technologies that offer significant savings in overcoming the complexities of fielding a unified C2 system. Specifically, this paper covers how existing aerospace platforms can affordably insert the technology necessary to operate with the future dynamic C2 systems. Furthermore, the paper discusses how C2 systems can benefit from the use of system level design representations and modeling.

DTIC

Command and Control; Computer Programs; Computers; Military Operations

20070009684 Naval Academy, Annapolis, MD USA

Software Fault Tree Key Node Metric Test Cases

Needham, D M; Jones, S A; Apr 25, 2006; 12 pp.; In English; Original contains color illustrations

Report No.(s): AD-A460760; USNA-CS-TR-2006-01; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This report contains 70 sets of software fault trees used to test a software fault tree key node safety metric. Each page represents a set of trees with an identical root node hazard. To the left of the initial tree on each page are the negatively

mutated trees. To the right are the positively mutated trees. Under each tree is the value produced by the metric equation, (S), when run on the tree.

DTIC

Computer Programs; Fault Trees; Safety

20070009766 University of Southern California, Marina del Rey, CA USA

Supporting Plan Authoring and Analysis

Kim, Jihie; Blythe, Jim; Jan 2003; 9 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): N66001-00-C-8018

Report No.(s): AD-A462214; No Copyright; Avail.: CASI: [A02](#), Hardcopy

Interactive tools to help users author plans or processes are essential in a variety of domains. KANAL helps users author sound plans by simulating them, checking for a variety of errors and presenting the results in an accessible format that allows the user to see an overview of the plan steps or timelines of objects in the plan. From our experience in two domains, users tend to interleave plan authoring and plan checking while extending background knowledge of actions. This has led us to refine KANAL to provide a high-level overview of plans and integrate a tool for refining the background knowledge about actions used to check plans. We report on these lessons learned and new directions in KANAL.

DTIC

Graphical User Interface; Computerized Simulation

20070009780 Army Tank-Automotive and Armaments Command, Warren, MI USA

Prognostics Models of Combat vehicles Software

Bankowski, Elena; Masrur, Abul; Apr 4, 2005; 8 pp.; In English

Report No.(s): AD-A461393; No Copyright; Avail.: CASI: [A02](#), Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA461393>

The Next Generation Software and Survivability Technology areas of TARDEC RDECOM proposed the Dependable Automated Reconfigurable Technology (DART). The DART's 'Health & Situation Control' will test the processing elements with Probe/Agent technology for software checking. Algorithms within the Health & Situation Control will assess the health of the processors and recommend element hand-off based on a Criticality Scoring System' in conjunction with the Statistical Usage Test (SUT) model. The DART technology represents the next generation of software systems for ground combat vehicles. DART will enhance the performance of a weapon system by providing on-the-fly reconfiguration to accommodate the loss or malfunction of processing elements or to optimize onboard computational capability. Off-vehicle probes will be launched to assess the health of companion vehicles within the Operations Unit. The SUT will be used to evaluate software reliability. The SUT combined with a test environment that includes test benches, simulators and automated testing will provide the ability to arrive at a statistically valid measure of the reliability of the software. The SUT methodology will enhance software development and test processes. The end result will be the increased reliability of fielded software intensive systems.

DTIC

Combat; Software Engineering; Software Reliability; Weapon Systems

20070009801 North Carolina State Univ., Raleigh, NC USA

Planning and User Interface Affordances

St Amant, Robert; Jan 1999; 9 pp.; In English

Contract(s)/Grant(s): F30602-91-1-0289

Report No.(s): AD-A461526; No Copyright; Avail.: CASI: [A02](#), Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA461526>

This paper takes a first step toward formalizing the concept of affordance in user interfaces. Using a simple example of an AI planning domain, we show how different types of affordance can be described in terms of the costs associated with plan execution. We identify a number of similarities between executing plans and interacting with a graphical user interface, and argue that affordances for planning environments apply equally well to user interface environments. We support our argument with examples of common user interface mechanisms, described in affordance terms.

DTIC

Graphical User Interface; Analogies

20070009807 University of Southern California, Marina del Rey, CA USA

Everything in Perspective

Muller, Tijmen J; Jan 14, 2004; 36 pp.; In English

Contract(s)/Grant(s): DAAD19-99-D-0046

Report No.(s): AD-A461215; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA461215>

The virtual world of the Mission Rehearsal Exercise project is three dimensional, but the scenery is projected on a 2D screen. As the user moves around in the virtual theatre, the view on the scenery should change accordingly. The goal of this assignment is to gather experience on camera movement to make the projection on the screen realistic.

DTIC

Cameras; Display Devices

20070009809 Carnegie-Mellon Univ., Pittsburgh, PA USA

Building VoiceXML-Based Applications

Bennett, Christina; Font Llitjos, Ariadna; Shriver, Stefanie; Rudnick, Alexander; Black, Alan W; Jan 2002; 5 pp.; In English

Contract(s)/Grant(s): N66001-99-1-8905

Report No.(s): AD-A461246; No Copyright; Avail.: CASI: A01, Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA461246>

The Language Technologies Institute (LTI) at Carnegie Mellon University has, for the past several years, conducted a lab course in building spoken-language dialog systems. In the most recent versions of the course, we have used (commercial) web-based development environments to build systems. This paper describes our experiences and discusses the characteristics of applications that are developed within this framework.

DTIC

Voice Communication; Commerce; Speech

20070009864 Carnegie-Mellon Univ., Pittsburgh, PA USA

Using Speculative Execution to Automatically Hide I/O Latency

Chang, Fay W; Dec 7, 2001; 188 pp.; In English

Contract(s)/Grant(s): N000174-96-C-0002; DARPA ORDER-D306

Report No.(s): AD-A461088; CMU-CS-01-172; No Copyright; Avail.: CASI: A09, Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA461088>

The gap between processing speeds and disk access times is widening. This trend is causing applications that must fetch data from disk to spend an increasing proportion of their execution times stalled on disk I/O. I/O prefetching, a well-known technique for hiding disk latency, has the potential to alleviate this problem, particularly when the data that needs to be fetched is distributed across multiple disks. A major hurdle to benefiting from this technique in practice is the difficulty of generating accurate and timely prefetches. In this dissertation, I put forth a new approach to generating accurate and timely prefetches without programmer involvement. The key to the proposed approach is its unique method for predicting what data an executing process will access in the future. The approach involves adding an execution of each target process's code that exploits spare processing cycles. These added executions skip some operations, like accesses to uncached data, so that they can run ahead of their target normal executions. This permits differences between the data values used during the added speculative executions and their target normal executions. Despite any such differences, the approach predicts that the data accesses encountered during speculative executions will often be the same as the data accesses that will be encountered during their target normal executions such that, by initiating prefetching of that data, speculative executions could reduce the I/O stall time of their target normal executions. To investigate the viability of this approach, I developed and evaluated SpecHint, a design and implementation for applying the approach automatically. SpecHint is based on binary modification and requires no operating system support specific to this approach. I evaluated SpecHint using six benchmarks from the TIP benchmark suite.

DTIC

Data Management; Input/Output Routines

20070009870 Carnegie-Mellon Univ., Pittsburgh, PA USA

Scenario Graphs and Attack Graphs

Sheyner, Oleg M; Apr 14, 2004; 142 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAAD19-01-1-0485; F30602-00-2-0523

Report No.(s): AD-A461100; CMU-CS-04-122; No Copyright; Avail.: CASI: [A07](#), Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA461100>

For the past twenty years, model checking has been used successfully in many engineering projects. Model checkers assist the engineer in identifying automatically individual design flaws in a system. A typical model checker takes as input a model of the system and a correctness specification. It checks the model against the specification for erroneous behavior. If erroneous behavior exists, the model checker produces an example that helps the user understand and address the problem. Once the problem is fixed, the user can repeat the process until the model satisfies the specification perfectly. In some situations the process of repeatedly checking for and fixing individual flaws does not work well. Sometimes it is not feasible to eliminate every undesirable behavior. For instance, network security cannot in practice be made perfect due to a combination of factors: software complexity, desire to keep up with the latest features, expense of fixing known system vulnerabilities, etc. Despite these difficulties, network system administrators would invest the time and resources necessary to find and prevent the most destructive intrusion scenarios. However, the find problem- fix problem-repeat engineering paradigm inherent in traditional uses of model checkers does not make it easy to prioritize the problems and focus the limited available resources on the most pressing tasks.

DTIC

Graphs (Charts); Identifying

20070009885 Michigan Univ., Ann Arbor, MI USA

The MIRV SimpleScalar/PISA Compiler

Postiff, Matthew; Greene, David; Lefurgy, Charles; Helder, Dave; Mudge, Trevor; Mar 29, 2000; 24 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DABT63-97-C-0047

Report No.(s): AD-A462001; UM-CSE-TR-421-00; No Copyright; Avail.: CASI: [A03](#), Hardcopy

We introduce a new experimental C compiler in this report. The compiler, called MIRV, is designed to enable research that explores the interaction between the compiler and microarchitecture. This introductory paper makes comparisons between MIRV and GCC. We notice trends between the compilers and optimization levels across SPECint1995 and SPEC2000. Finally, we provide a set of SimpleScalar/PISA binaries to the research community. As we improve the compiler, we encourage architecture researchers to use these optimized binaries as reference programs for architecture research.

DTIC

Compilers; Architecture (Computers); Optimization

20070009923 SRI International Corp., Menlo Park, CA USA

The Relax Image Relaxation System: Description and Evaluation

Laws, Kenneth I; Smith, Grahame B; Smith, Russell C; Pallas, Joseph A; Aug 1983; 59 pp.; In English

Contract(s)/Grant(s): MDA903-79-C-0588

Report No.(s): AD-A461067; SRI-1009; SRI-TN-301; No Copyright; Avail.: CASI: [A04](#), Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA461067>

RELAX is a system of routines that modifies the probabilities associated with labels attached to the elements of a two-dimensional array. These modifications reflect the compatibility of each element's labels with those of its neighbors. The initial probability assignments are usually derived from local property values in the neighborhood of each pixel. The final assignments may be used for object detection or segmentation, or may be mapped back to image intensities to achieve noise suppression, enhancement, or segmentation. The relaxation package was contributed to the ARPA/DMA Image Understanding Testbed at SRI by the University of Maryland. This report summarizes applications for which RELAX is suited the history and nature of the algorithm, details of the Testbed implementation, the manner in which RELAX is invoked and controlled the type of results that can be expected and suggestions for further development. The document includes both a user's guide to the RELAX system and an evaluation of the algorithm.

DTIC

Image Processing; Algorithms; Relaxation Method (Mathematics)

20070010447 NASA Langley Research Center, Hampton, VA, USA

Comparison of a Simple Patched Conic Trajectory Code to Commercially Available Software

AndersonPark, Brooke M.; Wright, Henry S.; [2007]; 11 pp.; In English; 17th AAS/AIAA Space Flight Mechanics Meeting, 28 Jan. - 1 Feb. 2007, Sedona, AZ, USA; Original contains color illustrations

Contract(s)/Grant(s): WBS 698671.02.07.02

Report No.(s): AAS 07-160; LAR-17446-1; No Copyright; Avail.: CASI: [A03](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20070010447>

Often in spaceflight proposal development, mission designers must evaluate numerous trajectories as different design factors are investigated. Although there are numerous commercial software packages available to help develop and analyze trajectories, most take a significant amount of time to develop the trajectory itself, which isn't effective when working on proposals. Thus a new code, PatCon, which is both quick and easy to use, was developed to aid mission designers to conduct trade studies on launch and arrival times for any given target planet. The code is able to run quick analyses, due to the incorporation of the patched conic approximation, to determine the trajectory. PatCon provides a simple but accurate approximation of the four body motion problem that would be needed to solve any planetary trajectory. PatCon has been compared to a patched conic test case for verification, with limited validation or comparison with other COTS software. This paper describes the patched conic technique and its implementation in PatCon. A description of the results and comparison of PatCon to other more evolved codes such as AGI's Satellite Tool Kit and JAQAR Astrodynamics# Swingby Calculator is provided. The results will include percent differences in values such as C3 numbers, and Vinfinity at arrival, and other more subjective results such as the time it takes to build the simulation, and actual calculation time.

Author

Trajectories; Computer Programs; Launching; Space Flight; Conics

20070010757 NASA Glenn Research Center, Cleveland, OH, USA

Modeling and Analysis of Space Based Transceivers

Reinhart, Richard C.; Liebetreu, John; Moore, Michael S.; Price, Jeremy C.; Abbott, Ben; [2005]; 23 pp.; In English; IEEE/NASA Software Engineering Workshop, 4-6 Apr. 2005, Greenbelt, MD, USA; Original contains color illustrations

Contract(s)/Grant(s): WBS 22-041-20-06; Copyright; Avail.: CASI: [A03](#), Hardcopy

This paper presents the tool chain, methodology, and initial results of a study to provide a thorough, objective, and quantitative analysis of the design alternatives for space Software Defined Radio (SDR) transceivers. The approach taken was to develop a set of models and tools for describing communications requirements, the algorithm resource requirements, the available hardware, and the alternative software architectures, and generate analysis data necessary to compare alternative designs. The Space Transceiver Analysis Tool (STAT) was developed to help users identify and select representative designs, calculate the analysis data, and perform a comparative analysis of the representative designs. The tool allows the design space to be searched quickly while permitting incremental refinement in regions of higher payoff.

Author

Transmitter Receivers; Software Development Tools; Computer Programs; Computers

20070010769 Massachusetts Univ., Amherst, MA USA

An Underlying Model for Defeat Mechanisms

Heeringa, Brent; Cohen, Paul R; Jan 2000; 9 pp.; In English

Contract(s)/Grant(s): F30602-97-1-0289; F30602-95-1-0021

Report No.(s): AD-A462285; No Copyright; Avail.: CASI: [A02](#), Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA462285>

Frequently, the goal of military action involves making one's opponent capitulate, so the study of military action includes 'defeat mechanisms,' or strategies for achieving capitulation. Defeat mechanisms include surprise, catastrophe, and victory by attrition. Surprise means catching an agent off-guard both psychologically and physically, catastrophe means inflicting significant damage in a short interval, and victory by attrition involves persistent damage until an agent surrenders or is destroyed. One view of defeat is that the warrior has a limited supply of psychological and physical resources, and that defeat occurs when these resources are used up. While grinding attrition undoubtedly depletes a warrior's psychological resources, other defeat mechanisms might bring about capitulation more quickly. However, it is difficult to empirically evaluate various defeat mechanisms and combinations of defeat mechanisms because modern wargaming systems model only victory by attrition. While military theorists design maneuvers explicitly to affect the psychological state of their opponents, they lack the simulation tools to evaluate these effects. A wargaming system that accurately models factors of fatigue and their effect on an agent's probability of surrender is more accurate, in a predictive and explanatory sense, than one that does not. The

authors have developed a wargame simulator called Capture the Flag (CtF) and have recently added fatigue and defeat models to it. In this paper, they describe their models for fatigue and defeat. For example, their fatigue model combines parameters that affect physical and emotional fatigue along with other attributes to produce an overall measure of fatigue called 'effective fatigue.' Their defeat model combines effective fatigue with an agent's state to compute a probability of surrender. These models are tested on catastrophe and surprise scenarios, and the results are discussed.

DTIC

Combat; Emotions; Simulation; War Games

20070010771 Virginia Univ., Charlottesville, VA USA

Genesis: A Framework for Achieving Software Component Diversity

LKnight, J C; Davidson, J W; Evans, D; Nguyen-Tuong, A; Wang, C; Jan 2007; 119 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): FA8750-04-2-0246; DARPA ORDER-S472; Proj-S472

Report No.(s): AD-A462289; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA462289>

The Genesis project sought to provide security through the diversification of software. A major weakness with current information systems is that they use software applications that are clones of each other; a major exploitable flaw in one implies a flaw in all other similarly configured software packages. Breaking this software monoculture was the goal of the bio-inspired diversity area of DARPA's self-regenerative systems program. The Genesis project exceeded the program's goal of producing 100 functionally equivalent versions of software such that no more than 33 exhibited the same deficiency. This report presents an overview of the Genesis project, the current status of the Genesis Diversity Toolkit, and future opportunities for technical transfer and research.

DTIC

Computer Programming; Computer Programs; Software Engineering; Warfare

20070010780 Naval Research Lab., Washington, DC USA

A Technique for Removing an Important Class of Trojan Horses from High-Order Languages

McDermott, John; Jan 1988; 8 pp.; In English

Report No.(s): AD-A462303; No Copyright; Avail.: CASI: A02, Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA462303>

In his 1984 Turing Award Lecture, Ken Thompson described a sophisticated Trojan horse attack on a compiler that is undetectable by any search of the compiler source code. The object of the compiler Trojan horse is to modify the semantics of the high-order language in a way that breaks the security of a trusted system generated by the compiler. The Trojan horse Thompson described is a form of virus (i.e., it is self-reproducing), but it has other characteristics that differentiate it from viruses that exploit the implementation details of a computer system. First, the self-reproduction is symbiotic -- the Trojan horse depends on the source text of the legitimate compiler for its continued existence. The virus only reproduces itself in the output stream of the compiler, when the compiler is compiling itself (thus destroying the original virus). A second difference is the relative portability of the virus to different systems. The Trojan horse Thompson described is less dependent on the design details of a particular machine because it exploits the portability of high-order languages. A final difference is the location of the virus in the executable file. The compiler Trojan horse is inserted in a place that is hard to search -- in mid-file. While this is possible for any form of virus, it is more difficult for viruses that do not have the compiler's functions at their disposal. In his lecture, Thompson asserted that 'no amount of source-level verification or scrutiny will protect you from using untrusted code.' However, this paper describes a technique that will remove such Trojan horses when used in conjunction with high-order language source code analysis. The remainder of the paper explains why this class of Trojan horse virus is important for trusted systems, describes the defense against it in detail, gives a brief sketch of some countermeasures, and concludes with some applications of the techniques described to building trusted systems.

DTIC

Compilers; Computer Viruses; Countermeasures; High Level Languages; Horses; Languages; Viruses

20070010789 Naval Research Lab., Washington, DC USA

Formal Specification and Verification of Data Separation in a Separation Kernel for an Embedded System

Heitmeyer, Constance L; Archer, Myla; Leonard, Elizabeth I; McLean, John; Nov 2006; 11 pp.; In English

Report No.(s): AD-A462321; XB-NRL/ITD/5500; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA462321>

Although many algorithms, hardware designs, and security protocols have been formally verified, formal verification of the security of software is still rare. This is due in large part to the large size of software, which results in huge costs for verification. This paper describes a novel and practical approach to formally establishing the security of code. The approach begins with a well defined set of security properties and, based on the properties, constructs a compact security model containing only information needed to reason about the properties. Our approach was formulated to provide evidence for a Common Criteria evaluation of an embedded software system which uses a separation kernel to enforce data separation. The paper describes 1) our approach to verifying the kernel code and 2) the artifacts used in the evaluation: a Top Level Specification (TLS) of the kernel behavior, a formal definition of data separation, a mechanized proof that the TLS enforces data separation, code annotated with pre- and post-conditions and partitioned into three categories, and a formal demonstration that each category of code enforces data separation. Also presented is the formal argument that the code satisfies the TLS.

DTIC

Access Control; Kernel Functions; Numerical Control; Program Verification (Computers); Security

20070010791 Naval Research Lab., Washington, DC USA

Analyzing Tabular Requirements Specifications Using Infinite State Model Checking

Bultan, Tevfik; Heitmeyer, Constance; Jan 2006; 11 pp.; In English

Contract(s)/Grant(s): NSF-CCR-0341365

Report No.(s): AD-A462324; XB-NRL/ITD/5500; No Copyright; Avail.: CASI: [A03](#), Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA462324>

This paper investigates the application of infinite state model checking to the formal analysis of requirements specifications in the SCR (Software Cost Reduction) tabular notation using Action Language Verifier (ALV). After reviewing the SCR method and tools and the Action Language, experimental results are presented of formally analyzing two SCR specifications using ALV. The application of ALV to verify or falsify (by generating counterexamples) the state and transition invariants of SCR specifications and to check Disjointness and Coverage properties is described. ALV is compared with the verification techniques that have been integrated into the SCR toolset.

DTIC

Program Verification (Computers); Specifications

20070010795 University of Southern California, Marina del Rey, CA USA

Applied Learning Networks (ALN)

Bannister, Joseph; Shen, Wei-Min; Touch, Joseph; Hou, Feili; Pingali, Venkata; Jan 2007; 29 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): FA8750-05-1-0051; Proj-T981

Report No.(s): AD-A462328; No Copyright; Avail.: CASI: [A03](#), Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA462328>

Applied Learning Networks (ALN) demonstrates that a network protocol can learn to improve its performance over time, showing how to incorporate learning methods into a general class of network protocols. ALN applies accumulated experience with previous network connections to help tune future network connections. ALN provides demonstration of non-trivial learning in complex communication protocols. It also provides proof that learning results in task specific performance enhancements.

DTIC

Communication Networks; Learning

20070010800 Army Tank-Automotive Research and Development Command, Warren, MI USA

Intelligent System Controller for the Full Spectrum Active Protection Close in Layered Shield

Salamango, Mark J; Rathgeb, Brian E; May 26, 2004; 9 pp.; In English

Report No.(s): AD-A462333; PN-IVSS-2004; No Copyright; Avail.: CASI: [A02](#), Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA462333>

Active protection may become heavily relied on for survivability of ground combat vehicles as the Army shifts to lighter platforms. Recent events in southwest Asia have also demonstrated a need for active protection on tactical vehicles. The Full spectrum active protection Close-in Layered Shield (FCLAS) system is an active protection system capable of intercepting threats fired even extremely close to a vehicle. The system was designed to provide significant protection for future vehicles while being applicable to the legacy fleet. FCLAS boasts elegant simplicity, which makes it an attractive solution to anyone

looking to add protection to their vehicles. The FCLAS system controller will offer both passive and active means 1:0 minimize fratricide when intercepting incoming threats. The system operators can actively disable individual tubes to prevent countermeasures from launching in the direction of dismounted troops; these areas are known as exclusion zones. A novel tracking system of dismounted troops allows the controller to dynamically create exclusion zones to maintain optimal protection while minimizing fratricide. The architecture used to implement the controller functionality provides a multitude of further benefits in the field. Among the benefits are diagnostics, prognostics, and logistics support.

DTIC

Combat; Control; Controllers; Protection; Shielding; Software Development Tools; Spectra

20070010803 TRADOC Program Integration Office, Fort Leavenworth, TX USA

The Army Operational Architecture Program

Sumerix, Wayde L; Douthitt, Thomas L; Sass, Sylvia I; Madigan, James C; Jan 1999; 26 pp.; In English; Original contains color illustrations

Report No.(s): AD-A462339; No Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA462339>

The Army Operational Architecture (AOA) Program provides the framework and integrates the operational architecture development efforts within the Army. OA is an integral part of the Army Enterprise Architecture (AEA) and is one of three architecture views, the others are System and Technical architecture. TPIO-ABCS is the Executive Agent for the Army's entire Operational Architecture (OA) and is responsible for the development, management, and oversight of all OA products. An extensive OA Configuration Management system has been established to ensure all protocols, standards, validation and approved procedures are in compliance. The Army OA Program is a function and responsibility of DCSOPS, DA and is an integral part of the Army Enterprise Architecture (AEA). This document is designed to enlighten the overall architecture community on the current status of the Army OA program. The AOA is a disciplined approach to the Requirements Determination Process and provides synergy and coordination enablers for the Combat Developments arena that meet the Warfighter requirements. Operational Architecture is the catalyst to re-engineering the Army. OA is a disciplined and systematic process used to identify and generate requirements for Doctrine, Training, Leader Development, Organization, Materiel, and Soldier Support (DTLOMS) domain incorporation. OA, as a combat development function, represents a dramatic change in thinking about requirement determination and generation. Given the unprecedented complexity of the digitized battlefield and the current austere resource environment, forming vague battle command information requirements in generic detail will not do. OA is the combat development process capable of accurately identifying force information requirements in sufficient enough detail to properly illuminate the investment decisions that must be made to move the Army forward.

DTIC

Architecture (Computers); Military Operations

20070010835 Naval Postgraduate School, Monterey, CA USA

Implementation of Configurable Fault Tolerant Processor (CFTP) Experiments

Caldwell, Gerald W; Dec 2006; 129 pp.; In English; Original contains color illustrations

Report No.(s): AD-A462393; No Copyright; Avail.: CASI: A07, Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA462393>

The Configurable Fault Tolerant Processor (CFTP) team at Naval Postgraduate School (NPS), Monterey, was created to develop, test, and implement reliable computing solutions for the space environment. The CFTP team seeks to design reliable circuits using Field Programmable Gate Arrays (FPGA) to include designs that mitigate the radiation hazards posed to FPGAs. A significant challenge faced by the CFTP team has been the integration and subsequent software development of the CFTP architecture, which includes a 'Controller' and an 'Experiment' FPGA. This thesis investigates some of the specific design issues that must be considered for future experiments, to include timing between the two FPGAs, and data throughput of the CFTP architecture. Procedures for the development and implementation of experiments are detailed for the benefit of future experimenters who may be new to designing for FPGAs. Lastly, the Controller program is streamlined such that only minor modifications are required by prospective users in order to conform to specific experiments. Over the years the CFTP team has produced several experiments that will provide reliable computing solutions for the space environment. Now, in addition to the 'what' is to be used in space, this thesis presents 'how' to run them in space.

DTIC

Aerospace Environments; Computer Systems Design; Fault Tolerance

20070010893 Bae Systems Advanced Information Technologies, Inc., Burlington, MA USA
Efficient, Realistic Physics-Based Modeling for Buried UXO Based on Time-Domain Electromagnetic Scattering Signatures

Weichman, Peter; Aug 19, 2005; 8 pp.; In English; Original contains color illustrations

Report No.(s): AD-A462497; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA462497>

The aim of this effort was to deliver to SERDP a software product suitable for transition to time-domain electromagnetic (TDEM) based sensors currently used for UXO discrimination. The methodology was intended to simultaneously address the requirements of (i) high fi-delity physics-based modelling for realistic target shapes and (ii) vastly accelerated CPU efficiency for forward modeling and inversion, and subsequent discrimination. This aim has essentially been achieved, as described below, through continued development of our highly efficient 'mean field' approach, together with the development of an entirely new complementary 'early time' approach, to high contrast EM scattering. This Final Report will summarize the substantial advances we have made, describe the nature of the work that still needs to be done to turn our results into a final self-contained product; and finally describe our ongoing and planned future efforts to transition that product to laboratory and field use.

DTIC

Computer Programs; Electromagnetic Scattering; Signatures

20070010900 Naval Postgraduate School, Monterey, CA USA

Assessing the Effect of Honeypots on Cyber-Attackers

Lim, Sze Li H; Dec 2006; 79 pp.; In English; Original contains color illustrations

Report No.(s): AD-A462526; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA462526>

A honeypot is a non-production system, design to interact with cyber-attackers to collect intelligence on attack techniques and behaviors. While the security community is reaping fruits of this collection tool, the hacker community is increasingly aware of this technology. In response, they develop anti-honeypot technology to detect and avoid honeypots. Prior to the discovery of newer intelligence collection tools, we need to maintain the relevancy of honeypots. Since the development of anti-honeypot technology indicates the deterrent effect of honeypot, we can capitalize on this deterrent effect to develop fake honeypot. Fake honeypot is a real production system with deterring characteristics of honeypot that induces the avoidance behavior of cyber-attackers. Fake honeypots will provide operators with workable production systems under obfuscation of deterring honeypot when deployed in hostile information environment. Deployed in a midst of real honeynets, it will confuse and delay cyber-attackers. To understand the effects of honeypot on cyber-attackers to design fake honeypot, we exposed a tightly secured, self-contained virtual honeypot to the Internet over a period of 28 days. We conclude that it is able to withstand the duration of exposure without compromise. The metrics pertaining to the size of last packet suggested departure of cyber-attackers during reconnaissance.

DTIC

Computer Information Security; Computer Networks; Computer Programs; Deception

20070010905 Maryland Univ., College Park, MD USA

SocialBrowsing: Integrating Social Networks and Web Browsing

Golbeck, Jennifer; Wasser, Michael M; Jan 2007; 7 pp.; In English

Report No.(s): AD-A462535; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA462535>

In this paper we introduce SocialBrowsing, a Firefox extension that adds social context to the web browsing experience. The extension is paired with services provided by social networking websites, analyzes the page's contents, and adds tooltips and highlighting to indicate when there is relevant social information. We present an overview of the tool and implementation, and outline future steps for analysis.

DTIC

Internets; Networks

20070010919 Clemson Univ., SC USA

Exact Generation of Epsilon-Efficient Solutions in Multiple Objective Programming

Engau, A; Wiecek, M M; Oct 2005; 27 pp.; In English

Contract(s)/Grant(s): NSF-DMS-0425768

Report No.(s): AD-A462569; TR2005-10-EWA; No Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA462569>

It is a common characteristic of many multiple objective programming problems that the efficient solution set can only be identified in approximation: since this set often contains an infinite number of points, only a discrete representation can be computed, and due to numerical difficulties, each of these points itself might in general be only approximate to some efficient point. From among the various approximation concepts, this paper considers the notion of epsilon-efficiency which has also been shown to be of relevance other than merely for the purpose to approximate solutions. Following preceding work by the same authors, new generating methods are proposed to resolve various drawbacks of those methods derived earlier. Supporting theoretical results are established and the methods demonstrated on an engineering design example.

DTIC

Computer Programming; Object-Oriented Programming

20070010943 Naval Research Lab., Washington, DC USA

An Architecture for Multilevel Secure Interoperability

Kang, Myong H; Froscher, Judith N; Moskowitz, Ira S; Jan 1997; 12 pp.; In English

Report No.(s): AD-A462626; No Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA462626>

As computer systems become distributed and heterogeneous, there is strong movement in the commercial sector to ease the problems of interoperability and security. Many standards have been proposed for these problems. However, the commercial sector has not shown strong interest in providing cost-effective high-assurance multilevel security (MLS) solutions to the relatively small communities (e.g. intelligence, military) that require them. In this paper, we introduce a practical, cost-effective, and high-assurance secure solution for multilevel distributed and heterogeneous environments using COTS components. The solution is based on an MLS architecture that consists of commercial single-level hardware and software, and a few specialized security devices. We show how an MLS CORBA can be constructed from single-level CORBAs and two security devices; the NRL Pump and the Starlight Interactive Link. We also introduce the concept of MLS cooperative Computing which is a way to semi-automate distributed computing among organizations at different security levels.

DTIC

Computer Information Security; Computer Programs; Interoperability

20070010967 Naval Research Lab., Washington, DC USA

A Formal Method for the Abstract Specification of Software

McLean, John; Jan 1984; 26 pp.; In English

Report No.(s): AD-A462691; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA462691>

An intuitive presentation of the trace method for the abstract specification of software contains sample specifications, syntactic and semantic definitions of consistency and totalness, methods for proving specifications consistent and total, and a comparison of the method with the algebraic approach to specification. This intuitive presentation is underpinned by a formal syntax, semantics, and derivation system for the method. Completeness and soundness theorems establish the correctness of the derivation system vis -a -vis the semantics, the coextensiveness of the syntactic definitions of consistency and totalness with their semantic counterparts, and the correctness of the proof methods presented. Areas for future research are discussed.

DTIC

Computer Programs; Semantics

20070011077 Northrop Grumman Information Technology, Leavenworth, TX USA

Development of a C2 Standard of Task Representation for C4ISR Systems, Simulations and Robotics: Battle Management Language

Carey, Scott; Kleiner, Martin; Hieb, Michael R; Brown, Richard; Jan 2002; 17 pp.; In English; Original contains color illustrations

Report No.(s): AD-A462397; No Copyright; Avail.: CASI: A03, Hardcopy

The science of Command and Control (C2) of military forces moves increasingly towards digital systems. As such, not only are humans consuming this information but also so are more automated systems. The need to use simulations to interact with Command, Control, Communications, Computers, Intelligence, Surveillance and Reconnaissance (C4ISR) systems is becoming more acute. The interaction is becoming less interpersonal and focused more on data. Most critical of all the C2 information are the commander's intent, orders and directives, but these don't currently flow as data. They are typically transmitted as free text elements within messages or as stand-alone files. This is acceptable for interpersonal communication but it is inadequate for use with simulations, or for the future forces that have robotic components. Commanders demand to train as they fight. This means using their C4ISR devices to control simulations in addition to live forces. We need to fix the free text problem. Battle Management Language (BML) is a means to provide a completely unambiguous C2 specification for live forces, simulations and robotic forces.

DTIC

Combat; Command and Control; Simulation

20070011088 Naval Postgraduate School, Monterey, CA USA

Investigating Ground Swarm Robotics Using Agent Based Simulation

Ho, Sze-Tek T; Dec 2006; 141 pp.; In English; Original contains color illustrations

Report No.(s): AD-A462523; No Copyright; Avail.: CASI: [A07](#), Hardcopy

The concept of employing ground swarm robotics to accomplish tasks has been proposed for future use in humanitarian de-mining, plume monitoring, searching for survivors in a disaster site, and other hazardous activities. More importantly in the military context, with the development of advanced explosive detectors, swarm robotics with autonomous search and detection capability could potentially address the improvised explosive device (IED) problem faced by foot patrols, and aid in the search for hidden ammunition caches and weapons of mass destruction (WMDs). The intent of this research is to leverage on agent based simulation to model a ground robotic swarm on a search and detection mission in a semi-urban environment rigged with stationary IEDs. Efficient design of experiment (DOE) techniques and data farming are engaged to help identify controllable factors and capabilities that have the most impact on overall effectiveness. The focus of this thesis is to explore agent based simulation applied to swarm robotics; the technological and algorithmic aspects are not delved on. Results from the simulations provide several insights on the impact of both decision and noise factors on the performance of the swarm. Incorporation of virtual pheromones as a shared memory map is modeled as an additional capability that is found to enhance the robustness and reliability of the swarm.

DTIC

Computerized Simulation; Experiment Design; Explosives Detection; Robotics; Simulation

20070011093 Naval Postgraduate School, Monterey, CA USA

Software Communications Architecture (SCA) Compliant Software Defined Radio Design for IEEE 802.16 Wirelessman-OFDM-TM Transceiver

Kian, Low W; Dec 2006; 98 pp.; In English; Original contains color illustrations

Report No.(s): AD-A462542; No Copyright; Avail.: CASI: [A05](#), Hardcopy

Demands for seamless mobile communications are driving the research and development of software defined radio (SDR), which enables a single terminal to transmit and receive in distinct wireless systems through a simple change in software to reconfigure the terminal's functions. Its application areas include military use, home networks, intelligent transport systems and cellular communications. Several SDR software architectures have been developed during the last few years. One implementation of the Software Communications Architecture is the Open Source SCA Implementation::Embedded (OSSIE) which is developed by the Mobile and Portable Radio Research Group (MPRG) at Virginia Tech. The goal of this thesis was to design and implement transmitter and receiver components using OSSIE. The components were designed for use in the IEEE 802.16 WirelessMAN-OFDM-TM transceiver and for contribution to the library of components being developed. Thus, the components will be flexible and useful for other transceivers by specifying the appropriate parameters.

DTIC

Architecture (Computers); Communication Networks; Computer Networks; Computer Programming; Elastic Properties; Radio Equipment; Radiotelephones; Telecommunication; Transmitter Receivers

20070011142 Texas Univ., San Antonio, TX USA

Apply Model Checking to Security Analysis in Trust Management

Reith, Mark G; Niu, Jianwei; Winsborough, William H; Feb 1, 2007; 11 pp.; In English

Report No.(s): AD-A462754; CI07-0030; No Copyright; Avail.: CASI: [A03](#), Hardcopy

Trust management is a form of access control that uses delegation to achieve scalability beyond a single organization or federation. However, delegation can be difficult to control. A resource owner that delegates some authority is naturally concerned not only about who has access today, but also who will have access after others make changes to the global policy state. They need tools to help answer such questions. This problem has been studied in the case of a trust management language called RT where, for simple questions concerning specific individuals, polynomial time algorithms are known. However, more useful questions, like ‘Could anyone who is not an employee ever get access?’ are in general intractable. This paper concerns our efforts to build practical tools that answer such questions in many cases nevertheless by using a lightweight approach that leverages a mature model checking tool called SMY Model checking is an automated technique that checks if desired purposes hold in the model. Our experience, reported here, suggests that in our problem domain, such a tool may often be able to identify delegations that are unsafe with respect to security questions like the one mentioned above. We explain our translation from a RT policy and containment query to an SMV model and specification as well as demonstrate the feasibility of our approach with a case study.

DTIC

Security; Software Development Tools

20070011147 Massachusetts General Hospital, Boston, MA USA

Enabling Technologies for Advanced Soft Tissue Modeling

Dawson, Steven L; Ottensmeyer, Mark P; Howe, Robert D; Cotin, Stephane M; Kerdok, Amy; Jordan, Petr; Galea, Anna M; Luboz, Vincent; Takashi, Maeno; Sep 2006; 72 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAMD17-01-1-0677

Report No.(s): AD-A462762; No Copyright; Avail.: CASI: [A04](#), Hardcopy

This report describes a 5-year research program to develop instrumentation, experimental protocols, mathematical models and tools, and validation techniques to determine and describe the biomechanical behavior of living tissues. The particular focus has been the study of non-load-bearing internal organs that have not been addressed significantly in the literature. These results will contribute to developing realistic simulation tools for medical training and medical device and procedure development. The report summarizes the results of the final year of the project, including completion of a physics-based tissue model and an algorithm to determine the values of characteristic parameters from experimental data; integration of a three-dimensional ultrasound scanning system with the authors’ indentation instrumentation and algorithms to accurately determine tissue motion; and work to develop new, minimally invasive instruments that would have applications for human use. The report then reviews the work completed over the full course of the program.

DTIC

Biodynamics; Instruments; Mathematical Models; Responses; Simulation

20070011190 Carnegie-Mellon Univ., Pittsburgh, PA USA

Interpreting Capability Maturity Model (Trademark) Integration (CMMI (Trademark)) for Business Development Organizations in the Government and Industrial Business Sectors

Beynon, Jr, Donald R; Jan 2007; 75 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): FA8721-05-C-0003

Report No.(s): AD-A462822; CMU/SEI-2007-TN-004; No Copyright; Avail.: CASI: [A04](#), Hardcopy

Just as use of a disciplined process has been shown to produce higher quality and more predictable software-intensive systems, use of a disciplined business development and marketing process can result in improved success for the business enterprise. Overall business performance and marketing of technology and software-intensive systems can be improved by applying the concepts defined in Capability Maturity Model (Trademark) Integration (CMMI (Trademark)) best practices. This interpretation of CMMI best practices is for business development activities applicable to contractors doing business within the government (Department of Defense) and industrial business sectors. Using CMMI for business development and product development in the same organization addresses process improvement from a larger business perspective, creating the potential for increased efficiency, improved quality, and better customer satisfaction, and improving the organization’s ability to achieve a profitable market share. Many organizations have achieved proven benefits from CMMI-based process improvement programs. This success can be extended beyond product and service engineering to business development organizations by interpreting CMMI best practices for the business development and marketing environments. This technical note uses the continuous representation of a CMMI model and provides interpretation of CMMI process areas in each of the model’s four categories: Project Management, Support, Process Management, and Engineering. Because many best practices for business development activities are not included in CMMI models, four new process areas were added to cover these activities. This technical note provides an initial construct for business development. Further discussions within the business

development and CMMI communities can result in improved refinements.

DTIC

Commerce; Computer Programming; Management Planning; Organizations; Production Engineering; Software Engineering

20070011241 Cornell Univ., Ithaca, NY USA

A Computation Infrastructure for Knowledge-Based Development of Reliable Software Systems

Constable, Robert; Kreitz, Christoph; Nov 10, 2006; 13 pp.; In English

Contract(s)/Grant(s): FA95550-05-1-0188

Report No.(s): AD-A462900; 47410; No Copyright; Avail.: CASI: [A03](#), Hardcopy

The Verification and Automated Reasoning research group at Cornell is involved in several DoD-related research projects that use formal methods, theorem proving, and knowledge management techniques to support the development of reliable software systems. These activities aim at making formal logical tools capable of solving difficult DoD tasks, using them for the development of safety-critical DoD software, making formalized algorithmic knowledge and logical software development tools accessible to researchers and programmers, and providing highly automated support for the training of researchers and programmers in the systematic design of reliable software. Due to the huge search spaces and high processing demands of formal reasoning tools, our prototype Logical Programming Environment and its associated Formal Digital Library require a large number of processors and large amounts of memory to run efficiently in state-of-the-art applications. With additional computing resources, funded under this grant the Cornell group contributed significantly to the DoD mission. The research instrumentation, described below provided the necessary computation infrastructure for making our research on system verification feasible, and it opened our proof system to remote users.

DTIC

Computation; Computer Programming; Expert Systems; Libraries; Liquid Phase Epitaxy; Programming Environments; Software Engineering

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.

20070009672 Air Force Research Lab., Rome, NY USA

Command, Control (C2) and Coalition Interoperability Post '911': Introducing the Network Centric Infrastructure for Command Control and Intelligence (NICCI)

Illingworth, Gary; Jan 2002; 17 pp.; In English; Original contains color illustrations

Report No.(s): AD-A461479; No Copyright; Avail.: CASI: [A03](#), Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA461479>

EFFORTS TOWARD INTEROPERABILITY, IN EITHER ITS JOINT UNITED STATES (CONUS) OR COALITION VARIETIES, HAVE EVOLVED SINCE WWII INTO TWO MAIN AREAS OF CONCERN: EQUIPMENT STANDARDIZATION and TRAINING, and THE COGNITIVE PSYCHOLOGICAL ISSUES SURROUNDING INTEROPERABILITY and COMMAND and CONTROL; PROGRESS HAS BEEN SLOW IN BOTH OF THESE AREAS, HOWEVER. THIS PAPER ADDRESSES PROBLEMS OF JOINT and COALITION INTEROPERABILITY and COMMAND and CONTROL IN TERMS OF BOTH OF THESE AREAS, and INTRODUCES TIME CRITICAL TARGETING (TCT) CURRENTLY AS A PRIME DRIVER FOR SEEKING CLOSER COALITION INTEROPERABILITY. THE ATTACKS OF 911 AGAINST THE UNITED STATES and THE WAR ON TERRORISM REEMPHASIZE THE NEED TO IMPLEMENT GREATER INTEROPERABILITY AMONG JOINT and COALITION FORCES ACROSS STRATEGIC, NATIONAL, MILITARY, and POLICE INTELLIGENCE AGENCIES, EMERGENCY RESPONDERS, NON-GOVERNMENT ORGANIZATIONS, AS WELL AS JOINT and COALITION MILITARY BRANCHES. TO MEET THIS NEED, THE DEFENSE ADVANCED RESEARCH PROJECTS AGENCY (DARPA), US NAVY SPACE and WARFARE SYSTEM (SPAWARS), THE US ARMY RESEARCH LABORATORY, FORT MONMOUTH, NJ, THE USAF RESEARCH LABORATORY, ROME RESEARCH SITE, ROME, NY, and THE US JOINT FORCES COMMAND ARE DEVELOPING THE NETWORK CENTRIC INFRASTRUCTURE FOR COMMAND, CONTROL, and INTELLIGENCE (NICCI).

DTIC

Command and Control; Intelligence; Interoperability; Military Operations; Research Facilities

20070009697 Veridian, Brooks AFB, TX USA

Collaborative Command and Control Research: Networking Multiple Simulation Platforms

Barnes, Christopher; Elliott, Linda R; Tessier, Phil; Petrov, Plamen; Jan 2002; 10 pp.; In English; Original contains color illustrations

Report No.(s): AD-A461998; No Copyright; Avail.: CASI: [A02](#), Hardcopy

The USA Air Force is positioned to take full advantage of Internet2 technologies and apply them to Command and Control (C2) research. This paper summarizes and updates progress on the Air Force's Distributed Mission Training Research Network (DMT- Rnet), an Internet2 based network for collaborative research and training via distributed PC- based systems. This network hosts complex environments for multi-operator simulation-based training and performance research.

DTIC

Command and Control; Control Simulation; Education; Internets

20070009760 Naval Research Lab., Washington, DC USA

Mobile Ad Hoc Networking and the IETF

Macker, Joseph P; Corson, M S; Jan 1998; 7 pp.; In English

Report No.(s): AD-A462127; No Copyright; Avail.: CASI: [A02](#), Hardcopy

This article is the first in a series intended to chronicle the status of work underway within the Mobile Ad hoc NETWORKS (MANET) Working Group of the Internet Engineering Task Force (IETF). This article provides a short history and high-level, conceptual tutorial of MANET technology. We present an overview of the working group's vision and charter, and a glimpse into a technical architecture under consideration for achieving this vision.

DTIC

Communication Networks; Internets; Engineering; Mobile Communication Systems

20070009761 SENSIS Corp., East Syracuse, NY USA

INFOSPACE Concept Exploration and Development Across Secure Community of Interest (COI) Boundaries

Kowalchuk, Nick; Dec 2006; 56 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): FA8750-05-C-0269; Proj-ICED

Report No.(s): AD-A462138; No Copyright; Avail.: CASI: [A04](#), Hardcopy

This effort developed technology to securely compose, maintain and dissolve infospheres, including aspects of service discovery, negotiation, configuration, revocation, and policy enforcement, and basic actions associated with composing and decomposing COIs. A capability was developed to automate the announcement, discovery, request matching, and life-cycle management of information services both within and across security domain boundaries. Requirements and design trade-offs associated with the management of information services across security domains were researched and documented. A requirements analysis indicated that in a multi-domain environment in which information services must be shared between domains, the security framework should include location transparency of both service registries and service providers between the domains. An architecture was defined that enforces location transparency while enabling secure sharing of information services via new methods for secure announcement across security domain boundaries in a manner that allows only intended recipient domains to decrypt the service announcement. The major contribution of this work was the development of a new Trust Model for Secure Service Management incorporating secure service announcements, secure Service Manager processes, a secure Private Registry and an open Application Programming Interface (API) for secure Service Invocation requests. The resulting technology was demonstrated for a combined Federal Aviation Administration (FAA) and DoD scenario regarding Special Use Airspaces.

DTIC

Computer Information Security; Technologies; Information Management; Computer Systems Programs

20070009800 Naval Postgraduate School, Monterey, CA USA

An Expert System and Tutor for Maritime Navigation Rules

Calfee, Sharif; Rowe, Neil C; Jan 2002; 15 pp.; In English; Original contains color illustrations

Report No.(s): AD-A461495; No Copyright; Avail.: CASI: [A03](#), Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA461495>

The Navigation Rules Expert System (NRES) is a CLIPS-based implementation of the International and Inland Maritime Navigation Rules (COMDTINST M16672.2C) to assist mariners. NRES functionality is divided into two components, the Mariner-Assistance Module and the Student-Tutor Module. The Mariner-Assistance Module (MAM) is designed for use in

real-time operations to assist mariners in correctly determining both the maritime situation and the necessary action(s) to be taken in accordance with the International and Inland Maritime Navigation Rules. In practice, NRES could double-check navigation decisions and issue warnings when the possibility of accidents arises; while some human judgment will always be necessary in this task, it could well be useful on the bridge to have a different and dispassionate point of view. The Student-Tutor Module (STM) is designed to train students in the understanding and application of the International and Inland Maritime Navigation Rules in order to strengthen maritime navigation situational decision-making. The STM utilizes the NRES CLIPS rules database as the source from which the tutor questions are drawn and employs audio and visual cueing information derived from the navigation rules to enhance the student learning process.

DTIC

Computer Assisted Instruction; Education; Expert Systems; Navigation; Training Devices

20070009802 California Univ., Santa Cruz, CA USA

Distributed Routing for Very Large Networks Based on Link Vectors

Behrens, Jochen; Jun 1997; 120 pp.; In English

Report No.(s): AD-A461553; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA461553>

Routing is the network-layer function that selects the paths that data packets travel from a source to a destination in a computer communication network. This thesis is on distributed adaptive routing algorithms for large packet-switched networks. A new type of routing algorithms for computer networks, the link-vector algorithm (LVA) is introduced. LVAs use selective dissemination of topology information. Each router running an maintains a subset of the topology that corresponds to adjacent links and those links used by its neighbor routers in their preferred paths to known destinations. Based on that subset of topology information, the router derives its own preferred paths and communicates the corresponding link-state information to its neighbors. An update message contains a vector of updates; each such update specifies a link and its parameters. LVAs can be used for different types of routing policies. LVAs are shown to have better performance than the ideal link-state algorithm based on flooding and the distributed Bellman-Ford algorithm.

DTIC

Interprocessor Communication; Vectors (Mathematics); Computer Networks

20070009803 Silkroad, Inc., McLean, VA USA

The New Global Information Economy: Implications and Recommendations for Service-Oriented Architectures (SOAs)

Bass, Tim; Donahue, William; Jun 2005; 26 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): GS-35F-0290K

Report No.(s): AD-A461556; ICCRTS-021; No Copyright; Avail.: CASI: [A03](#), Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA461556>

Service-oriented architecture (SOA), a term often used today in conjunction with net-centric operations, implies that existing and future DoD information capabilities will be engineered to publish product and/or service offerings within a strategic context that allows virtually all employees and applications to readily discover and use them. SOA principles are essential to transforming traditional system-centric Defense organizations into Information Age activities that are net-centric, architecturally agile, and otherwise responsive to fast changing mission and business needs. The large-scale service-oriented architectures that DoD planners envision are designed to lower barriers to dynamic information sharing and improve content quality, quantity and propriety by leveraging the power of self-organization, self-synchronization and market forces. For these reasons, SOAs promise to help organizations deliver unprecedented value to their customers. In this paper we review a few key concepts of service-oriented architectures as fundamental enablers of net-centricity. We then examine the implications for SOAs in the new DoD global information economy and offer a few key recommendations.

DTIC

Architecture (Computers); Information Systems; Economics

20070009805 Carnegie-Mellon Univ., Pittsburgh, PA USA

Providing Contextual Information to Ubiquitous Computing Applications

Judd, Glenn; Steenkiste, Peter; Jul 2002; 23 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): F30602-99-1-0518

Report No.(s): AD-A461173; CMU-CS-02-154; No Copyright; Avail.: CASI: [A03](#), Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA461173>

Ubiquitous computing applications are increasingly leveraging contextual information from several sources to provide users with behavior appropriate to the environment in which they reside. If these sources of contextual information are used and deployed in an ad hoc manner, however, they may provide overlapping functionality, fail to provide needed functionality, and require the use of inconsistent interfaces by applications. To overcome these problems, we introduce a concise organization of services and a single service interface that provide applications with contextual information in a unified manner. We show, via example applications and services that we have implemented, how our service organization and interface can be used to allow proactive applications to adapt their behavior to match a user's current environment.

DTIC

Computer Techniques; Applications Programs (Computers); Information Systems; Deployment

20070009812 California Univ., Santa Cruz, CA USA

A Practical Approach to Minimizing Delays in Internet Routing

Garcia-Luna-Aceves, J J; Vutukury, Srinivas; Zaumen, William T; Jan 1999; 6 pp.; In English

Contract(s)/Grant(s): F30602-97-1-0291; F19628-96-C-0038

Report No.(s): AD-A461695; No Copyright; Avail.: CASI: [A02](#), Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA461695>

We present a practical approach to internet routing that provides near-minimum delays over multiple loop-free paths to destinations. The new protocol, which we call NEAR-OPT, obtains multiple loop-free paths to destinations using long-term delay measures, and allocates destination-oriented flows over such paths using short-term delay measures to minimize delay. We compare the performance of NEAR-OPT with traditional single-path routing and the only known adaptation for dynamic networks of Gallager's minimum-delay routing algorithm. Using actual Internet traffic traces and other traffic source models, we show that NEAR-OPT provides delays comparable to the lower bounds achievable with Gallager's algorithm for static networks, provides lower delays than implementations of Gallager's algorithm in networks subject to fractal traffic, and renders far smaller delays and better use of resources than traditional single-path routing. NEAR-OPT does not depend on any global constant and is completely distributed, making it easy to implement as a loop-free distance-vector protocol similar to Cisco's EIGRP.

DTIC

Internets; Delay

20070009814 California Univ., Santa Cruz, CA USA

A Scalable Architecture for Providing Deterministic Guarantees

Vutukury, Srinivas; Garcia-Luna-Aceves, J J; Jan 1999; 7 pp.; In English

Contract(s)/Grant(s): F30602-97-1-0291; F19628-96-C-0038

Report No.(s): AD-A461696; No Copyright; Avail.: CASI: [A02](#), Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA461696>

The Internet community has proposed the Integrated Services architecture (Intserv) and the signaling protocol RSVP to provide deterministic guarantees (bandwidth, delay and jitter) to individual flows. However, experience with practical systems has revealed the severe scalability problems of the Intserv model due to the amount of routing and reservation state that is required to be maintained in the routers. A natural approach to improving scalability of Intserv architecture is through reduction of amount of state in the routers by using aggregated flow state instead of per-flow state. We present a novel architecture that uses very light state in the routers, while still providing the deterministic guarantees of the Intserv model.

DTIC

Protocol (Computers); Architecture (Computers); Data Integration

20070009817 California Univ., Santa Cruz, CA USA

A Traffic Engineering Approach based on Minimum-Delay Routing

Vutukury, Srinivas; Garcia-Luna-Aceves, J J; Jan 2000; 7 pp.; In English

Contract(s)/Grant(s): F30602-97-1-0291; F19628-96-C-0038

Report No.(s): AD-A461697; No Copyright; Avail.: CASI: [A02](#), Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA461697>

Single-path routing provided by today's widely used IGP's such as RIP make extremely inefficient usage of network bandwidth, and is evident in the large end-to-end delays flows experience in single-path routing as compared to minimum-delay routing. Enhancement to OSPF such as optimized multipath have not proved to be adequate to bridge this

large delay gap. Practical implementation of minimum-delay routing, on the other hand, have been largely unsuccessful for reasons such as scalability, slow convergence and out-of-order packet delivery. This paper proposes a traffic engineering solution that for a given long-term traffic matrix adapts the minimum-delay routing to the backbone networks which is practical and is suitable to implement in a Differential Services framework. A simple scalable packet forwarding technique is introduced that distinguishes between datagram and traffic that requires in-order delivery and forwards them accordingly and efficiently. Using simulations we show that the delays obtained are comparable to minimum delays and far better than single-path routing.

DTIC

Packets (Communication); Multipath Transmission; Architecture (Computers); Network Control; Delay

20070009828 California Univ., Santa Cruz, CA USA

Performance Comparison of Three Routing Protocols for Ad Hoc Networks

Jiang, Hong; Garcia-Luna-Aceves, J J; Jan 2001; 9 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): F30602-97-2-0338

Report No.(s): AD-A461699; No Copyright; Avail.: CASI: [A02](#), Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA461699>

Many routing protocols for ad hoc networks have been proposed to date. Among them, STAR is a representative table-driven protocol, while AODV and DSR are two representative on-demand protocols. This paper analyzes these three protocols using the GloMoSim simulation environment. The scenarios used in the simulation experiments take into account a variety of environmental factors that influence protocol performance. The performance of the protocols is compared in terms of their control overhead, amount of data delivered, and average latency in packet delivery. The simulation results show that STAR achieves better overall performance than AODV and DSR in sparsely connected networks. For the case of densely connected networks, AODV performs better in terms of data delivery, while STAR performs much better in terms of control overhead. The study also addresses the question of how accurate a simulator could be regarded for presenting the characteristics of the routing protocols and for comparison purposes.

DTIC

Protocol (Computers); Communication Networks

20070009833 California Univ., Santa Cruz, CA USA

Achieving Loop-Free Incremental Routing in Ad Hoc Networks

Rangarajan, Hari; Garcia-Luna-Aceves, J J; Jan 2004; 7 pp.; In English

Contract(s)/Grant(s): F49620-00-1-0330

Report No.(s): AD-A461702; No Copyright; Avail.: CASI: [A02](#), Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA461702>

We present the Dynamic Incremental Routing (DIR) protocol, which features instantaneous loop-free routing of data packets based on their destination addresses (hop-by-hop routing). Loop-free routes are maintained by using 'feasible distances' to order the nodes with respect to a destination. Simulation results show that the performance of DIR is much better than the performance of AODV, DSR and OLSR, which are indicative of the state of the art in routing protocols.

DTIC

Protocol (Computers); Communication Networks; Dynamic Programming; Simulation

20070009835 California Univ., Santa Cruz, CA USA

Channel Access Scheduling in Ad Hoc Networks with Unidirectional Links

Bao, Lichun L; Garcia-Luna-Aceves, J J; Jan 2001; 11 pp.; In English

Contract(s)/Grant(s): F30602-97-2-0338

Report No.(s): AD-A461743; No Copyright; Avail.: CASI: [A03](#), Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA461743>

A new family of collision-free channel access protocols for ad hoc networks with unidirectional links is introduced. These protocols are based on a distributed contention resolution algorithm that operates at each node based on the list of direct contenders (one-hop neighbors or incident links) and indirect interferences (two-hop neighbors and related links). Depending on the activation scheme (node activation or link activation), a network node uses the identifiers of its neighbors one and two hops away to elect deterministically one or multiple winners for channel access in each contention context (e.g., a time slot or a frequency band). The protocols are shown to be fair and capable of achieving maximum utilization of the channel

bandwidth. The delay and throughput characteristics of the channel access protocols is studied by simulations.
DTIC

Scheduling; Channels (Data Transmission); Multiple Access; Data Links

20070009872 Carnegie-Mellon Univ., Pittsburgh, PA USA

Mobile Information Access

Satyanarayanan, M; Jan 1996; 16 pp.; In English

Contract(s)/Grant(s): F196828-93-C-0193

Report No.(s): AD-A461116; CMU-CS-96-107; No Copyright; Avail.: CASI: [A03](#), Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA461116>

The ability to access information on demand when mobile will be a critical capability in the 21st century. In this paper, we examine the fundamental forces at work in mobile computing systems and explain how they constrain the problem of mobile information access. From these constraints, we derive the importance of adaptivity as a crucial requirement of mobile clients. We then develop a taxonomy of adaptation strategies, and summarize our research in application-transparent and application-aware adaptation in the Coda and Odyssey systems respectively.

DTIC

Computer Networks; Mobility; Distributed Processing; Computer Storage Devices

20070009886 Naval Research Lab., Washington, DC USA

Attack-Potential-Based Survivability Modeling for High-Consequence Systems

McDermott, J; Mar 24, 2005; 22 pp.; In English

Report No.(s): AD-A462191; XB-NRL/MR/5540; No Copyright; Avail.: CASI: [A03](#), Hardcopy

Previous quantitative models of security or survivability have been defined on a range of probable intruder behavior. This measures survivability as a statistic such as mean time to breach. This kind of purely stochastic quantification is not suitable for high-consequence systems. For high-consequence systems the quantified survivability should be based on the most competent intruders the system is likely to face. We show how to accomplish this with a contingency analysis based on variations in intruder attack-potential. The quantitative results are then organized and presented according to intruder attack potential. Examples of the technique are presented using stochastic process algebra. An interesting result for diverse replication is included in the examples.

DTIC

Mathematical Models; Intrusion Detection (Computers); Computer Systems Programs

20070009910 California Univ., Santa Cruz, CA USA

Performance of Group Communication Over Ad-Hoc Networks

Mosko, Marc; Garcia-Luna-Aceves, J J; Jan 2002; 9 pp.; In English

Report No.(s): AD-A461912; No Copyright; Avail.: CASI: [A02](#), Hardcopy

We study the performance of reliable and unreliable all node broadcast over ad-hoc networks that use contention-based channel access. To obtain analytical results while preserving hidden-terminal and node clustering characteristics of ad-hoc networks, we introduce a novel differential-equation fluid model for information flow through a network of cluster trees, where a spanning tree joins groups of fully connected nodes. Through numerical analysis and simulations in GloMoSim, we show throughput, goodput, and loss rates for reliable and unreliable networks. For reliable broadcast, we also find NAK rates, NAK loss rates, and retransmission rates. We show that using end-to-end sequence numbers, which are common in reliable multicast, for NAK generation in ad-hoc networks creates substantial unnecessary traffic.

DTIC

Communication Networks; Information Flow

20070009915 SRI International Corp., Menlo Park, CA USA

Overview of the Image Understanding Testbed

Hanson, Andy; Oct 1983; 26 pp.; In English

Contract(s)/Grant(s): MDA903-79-C-0588; Proj-1009

Report No.(s): AD-A461028; SRI-TN-310; No Copyright; Avail.: CASI: [A03](#), Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA461028>

The Image Understanding Testbed is a system of hardware and software that is designed to facilitate the integration,

testing, and evaluation of implemented research concepts in machine vision. The system was developed by the Artificial Intelligence Center of SRI International under the joint sponsorship of the Defense Advanced Research Projects Agency (DARPA) and the Defense Mapping Agency (DMA). The primary purpose of the Image Understanding (IU) Testbed is to provide a means for transferring technology from the DARPA-sponsored IU research program to DMA and other organizations in the defense community. The approach taken to achieve this purpose has two components: * The establishment of a uniform environment that will be as compatible as possible with the environments of research centers at universities participating in the IU program. Thus, organizations obtaining copies of the testbed can receive new results of ongoing research as they become available. * The acquisition, integration, testing, and evaluation of selected scene analysis techniques that represent mature examples of generic areas of research activity. These contributions from IU program participants will allow organizations with testbed copies to immediately begin investigating potential applications of IU technology to problems in automated cartography and other areas of scene analysis.

DTIC

Computer Techniques; Measure and Integration

20070009924 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Hera - The HEASARC's New Data Analysis Service

Pence, William; May 04, 2006; 1 pp.; In English; IAU General Assembly, 14-25 Aug. 2006, Prague, Czech Republic; No Copyright; Avail.: Other Sources; Abstract Only

Hera is the new computer service provided by the HEASARC at the NASA Goddard Space Flight Center that enables qualified student and professional astronomical researchers to immediately begin analyzing scientific data from high-energy astrophysics missions. All the necessary resources needed to do the data analysis are freely provided by Hera, including: * the latest version of the hundreds of scientific analysis programs in the HEASARC's HEASOFT package, as well as most of the programs in the Chandra CIAO package and the XMM-Newton SAS package. * high speed access to the terabytes of data in the HEASARC's high energy astrophysics Browse data archive. * a cluster of fast Linw workstations to run the software * ample local disk space to temporarily store the data and results. Some of the many features and different modes of using Hera are illustrated in this poster presentation.

Author

Data Processing; Computer Programs; Astrophysics; Space Missions

20070010768 Idaho Univ., Moscow, ID USA

What are Multi-Protocol Guessing Attacks and How to Prevent Them

Malladi, Sreekanth; Alves-Foss, Jim; Malladi, Sreenivas; Apr 1, 2002; 8 pp.; In English

Contract(s)/Grant(s): MDA972-00-1-0001

Report No.(s): AD-A462228; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA462228>

A guessing attack on a security protocol is an attack where an attacker guesses a poorly chosen secret (usually a low-entropy user password) and then seeks to verify that guess using other information. Past efforts to address guessing attacks in terms of design or analysis considered only protocols executed in isolation. However, security protocols are rarely executed in isolation and reality is always a case of mixed-protocols. In this paper, we introduce new types of attacks called multi-protocol guessing attacks, which can exist when protocols are mixed. We then develop a systematic procedure to analyze protocols subject to guessing attacks. Using this procedure, we will present a method of deriving some syntactic conditions to be followed in order for a protocol to be secure against multi-protocol guessing attacks. Lastly, we use the strand space framework to prove that a protocol will remain secure, given that these conditions are followed, by modeling the conditions within the strand space framework. We illustrate these concepts using the Mellovin and Berritt protocol (EKE) as an example.

DTIC

Access Control; Intrusion; Numerical Control; Prevention; Protocol (Computers); Security

20070010774 Idaho Univ., Moscow, ID USA

On Preventing Replay Attacks on Security Protocols

Malladi, Sreekanth; Alves-Foss, Jim; Heckendorn, Robert B; Jan 2002; 8 pp.; In English

Contract(s)/Grant(s): MDA972-00-1-0001

Report No.(s): AD-A462295; No Copyright; Avail.: CASI: A02, Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA462295>

Replay attacks on security protocols have been discussed for quite some time in the literature. However, the efforts to address these attacks have been largely incomplete, lacking generality and many times in fact, proven unsuccessful. In this paper we address these issues and prove the efficacy of a simple and general scheme in defending a protocol against these attacks. We believe that our work will be particularly useful in security critical applications and to protocol analyzers that are unable to detect some or all of the attacks in this class.

DTIC

Computer Information Security; Protocol (Computers); Security

20070010779 Naval Research Lab., Washington, DC USA

Towards a Hierarchy of Cryptographic Protocol Models

Meadows, Catherine; Oct 30, 2003; 3 pp.; In English

Report No.(s): AD-A462302; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA462302>

Recently there has been an increasing amount of research on the introduction of cryptographic ideas into discrete methods for cryptographic protocol analysis. This is often done by developing a discrete model and a cryptographic model such that the discrete model can be shown sound with respect to the cryptographic model. In this position paper, the author presents a brief outline of a strategy for rendering the analysis of cryptographic protocols by formal methods both sound and tractable. She also talks about some of the other issues in cryptographic protocol analysis that could be addressed with this approach, and proposes a hierarchy of models.

DTIC

Computer Information Security; Computer Networks; Cryptography; Hierarchies; Protocol (Computers)

20070010792 Navy Technology Center for Safety and Survivability, Washington, DC, DC USA

Future Naval Concepts -- Crew Reductions through Improved Damage Control Communications (FNC-CRIDCC), Triad Test 2 Report (18-22 Sep 2006)

Street, Thomas T; Williams, Frederick W; Cooper, L S; Holloway, III, Kenneth E; Rininger, Michael; Miller, Charles; Shirley, Bradley; Genovese, Samuel; Perry, Rendell; McCombs, Kenney; Jan 12, 2007; 70 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): N00014-05-C-0332; Proj-61-8513-0-6-5

Report No.(s): AD-A462325; NRL/MR/6180--07-9025; No Copyright; Avail.: CASI: A04, Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA462325>

The object of Triad Test 2 was to conduct and document an RF coverage survey of the installed WLAN aboard ex-USS Shadwell in a benign environment, obtain RF WLA data during fire events, and evaluate the ability of the communications equipment to continue to provide a communication capability. The fire events were used to determine the ability of the equipment to provide voice and data communications over Voice over Internet Protocol (VoIP) and Power Line Communication (PLC) paths during actual fire and smoke environments. The intelligibility of the information communicated was subjectively and objectively determined using ANSI intelligibility standards.

DTIC

Damage; Data Transmission; Internets; Local Area Networks; Power Lines; Protocol (Computers); Telephones; Voice Communication; Wireless Communication

20070010802 Naval Postgraduate School, Monterey, CA USA

International Crisis Information Network

Catanzaro, Basil J; Horine, Brian S; Dec 2006; 131 pp.; In English; Original contains color illustrations

Report No.(s): AD-A462338; No Copyright; Avail.: CASI: A07, Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA462338>

Historically, there has been a separation between the U.S. military and outside agencies, to include non-governmental organizations (NGOs) and international organizations (IOs). These communities often have misconceptions, biases, and stereotypical misperceptions of each other. Furthermore, these effects have sometimes degraded the ability of the military to accomplish its missions in stability, stabilization, transition, and reconstruction operations. It is imperative that the military and outside agencies cooperate with each other. From this observation, we ask the question: How can we develop a system to share information and lessons learned and collaborate on humanitarian activities within the international community? From this question the following hypothesis emerges: Information sharing and collaboration on lessons learned can be accomplished

through a web-based network. The thesis will study the rift between the military, NGOs and IOs, show their overlapping area of operations, the results of this separation, and the fact that these communities have a desire and a need to share information; discuss the definition of networks and explain how networks and communities of interest have developed and advance a business model of how to best implement a web-based information sharing network. Note: This thesis includes the establishment of a prototype website to test the hypothesis.

DTIC

Computer Networks; Organizations

20070010818 Naval Research Lab., Washington, DC USA

The Handbook for the Computer Security Certification of Trusted Systems

Froscher, Judith N; Payne, Jr, Charles N; Oct 12, 1992; 6 pp.; In English

Report No.(s): AD-A462362; No Copyright; Avail.: CASI: [A02](#), Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA462362>

The Navy has designated the Naval Research Laboratory (NRL) as its Center for Computer Security Research and Evaluation. NRL is actively developing a Navy capability to certify trusted systems. This paper describes the NRL effort to understand assurance, certification, and trusted system certification criteria through the production of the Handbook for the Computer Security Certification of Trusted Systems. Through this effort, NRL hopes to discover new and more efficient ways of satisfying the assurance requirement for a high assurance system.

DTIC

Certification; Computer Information Security; Handbooks; Security; Warning Systems

20070010821 George Mason Univ., Fairfax, VA USA

Transaction Processing Using an Untrusted Scheduler in a Multilevel Database with Replicated Architecture

Costich, Oliver; Jan 1992; 18 pp.; In English

Contract(s)/Grant(s): N00014-89-C-2389

Report No.(s): AD-A462366; No Copyright; Avail.: CASI: [A03](#), Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA462366>

Replicated architecture has been proposed as a way to obtain acceptable performance in a multilevel secure database system. This architecture contains a separate database for each security level such that each contains replicated data from lower security classes. The consistency of the values of replicated data items must be maintained without unnecessarily interfering with concurrency of database operations. This paper provides a protocol to do this that is secure, since it is free of covert channels, and also ensures one-copy serializability of executing transactions. The protocol can be implemented with untrusted processes for both concurrency and recovery.

DTIC

Data Bases; Information Systems; Scheduling; Security

20070010823 Naval Research Lab., Washington, DC USA

The Specification and Modeling of Computer Security

McLean, John; Jan 1990; 17 pp.; In English

Report No.(s): AD-A462368; No Copyright; Avail.: CASI: [A03](#), Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA462368>

Computer security models are specifications designed, among other things, to limit the damage caused by Trojan Horse programs such as computer viruses. Recent work in such models has revealed limitations of the widely accepted model of Bell and LaPadula. This paper provides an introduction to computer security modeling in general, the Bell and LaPadula model in particular, and the limitations of the model. Many of the issues raised are of interest not simply to the security community, but for the software specification community as a whole. We then construct a framework for security models that address these limitations. The result is a model that not only better addresses government security policies, but nongovernment security policies as well.

DTIC

Computer Information Security; Computer Viruses

20070010824 Naval Research Lab., Washington, DC USA

A Comment on the 'Basic Security Theorem' of Bell and LaPadula

McLean, John; Jan 1985; 5 pp.; In English

Report No.(s): AD-A462369; No Copyright; Avail.: CASI: [A01](#), Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA462369>

Many claim that the security model developed by Bell and LaPadula and used as a basis for numerous prototype military computer systems is superior to others partly because its authors prove a 'Basic Security Theorem' that applies to it. This paper shows that the theorem does not support such claims since it can be proven for security models that are obviously not secure. Further, the theorem provides little help to those who design and implement secure systems.

DTIC

Security; Theorems

20070010825 Naval Postgraduate School, Monterey, CA USA

A Secure Alert System

Chew, Heng Hui; Dec 2006; 83 pp.; In English; Original contains color illustrations

Report No.(s): AD-A462371; No Copyright; Avail.: CASI: [A05](#), Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA462371>

The integrated mobile alert system (IMAS) is a mobile device messaging system that provides a means for people to stay connected and receive information in a modality that is constantly available to them. It was developed and built into a proof-of-concept (PoC) system at the Naval Postgraduate School (NPS) from commercial off the shelf (COTS) products. Like other systems, this system suffers from vulnerabilities because of bugs. These bugs come from (1) COTS products, (2) design of the system and (3) developed processes/applications. The study will review the design of IMAS, its processes and the COTS products. The focus of the study is to review these components and identify potential vulnerabilities. Furthermore, it will explain how these vulnerabilities may be exploited by probable threats. It will recommend solutions that can correct or prevent vulnerabilities. Lastly, the thesis will propose other measures that would make the system more secure.

DTIC

Communication Networks; Vulnerability; Warning Systems

20070010859 Naval Postgraduate School, Monterey, CA USA

Performance Analysis of Automated Attack Graph Generation Software

Cullum, James J; Dec 2006; 159 pp.; In English; Original contains color illustrations

Report No.(s): AD-A462426; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA462426>

The current generation of network vulnerability detection software uses databases of known vulnerabilities and scans target networks for these weaknesses. The results can be voluminous and difficult to assess. Thus, the success of this technology has created a need for software to aid in network vulnerability analysis. Although research has shown the effectiveness of automated attack graph generation tools in displaying potential attack paths in a network, research involving the performance of these tools has been limited. Using empirical testing, we have collected quantitative data using CAULDRON, an attack graph generation tool developed at George Mason University, on a collection of simulated networks. By defining our model to include sets of nodes, which allow connectivity from all nodes to all nodes in the set; the number of nodes present in each set, the number of connections between sets; and the number of vulnerabilities per node as our variables, we are able to observe the performance impact on CAULDRON of connectivity and the increased presence of vulnerabilities in our networks. The effect of these variables on processing time and memory usage is presented and can be used as a metric to assess the scalability of this tool within various customer environments.

DTIC

Computer Networks; Computer Programming; Reliability Analysis; Software Engineering

20070010861 Naval Postgraduate School, Monterey, CA USA

Software Independent Verification and Validation (SIV&V) Simplified

Davidson, Reffela; Mathis, Ashley; Patterson, David; von Spakovsky, Alexis P; Dec 2006; 115 pp.; In English; Original contains color illustrations

Report No.(s): AD-A462428; No Copyright; Avail.: CASI: [A06](#), Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA462428>

SIV&V has been in existence for some 40 years, and many people still know little about its existence. Software IV&V certifies the quality of the software and independently validates and verifies that it meets or exceeds the customer's expectations. Independent V&V for component or element software development activities encompasses the following: (1) review and thorough evaluations of the software development, (2) review and comment on software documentation, (3) participation in all software requirements and design reviews, and (4) participation in software integration and testing for each software build. This thesis will explore and explain the benefits and rationale for Software Independent Verification and Validation. It will identify SIV&V processes that are used to support acquisition weapon systems. 'SIV&V Simplified' will translate, into understandable terms, why SIV&V is considered Cheap Insurance and why it is needed. Additionally, this thesis serves as a tutorial, providing suggested policy and guidance, suggested software Computer-Aided Software Engineering (CASE) tools, criteria, and lessons learned for implementing a successful SIV&V program.

DTIC

Computer Programming; Program Verification (Computers); Software Engineering

20070010885 Library of Congress, Washington, DC USA

Internet Development and Information Control in the People's Republic of China

Lum, Thomas; Feb 10, 2006; 17 pp.; In English

Report No.(s): AD-A462477; CRS/DC-RL33167; No Copyright; Avail.: CASI: [A03](#), Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA462477>

Since its founding in 1949, the People's Republic of China (PRC) has exerted great effort in manipulating the flow of information and prohibiting the dissemination of viewpoints that criticize the government or stray from the official Communist party view. The introduction of Internet technology in the mid-1990's presented a challenge to government control over news sources, and by extension, over public opinion. While the Internet has developed rapidly, broadened access to news, and facilitated mass communications in China, many forms of expression online, as in other mass media, are still significantly stifled.

DTIC

China; Command and Control; Information Transfer; Internets

20070010902 Naval Research Lab., Washington, DC USA

Security Models and Information Flow

McLean, John; Jan 1990; 13 pp.; In English

Report No.(s): AD-A462529; No Copyright; Avail.: CASI: [A03](#), Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA462529>

We develop a theory of information flow that differs from Nondeducibility's, which we see is really a theory of information sharing. We use our theory to develop a flow-based security model, FM, and show that the proper treatment of security-relevant causal factors in such a framework is very tricky. Using FM as a standard for comparison, we examine Noninterference, Generalized Noninterference, and extensions to Noninterference designed to protect high-level output, and see that the proper treatment of causal factors in such models requires us to consider programs as explicit input to systems. This gives us a new perspective on security levels. The Bell and LaPadula Model, on the other hand, more successfully models security-relevant causal information although this success is bought at the expense of the model being vague about its primitives. This vagueness is examined with respect to the claim that the Bell and LaPadula Model and Noninterference are equivalent.

DTIC

Information Flow; Security

20070010903 George Mason Univ., Fairfax, VA USA

A Multilevel Transaction Problem for Multilevel Secure Database Systems and its Solution for the Replicated Architecture

Costich, Oliver; McDermott, John; Jan 1992; 19 pp.; In English

Report No.(s): AD-A462530; No Copyright; Avail.: CASI: [A03](#), Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA462530>

A user of a database management system has an intuitive idea of a transaction as a sequence of database commands that he or she submits. The user expects this sequence of commands to be executed in the order of submission, without interference from other database commands submitted by other users. Techniques for doing this while concurrently supporting multiple

database users are well known for conventional (i.e., not multilevel) database systems [2]. Transaction management theory for conventional database systems is not only mature, but useful in practice. The corresponding theory for multilevel secure database systems is still developing but some progress has been made [3,5,6,7,8,9,10].

DTIC

Data Bases; Security

20070010904 Naval Research Lab., Washington, DC USA

The Need for a Failure Model for Security

Meadows, Catherine; Jan 1994; 4 pp.; In English

Report No.(s): AD-A462531; No Copyright; Avail.: CASI: A01, Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA462531>

Researchers in fault tolerance have long made use of the notion of a failure model, which describes the different ways a component in a system can fail. For example, a node can fail quietly (that is, it send out no information), it can fail with respect to timing (that is, send out information too late), it can fail arbitrarily, or it can fail maliciously. The intent of the failure model for fault tolerance is to make it possible to develop different types of algorithms that address different kinds of failures. Security has traditionally followed a different type of approach. When security is modeled, it is assumed that the system is trying to operate in the face of a hostile adversary with unlimited capabilities in certain areas. For example, the modeling of secure operating systems assumes the existence of Trojan Horse code that is able to signal information along covert channels, while the modeling of secure protocols assumes the existence of an intruder who is able to read and modify all traffic, gain control of nodes, and compromise old secret information. In the actual development of secure systems, such assumptions may be relaxed, of course, but, for theoretical models the most stringent assumptions usually apply.

DTIC

Failure; Security

20070010906 Carnegie-Mellon Univ., Pittsburgh, PA USA

Deriving Key Distribution Protocols and their Security Properties

Cervesato, Iliano; Meadows, Catherine; Pavlovic, Dusko; Dec 4, 2006; 45 pp.; In English

Contract(s)/Grant(s): N00014-99-1-0150; N00014-03-C-0237

Report No.(s): AD-A462541; CMU-CS-06-172; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA462541>

We apply the derivational method of protocol verification to key distribution protocols. This method assembles the security properties of a protocol by composing the guarantees offered by embedded fragments and patterns. It has shed light on fundamental notions such as challenge-response and fed a growing taxonomy of protocols. Here, we similarly capture the essence of key distribution, authentication time stamps and key confirmation. With these building blocks, we derive the authentication properties of the Needham-Schroeder shared-key and the Denning-Sacco protocols, and of the cores of Kerberos 4 and 5. The main results of this research were obtained in 2003-04 and appeared in [3]. The present document collects proofs omitted for space reasons and unpublished background material.

DTIC

Cryptography; Data Transmission; Protocol (Computers); Security

20070010923 Carnegie-Mellon Univ., Pittsburgh, PA USA

The Role of Dynamic-Network Multi-Agent Models of Socio-Political Systems in Policy

Louie, Marcus A; Carley, Kathleen M; Jan 2007; 42 pp.; In English; Original contains color illustrations

Report No.(s): AD-A462579; CMU-ISRI-07-102; No Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA462579>

Researchers and policy makers are increasingly turning to multi-agent and dynamic-network multi-agent models to study real-world systems. The models hold particular appeal because of their intuitive representation of complex real-world systems that can be thought of as complex systems. Both policy makers and those affected by the policies influenced by these models often question whether a model is valid. We explore the intended use of these models, the extent to which they can be validated, and the consequent implications for their use in setting policy. We ground the analysis using a dynamic-network multi-agent model we are helping to develop called the Regional Threat Evaluator (RTE), applied to data from Indonesia and

Thailand. We find that there are three core difficulties in validating these models: defining the appropriate operating domain, data availability, and validating a model that integrates multiple theories.

DTIC

Computer Techniques; Decision Support Systems; Dynamic Models; Mathematical Models; Policies; Sociology

20070010928 Carnegie-Mellon Univ., Pittsburgh, PA USA

Theory and Techniques for Automatic Generation of Vulnerability-Based Signatures

Brumley, David; Newsome, James; Song, Dawn; Wang, Hao; Jha, Somesh; Feb 2006; 28 pp.; In English

Contract(s)/Grant(s): N00014-01-1-0708

Report No.(s): AD-A462599; CMU-CS-06-108; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA462599>

In this paper, we explore the problem of creating vulnerability signatures. A vulnerability signature matches all exploits of a given vulnerability, including polymorphic and metamorphic variants. Our work departs from previous approaches by focusing on the semantics of the program and vulnerability exercised by a sample exploit instead of the semantics or syntax of the exploit itself. We show the semantics of a vulnerability define a language which contains all and only those inputs that exploit the vulnerability. A vulnerability signature is a representation (e.g., a regular expression) of the vulnerability language. Unlike exploit-based signatures whose error rate can only be empirically measured for known test cases, the quality of a vulnerability signature can be formally quantified for all possible inputs. We provide a formal definition of a vulnerability signature and investigate the computational complexity of creating and matching vulnerability signatures. We also systematically explore the design space of vulnerability signatures. We identify three central issues in vulnerability-signature creation: how a vulnerability signature represents the set of inputs that may exercise a vulnerability, the vulnerability coverage (i.e., number of vulnerable program paths) that is subject to our analysis during signature creation, and how a vulnerability signature is created for a given representation and coverage. We propose new data-flow analysis and a novel adoption of existing techniques, such as constraint solving, for automatically generating vulnerability signatures. We have built a prototype system to test our techniques. Our experiments show that we can, using a single exploit, automatically generate a vulnerability signature which is of much higher quality than previous exploit-based signatures. In addition, our techniques have several other security applications, and thus may be of independent interest.

DTIC

Computer Information Security; Computers; Signatures; Vulnerability

20070010935 Naval Postgraduate School, Monterey, CA USA

Traffic Profiling in Wireless Sensor Networks

Kirykos, Georgios; Dec 2006; 87 pp.; In English; Original contains color illustrations

Report No.(s): AD-A462611; No Copyright; Avail.: CASI: [A05](#), Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA462611>

Network security is vital in wireless networks that are widely used today. We desire wireless networks that maintain a high degree of confidentiality, integrity, and availability. Wireless sensor networks pose unique challenges and limitations to the traditional schemes, which are used in the other wireless networks for security protection, and are due mainly to the increased vulnerability of physical attacks, energy and communication limitations. This thesis introduces the foundations of a network and anomaly-based Intrusion Detection System (IDS) tool, including both hardware and software components, that can be used for traffic profiling and monitoring of a wireless sensor network. The work demonstrates how the IDS should capture and store traffic and use this information to create traffic profiles and baselines for normal traffic behavior. Then it describes how these baselines can be used to generate alerts based on traffic variations that imply possible attacks. Profiles on typical implementations of wireless sensor networks were observed and analyzed. Finally, initial indications from basic analysis of wireless sensor network traffic demonstrated a high degree of self-similarity.

DTIC

Communication Networks; Radiotelephones; Traffic; Wireless Communication

20070010947 Naval Postgraduate School, Monterey, CA USA

The Department of Defense's Transition of Program of Record (POR) Systems from Internet Protocol Version Four (IPv4) to Internet Protocol Version Six (IPv6)

Perkins, Kyle L; Scott, Michael A; Dec 2006; 89 pp.; In English; Original contains color illustrations

Report No.(s): AD-A462663; No Copyright; Avail.: CASI: [A05](#), Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA462663>

The objective of this Joint Applied Project was to examine the technical, financial, and implementation aspects for DoD transitioning POR systems to IPv6. The research outlines the initial intended useful life and limitations of IPv4 and IPv6. The financial aspects of transitioning to IPv6 are examined from a programs perspective, relative to the Program Objective Memorandum (POM). Implementation of transition strategies and mechanisms are identified and courses of action for implementing the mandatory IPv6 requirement are recommended. The principal finding of this research is that DoD Global Information Grid (GIG) assets must function in a dual IPv4/IPv6 capacity when transitioning to IPv6 in order to maintain the relevance of currently fielded programs. Furthermore, legacy GIG assets should be transitioned using Technology Refresh or Software Block upgrade programs while paying careful attention to the effects the transition has on tactical network operations.

DTIC

Defense Program; Internets; Protocol (Computers)

20070010968 Naval Research Lab., Washington, DC USA

Applying the Dependability Paradigm to Computer Security

Meadows, Catherine; Jan 1995; 6 pp.; In English

Report No.(s): AD-A462692; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA462692>

Dependability is that property of a computer system such that reliance can justifiably be place on the service it delivers [Lap94]. In this paper we contrast the way different ways faults are handled in the dependability paradigm with the way they are handled in the current paradigms for secure system design. We show how the current security paradigm is generally restricted to a subset of the types of approaches used in dependability, largely concentrating on fault prevention and removal while neglecting fault tolerance and forecast, and argue that this paradigm is fast becoming obsolete. We discuss the implications of extending the security paradigm to cover the full range of options covered by dependability. In particular, we develop a rough outline of a fault model for security and show how it could be applied to better our understanding of the place of both fault tolerance and fault forecast in computer security.

DTIC

Computer Information Security; Fault Tolerance

20070011090 Naval Postgraduate School, Monterey, CA USA

Performance Analysis of the Mobile IP Protocol (RFC 3344 and Related RFCs)

Ng, Chin C; Dec 2006; 148 pp.; In English; Original contains color illustrations

Report No.(s): AD-A462537; No Copyright; Avail.: CASI: [A07](#), Hardcopy

Mobile IP defines the mechanisms and protocol behaviors necessary to facilitate the seamless flow of traffic to a mobile host that roams from its normal home network. Of particular interest in this research, is how this capability might support the relatively rapid roaming of a wirelessly connected host. This research is focused on isolating and analyzing the constituent components of the Mobile IP protocol for the purpose of identifying any component(s) that may be improved upon, or may be exploited by an attacker intent on denying or delaying proper handoff service.

DTIC

Internets; Protocol (Computers); Reliability Analysis

20070011108 Carnegie-Mellon Univ., Pittsburgh, PA USA

Abstraction Techniques for Parameterized Verification

Talupur, Muralidhar; Nov 2006; 278 pp.; In English; Original contains color illustrations

Report No.(s): AD-A462593; CMU-CS-06-169; No Copyright; Avail.: CASI: [A13](#), Hardcopy

Model checking is a well known formal verification technique that has been particularly successful for finite state systems such as hardware systems. Model checking essentially works by a thorough exploration of the state space of a given system. As such, model checking is not directly applicable to systems with unbounded state spaces like parameterized systems. The standard approach for applying model checking to unbounded systems is to extract finite state models from them using conservative abstraction techniques. Properties of interest can then be verified over the finite abstract models. In this thesis, we propose a novel abstraction technique for model checking parameterized systems. Parameterized systems are systems with replicated processes in which the number of processes is a parameter. This kind of replicated structure is quite common in practice. Standard examples of systems with replicated processes are cache coherence protocols, mutual exclusion protocols, and controllers on automobiles. As the exact number of processes is a parameter, the system is essentially an unbounded

system. The abstraction technique we propose, called environment abstraction, tries to simulate the way a human designer thinks about systems with replicated processes. The abstract models we construct are easy to compute and powerful enough to verify properties of interest without giving any spurious counterexamples. We have applied this abstraction method to several well known parameterized systems like cache coherence protocols and mutual exclusion protocols to demonstrate its efficacy. Importantly, we show how to remove a commonly used, but severely restricting assumption, called the atomicity assumption, while verifying parameterized systems.

DTIC

Extraction; Independent Variables

20070011135 Massachusetts Inst. of Tech., Lexington, MA USA

Performance Assessment of Intelligence, Surveillance, and Reconnaissance (ISR) Enterprise Workflows

Hurley, M B; Jones, P B; Jan 31, 2007; 47 pp.; In English

Contract(s)/Grant(s): FA8721-05-C-0002

Report No.(s): AD-A462746; TR-1118; No Copyright; Avail.: CASI: [A03](#), Hardcopy

This report presents an end-to-end assessment framework for C4ISR enterprises that identifies potential FOMs and thereby eliminates a significant fraction of the uncertainty the currently exists on how to assess the performance of these systems. The framework delineates how measurements from laboratory tests, operational experiments, and field deployments can be analyzed to produce accurate, quantitative descriptions of system performance. These FOMs not only inform the development and acquisition processes but also allow military users to ensure that they are optimizing the information enterprise to achieve improved operational capability. In fact, active participation by the military user community in defining appropriate FOMs is essential to providing users with systems that meet their operational needs. An analysis of a simple ISR enterprise through simulation is conducted to show how FOMs might be calculated and used to assess the relative merit of different communications architectures for the construction of a common operational picture (COP) among a collection of distributed sensors.

DTIC

Figure of Merit; Information Systems; Intelligence; Reconnaissance; Surveillance

20070011169 South Carolina Univ., Columbia, SC USA

New Metrics for Characterizing and Predicting Network Behavior

Johnson, Joseph E; Gudkov, Vladimir; Huang, Chin-Tser; Farkas, Cilia; Buell, Duncan; Jan 2007; 32 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): FA8750-04-2-0260; DARPA ORDER-T018/00; Proj-T018

Report No.(s): AD-A462797; No Copyright; Avail.: CASI: [A03](#), Hardcopy

Networks are systems of point (nodes) with connections among some pairs of nodes measuring the degree of linkage. Networks represent an entire problem domain of many of the most difficult and unsolved mathematical problems. The objective of this effort was to formulate a foundational structure for networks and specifically develop new mathematical metrics for the description of networks in order to usefully describe both the static and dynamic properties of networks. Specifically, these new metrics provide a means of monitoring networks such as internet traffic over time by identifying anomalies, malicious processes, and abnormal network behavior. The criteria used for establishing network metrics were: (a) well-defined mathematically, (b) lossless in the description of a network, (c) hierarchical in providing a sequence of numerical metrics of decreasing importance, (d) intuitive in order to guide the use of the mathematical network expansions and associated metric values, (e) descriptive of the inherent topology of the network and strengths of connectivity, (f) sufficiently fast computationally in order to be dynamically useful as a tool, and (g) ideally distinguishing types of metrics that are: (1) network invariants, (2) variables which have dynamic behavior, and (3) variables which are chaotic or random. Results include: (a) finding network metrics that satisfy these criteria, (b) building the computer software to derive such metrics for general networks, and (c) testing limited internet traffic with this software.

DTIC

Communication Networks; Predictions

20070011175 Naval Postgraduate School, Monterey, CA USA

Collection Management and Targeting Architecture

Schacher, Gordon; Irvine, Nelson; Nov 1, 2006; 81 pp.; In English; Original contains color illustrations

Report No.(s): AD-A462804; NPS-IS-06-004; No Copyright; Avail.: CASI: [A05](#), Hardcopy

The Joint Intelligence Interoperability Board sponsors the System Baseline Assessment interoperability experiments. A collection management and targeting architecture has been developed to support these experiments. The model is based on Air Force Air Operations Center doctrine with the addition of operational activities performed by a higher-authority and generic Component and Coalition Commands.

DTIC

Experiment Design; Interoperability

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*.

20070009617 Rutgers - The State Univ., New Brunswick, NJ USA

HITIQA: Scenario Based Question Answering

Kantor, Paul; Kelly, Diane; Rittman, Robert; Wacholder, Nina; Yamrom, Boris; Jan 2004; 9 pp.; In English; Original contains color illustrations

Report No.(s): AD-A461267; No Copyright; Avail.: CASI: [A02](#), Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA461267>

In this paper we describe some preliminary results of qualitative evaluation of the answering system HITIQA (High-Quality Interactive Question Answering) which has been developed over the last 2 years as an advanced research tool for information analysts. HITIQA is an interactive open-domain question answering technology designed to allow analysts to pose complex exploratory questions in natural language and obtain relevant information units to prepare their briefing reports in order to satisfy a given scenario. The system uses novel data-driven semantics to conduct a clarification dialogue with the user that explores the scope and the context of the desired answer space. The system has undergone extensive hands-on evaluations by a group of intelligence analysts representing various foreign intelligence services. This evaluation validated the overall approach in HITIQA but also exposed limitations of the current prototype.

DTIC

Artificial Intelligence; Natural Language (Computers)

20070009738 University of Southern California, Marina del Rey, CA USA

An Unsupervised Approach to Recognizing Discourse Relations

Marcu, Daniel; Echihiabi, Abdessamad; Jan 2002; 9 pp.; In English

Contract(s)/Grant(s): MDA908-02-C-0007; IIS-0097846

Report No.(s): AD-A462240; No Copyright; Avail.: CASI: [A02](#), Hardcopy

We present an unsupervised approach to recognizing discourse relations of CONTRAST, EXPLANATION-EVIDENCE, CONDITION and ELABORATION that hold between arbitrary spans of texts. We show that discourse relation classifiers trained on examples that are automatically extracted from massive amounts of text can be used to distinguish between some of these relations with accuracies as high as 93%, even when the relations are not explicitly marked by cue phrases.

DTIC

Bayes Theorem; Classifications; Classifiers; Linguistics; Natural Language Processing; Semantics

20070009756 Idaho Univ., Moscow, ID USA

Securing Mobile Agents Through Evaluation of Encrypted Functions

Lee, Hyungjick; Alves-Foss, Jim; Harrison, Scott; Jan 2004; 22 pp.; In English

Contract(s)/Grant(s): DMA972-00-1-0001; F30602-02-1-0178

Report No.(s): AD-A462024; No Copyright; Avail.: CASI: [A03](#), Hardcopy

The mobile agent technology is a new paradigm of distributed computing that can replace the conventional client-server model. However, it has not become popular due to some problems such as security. The fact that computers have complete control over all the programs makes it very hard to protect mobile agents from untrusted hosts. In this paper we propose a security approach for mobile agents, which protects mobile agents from malicious hosts. Our new approach prevents privacy attacks and integrity attacks to mobile agents from malicious hosts. Many people have proposed good security approaches, but most of them do not prevent both integrity and privacy attacks. We review a few security approaches for mobile agents, discuss their weaknesses and strengths, and propose a new approach that can fix many of their problems. One interesting

approach is mobile cryptography proposed by Sander and Tschudin. It encrypts mobile agents and the encrypted mobile agents are executable without decryption. Implementing mobile cryptography requires an interesting types of cryptosystem called homomorphic encryption scheme, which allows direct computation on encrypted data, but none of such a homomorphic encryption scheme is known yet.

DTIC

Cryptography; Homomorphisms; Computer Systems Programs; Computer Information Security

20070009832 Massachusetts Univ., Amherst, MA USA

On the Development of Visual Object Memory: The Stay/Go Decision Problem

Morrison, Clayton T; Cohen, Paul R; Sebastiani, Paola; Jan 2002; 7 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DASG60-99-C-0074

Report No.(s): AD-A461329; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA461329>

A developing memory requires a mechanism for deciding how much information to gather, based on what is currently represented in memory. That is, we need to know when we have seen enough to say we have or have not seen this before, or that we need to continue collecting data. We present a novel statistical approach to this decision mechanism. This serves as the foundation for a simple visual object memory. We present results from simulations showing that the statistical measure can serve as the basis of the stay/go decision process.

DTIC

Pattern Recognition; Memory

20070009903 SRI International Corp., Menlo Park, CA USA

Evaluation of Stereosys vs. other Stereo Systems

Hannah, Marsha J; Oct 10, 1985; 9 pp.; In English

Contract(s)/Grant(s): MDA903-83-C-0027

Report No.(s): AD-A461667; TN-365; No Copyright; Avail.: CASI: A02, Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA461667>

As previously reported [Fischler, 1984], SRI International is implementing a complete, state-of-the-art stereo system that will produce dense three-dimensional (3-D) data from stereo pairs of intensity images. This system forms a framework for much of our stereo research and will be a base component of our planned expert system for 3-D compilation. Ideally, we would assess the capabilities of our system by running it on a data set that has known ground truth against which to compare our results. Unfortunately, such data sets do not currently exist because of the extremely high cost of the ground work necessary to measure terrain elevations accurately for a close spacing and to assess the heights of all vegetation and buildings in the area. Lacking such a data set, we can only compare our results against those produced by other stereo systems or against the perceptions of a human looking at the same imagery in stereo on a CRT. To test our system, currently called STEREOSYS, we have run it on several data sets, including two for which we also have results produced by the DIMP system at the U.S. Army Engineer Topographic Laboratories (ETL). Comparing our matching results to DIMP results or to human perception of what the correct match should be, we have begun to assess the strengths and weaknesses of STEREOSYS's matching techniques, as well as accumulating a catalog of examples of difficult areas for matching [Hannah, 1985]. A description of the experiments that we have conducted and our preliminary conclusions regarding the accuracy of the system are set forth in this report.

DTIC

Image Processing; Perception

20070009914 SRI International Corp., Menlo Park, CA USA

Resolution for Epistemic Logics

Konolige, Kurt; Aug 25, 1991; 33 pp.; In English

Contract(s)/Grant(s): N00014-85-C-0251; N00039-84-C-0211

Report No.(s): AD-A461010; TN-447; No Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA461010>

Quantified modal logics have emerged as useful tools in computer science for reasoning about knowledge and belief of agents and systems. An important class of these logics have a possible-world semantics from Kripke. In this paper we report on a resolution proof method for logics of belief that is suitable for automatic reasoning in common sense domains. This

method is distinguished by its use of an unrestricted first-order modal language, a ‘bullet operator’ for dealing with quantified-in variables and skolemization, semantic attachment methods for analyzing the belief operators, and an efficient implementation using a slight modification of ordinary first-order resolution.

DTIC

Artificial Intelligence; Mathematical Logic

20070009916 California Univ., Santa Cruz, CA USA

Variable Projection for Near-Optimal Filtering in Low Bit-Rate Block Coders

Tsaig, Yaakov; Elad, Michael; Milanfar, Peyman; Golub, Gene H; Jan 2005; 8 pp.; In English

Contract(s)/Grant(s): CCR-9984246; CCR-9971010

Report No.(s): AD-A461037; No Copyright; Avail.: CASI: [A02](#), Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA461037>

Recent work on block-based compression for low bit-rate coding has shown that employing a block coder within a sampling scheme where the image is downsampled prior to coding (and upsampled after the decoding stage) results in superior performance compared to standard block coding. In this paper, we explore the use of optimal decimation and interpolation filters in this coding scheme. We show that the problem of finding optimal filters for a general, unknown, black-box coder can be written as a separable least squares problem in two sets of variables. We then elegantly solve this optimization problem using the Variable Projection method. The experimental results presented clearly exhibit a significant improvement over existing approaches.

DTIC

Coders; Electronic Equipment; Coding

20070009917 SRI International Corp., Menlo Park, CA USA

Reasoning About Control: An Evidential Approach

Wesley, Leonard P; Lowrance, John D; Garvey, Thomas D; Jul 30, 1984; 43 pp.; In English

Contract(s)/Grant(s): N00014-81-C-0115; N00014-82-K-0464

Report No.(s): AD-A461039; SRI-PROJ-6386; No Copyright; Avail.: CASI: [A03](#), Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA461039>

Expert systems that operate in complex domains are continually confronted with the problem of deciding what to do next. Being able to reach a decision requires, in part, having the capacity to ‘reason’ about a set of alternative actions. It has been argued that expert systems must reason from evidential information -- i.e., uncertain, incompletes, and occasionally inaccurate information. As a consequence, a model for reasoning about control must be capable of performing several tasks: to combine the evidential information that is generically distinct and from disparate sources; to overcome minor inaccuracies in the evidential information that is needed to reach a decision; to reason about what additional evidential information is required; to explain the actions taken (based on such information) by the system. These are a few of the formidable control problems that remain largely unsolved. If expert systems are to improve their performance significantly, they must utilize increasingly sophisticated and general models for dealing with the evidential information required for reasoning about their behavior. To this end we present an alternative, evidentially-based approach to reasoning about control that has several advantages over existing techniques. It enables us to reason from limited and imperfect information; to partition bodies of meta- and domain-knowledge into modular components; and to order potential actions flexibly by allowing any number of constraints (i.e., control strategies) to be imposed over a set of alternative actions. Furthermore, because it can be used for reasoning about the expenditure of additional resources to obtain the evidential information needed as a basis for choosing among alternatives, this approach can be employed recursively.

DTIC

Information Theory; Domains; Information Systems

20070009918 SRI International Corp., Menlo Park, CA USA

An Inductive Approach to Figural Perception

Barnard, Stephen T; Sep 19, 1984; 26 pp.; In English

Contract(s)/Grant(s): MDA903-83-C-0027

Report No.(s): AD-A461040; SRI-PROJ-5355; No Copyright; Avail.: CASI: [A03](#), Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA461040>

The problem of interpreting single images of abstract figures is addressed. It is argued that neither rule-based deductive

inference nor model-based matching are satisfactory computational paradigms for this problem. As an alternative, an inductive approach consisting of two parts is presented. The first part involves a scheme, based on differential geometry, for describing the shapes of curves and surfaces, and for generating these descriptions from images. The second part of the approach relies on a criterion for deciding which description, among the candidates allowed by the constraints in the image, is to be preferred. This criterion -- minimum entropy -- is related to concepts from Gestalt psychology, thermodynamics, and information theory. Several examples are given to illustrate the inductive approach.

DTIC

Images; Perception

20070010589 NASA Johnson Space Center, Houston, TX, USA

Evolution of the Space Station Robotic Manipulator

Razvi, Shakeel; Burns, Susan H.; [2007]; 1 pp.; In English; 58th International Astronautic Congress, 24-28 Sept. 2007, Hyderabad, India

Contract(s)/Grant(s): 401769.06.03.06.02.17; No Copyright; Avail.: CASI: [A01](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20070010589>

The Space Station Remote Manipulator System (SSRMS), Canadarm2, was launched in 2001 and deployed on the International Space Station (ISS). The Canadarm2 has been instrumental in ISS assembly and maintenance. Canadarm2 shares its heritage with the Space Shuttle Arm (Canadarm). This article explores the evolution from the Shuttle Canadarm to the Space Station Canadarm2 design, which incorporates a 7 degree of freedom design, larger joints, and changeable operating base. This article also addresses phased design, redundancy, life and maintainability requirements. The design of Canadarm2 meets unique ISS requirements, including expanded handling capability and the ability to be maintained on orbit. The size of ISS necessitated a mobile manipulator, resulting in the unique capability of Canadarm2 to relocate by performing a walk off to base points located along the Station, and interchanging the tip and base of the manipulator. This provides the manipulator with reach and access to a large part of the Station, enabling on-orbit assembly of the Station and providing support to Extra-Vehicular Activity (EVA). Canadarm2 is evolving based on on-orbit operational experience and new functionality requirements. SSRMS functionality is being developed in phases to support evolving ISS assembly and operation as modules are added and the Station becomes more complex. Changes to sustaining software, hardware architecture, and operations have significantly enhanced SSRMS capability to support ISS mission requirements. As a result of operational experience, SSRMS changes have been implemented for Degraded Joint Operations, Force Moment Sensor Thermal Protection, Enabling Ground Controlled Operations, and Software Commutation. Planned Canadarm2 design modifications include: Force Moment Accommodation, Smart Safing, Separate Safing, and Hot Backup. In summary, Canadarm2 continues to evolve in support of new ISS requirements and improved operations. It is a tribute to the design that this evolution can be accomplished while conducting critical on-orbit operations with minimal hardware changes.

Author

Support Systems; Space Stations; Manipulators; Mission Planning; International Space Station; Thermal Protection; Spacecraft Design; Robot Arms

20070010891 Clemson Univ., SC USA

Dynamic Modelling for Planar Extensible Continuum Robot Manipulators

Tatlicioglu, E; Walker, Ian D; Dawson, Darren M; Jan 2006; 28 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): N66001-C-8043

Report No.(s): AD-A462495; CU/CRB/9/15/06 1; No Copyright; Avail.: CASI: [A03](#), Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA462495>

In this paper, a new dynamic model for continuum robot manipulators is derived. The dynamic model is developed based on the geometric model of extensible continuum robot manipulators with no torsional effects. The development presented in this paper is an extension of the dynamic model proposed by Mochiyama and Suzuki to include a class of extensible continuum robot manipulators. Numerical simulation results are presented for a planar 3-link extensible continuum robot manipulator.

DTIC

Continuums; Dynamic Models; Manipulators; Mathematical Models; Robot Arms; Robots

20070010931 Clemson Univ., SC USA

Vision-Based Leader/Follower Tracking for Nonholonomic Mobile Robots

Kannan /Vilas K /Chitrakaran, Hariprasad; Dawson, Darren M; Burg, Timothy; Jan 2006; 8 pp.; In English; Original contains color illustrations

Report No.(s): AD-A462604; CU/CRB/09/25/06/ 1; No Copyright; Avail.: CASI: [A02](#), Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA462604>

This paper presents a strategy for a nonholonomic mobile robot to autonomously follow a target based on vision information from an onboard pan camera unit (PCU). Homography-based techniques are used to obtain relative position and orientation information from the monocular camera images. The proposed kinematic controller, based on the Lyapunov method, achieves uniform ultimately bounded (UUB) tracking.

DTIC

Robots; Targets

20070011101 Clemson Univ., SC USA

Neural Network Grasping Controller for Continuum Robots

Braganza, D; Dawson, D M; Walker, I D; Nath, N; Jan 2006; 12 pp.; In English; Original contains color illustrations

Report No.(s): AD-A462583; CU/CRB/3/2/06/ 1; No Copyright; Avail.: CASI: [A03](#), Hardcopy

Continuum or hyper-redundant robots are robots which exhibit behavior similar to biological trunks, tentacles and snakes. Unlike traditional robots, continuum robot manipulators do not have rigid joints, hence the manipulators are compliant, extremely dexterous, and capable of dynamic, adaptive manipulation in unstructured environments; however, the development of high-performance control algorithms for these manipulators is a challenging problem. In this paper, we present an approach to whole arm grasping control for continuum robots. The grasping controller is developed in two stages; high level path planning for the grasping objective, and a low level joint controller using a neural network feedforward component to compensate for dynamic uncertainties. These techniques are used to enable whole arm grasping without using contact force measurements and without using a dynamic model of the continuum robot. Experimental results using the OCTARM, a soft continuum robotic manipulator are included to illustrate the efficacy of the proposed low level joint controller.

DTIC

Continuums; Controllers; Manipulators; Neural Nets; Robots

20070011120 Carnegie-Mellon Univ., Pittsburgh, PA USA

Agendas for Multi-Agent Learning

Gordon, Geoffrey J; Dec 2006; 35 pp.; In English; Original contains color illustrations

Report No.(s): AD-A462725; CMU-ML-06-116; No Copyright; Avail.: CASI: [A03](#), Hardcopy

Shoham et al. [1] identify several important agendas which can help direct research in multi-agent learning. We propose two additional agendas called modelling and design which cover the problems we need to consider before our agents can start learning. We then consider research goals for modelling, design, and learning, and identify the problem of finding learning algorithms that guarantee convergence to Pareto-dominant equilibria against a wide range of opponents. Finally, we conclude with an example: starting from an informally-specified multi-agent learning problem, we illustrate how one might formalize and solve it by stepping through the tasks of modelling, design, and learning. This report is an extended version of a paper which will appear in a special issue of Artificial Intelligence Journal [2]; in addition to the topics covered in that paper, this report contains several appendices providing extra details on various algorithms, definitions, and examples.

DTIC

Algorithms; Machine Learning

20070011193 Naval Research Lab., Washington, DC USA

A New Paradigm Hidden in Steganography

Moskowitz, Ira S; Longdon, Garth E; Chang, LiWu; Jan 2000; 11 pp.; In English; Original contains color illustrations

Report No.(s): AD-A462825; No Copyright; Avail.: CASI: [A03](#), Hardcopy

We discuss how steganography, in contrast to similar disciplines, requires a new paradigm based upon discontinuities and the absence of noise as a detection deterrent.

DTIC

Cryptography; Steganography

20070011206 Georgia Inst. of Tech., Atlanta, GA USA

Robotic Discovery of the Auditory Scene

Martinson, E; Schultz, A; Jan 2007; 7 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): N00014-06-WX3-0002

Report No.(s): AD-A462842; No Copyright; Avail.: CASI: [A02](#), Hardcopy

In this work, we describe an autonomous mobile robotic system for finding and investigating ambient noise sources in the environment. Motivated by the large negative effect of ambient noise sources on robot audition, the long-term goal is to provide awareness of the auditory scene to a robot, so that it may more effectively act to filter out the interference or re-position itself to increase the signal-to-noise ratio. Here, we concentrate on the discovery of new sources of sound through the use of mobility and directed investigation. This is performed in a two-step process. In the first step, a mobile robot first explores the surrounding acoustical environment, creating evidence grid representations to localize the most influential sound sources in the auditory scene. Then in the second step, the robot investigates each potential sound source location in the environment so as to improve the localization result, and identify volume and directionality characteristics of the sound source. Once every source has been investigated, a noise map of the entire auditory scene is created for use by the robot in avoiding areas of loud ambient noise when performing an auditory task.

DTIC

Ambience; Noise (Sound); Robotics; Robots; Sound Localization

20070011208 Naval Research Lab., Washington, DC USA

Auditory Perspective Taking

Martinson, Eric; Brock, Derek; Jan 2006; 3 pp.; In English; Original contains color illustrations

Report No.(s): AD-A462844; No Copyright; Avail.: CASI: [A01](#), Hardcopy

Auditory perspective taking is imagining being in another's place, and predicting what they are able to hear and how it will affect their general comprehension. From this knowledge of another's auditory perspective, a conversational partner can then adapt his or her auditory output to overcome a variety of environmental challenges and insure that what is said is intelligible. In collaborative activities, perspective taking skills greatly facilitate the effort participants must make in communicating with each other. By focusing on perspective taking in the auditory domain, one seeks to allow a robot to use its knowledge of the environment, both a priori and sensed, to predict what its human counterpart can hear and effectively understand. Equipped with this knowledge, the robot can change its auditory presentation behavior accordingly. In the case of the helicopter flying overhead, for instance, the robot should be able to predict the inability of its addressee to adequately hear what it is saying and either try to talk louder or simply pause until noise levels return to normal. Either option is something that is easily implemented, and which could go far towards improving the quality of human-robot interaction. In general, a robot capable of auditory perspective taking could pay attention to a number of different factors that might affect human robot communication: masking noises, interruptions/distractions, changes in operator or robot position, and individual differences between different operators. As people can adapt to each of these naturally, a robot speech interface unable to similarly adapt is likely to prove frustrating to a human partner. In this poster presentation, the authors explore the concept of auditory perspective taking using an audio-visual robot speech interface.

DTIC

Human-Computer Interface; Robots; Voice Communication

20070011227 Georgia Inst. of Tech., Atlanta, GA USA

Auditory Evidence Grids

Martinson, Eric; Schultz, Alan; Jan 2006; 7 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): N00014-05-WX-30022

Report No.(s): AD-A462871; No Copyright; Avail.: CASI: [A02](#), Hardcopy

Sound source localization on a mobile robot can be a difficult task due to a variety of problems inherent to a real environment, including robot ego-noise, echoes, and the transient nature of ambient noise. As a result, source localization data are often very noisy and unreliable. In this work, we overcome some of these problems by combining the localization evidence over a variety of robot poses using an evidence grid. The result is a representation that localizes the pertinent objects well over time, can be used to filter poor localization results, and may also be useful for global re-localization from sound localization results.

DTIC

Acoustics; Robots; Sound Localization

NUMERICAL ANALYSIS

Includes iteration, differential and difference equations, and numerical approximation.

20070009892 Michigan Univ., Ann Arbor, MI USA

Satometer: How Much Have We Searched? (Preprint)

Aloul, Fadi A; Sierawski, Brian D; Sakallah, Karem A; Jun 1, 2002; 18 pp.; In English; Original contains color illustrations
Report No.(s): AD-A461999; No Copyright; Avail.: CASI: [A03](#), Hardcopy

We introduce Satometer, a tool that can be used to estimate the percentage of the search space actually explored by a backtrack SAT solver. Satometer calculates a normalized minterm count for those portions of the search space identified by conflicts. The computation is carried out using a zero-suppressed binary decision diagram (ZBDD) data structure and can have adjustable accuracy. The data provided by Satometer can help diagnose the performance of SAT solvers and can shed light on the nature of a SAT instance.

DTIC

Data Structures; Search Profiles; Algorithms

20070009900 SRI International Corp., Menlo Park, CA USA

Stereo Integral Equation

Smith, Grahame B; Sep 3, 1986; 16 pp.; In English

Contract(s)/Grant(s): MDA903-83-C-0027; DACA76-85-C-0004

Report No.(s): AD-A461660; AIC-TN-379; No Copyright; Avail.: CASI: [A03](#), Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA461660>

A new approach to the formulation and solution of the problem of recovering scene topography from a stereo image pair is presented. The approach circumvents the need to solve the correspondence problem, returning a solution that makes surface interpolation unnecessary. The methodology demonstrates a way of handling image analysis problems that differs from the usual linear-system approach. We exploit the use of nonlinear functions of local image measurements to constrain and infer global solutions that must be consistent with such measurements. Because the solution techniques we present entail certain computational difficulties, significant work still lies ahead before they can be routinely applied to image analysis tasks.

DTIC

Integral Equations; Linear Systems; Image Analysis

20070010019 NASA Johnson Space Center, Houston, TX, USA

Simple and Efficient Numerical Evaluation of Near-Hypersingular Integrals

Fink, Patricia W.; Wilton, D. R.; Khayat, Michael A.; [2007]; 5 pp.; In English; Copyright; Avail.: CASI: [A01](#), Hardcopy

Simple and efficient numerical procedures for evaluating the gradient of Newton-type potentials are presented. Convergences of both normal and tangential components of the gradient are examined. The convergence of the vector potential is also examined, and it is shown that the scheme for handling near-hypersingular integrals also is effective for the nearly singular potential terms.

Author

Numerical Integration; Singular Integral Equations; Newton Theory; Convergence

20070010881 Virginia Polytechnic Inst. and State Univ., Blacksburg, VA USA

Dynamic Testing of In-Situ Composite Floors and Evaluation of Vibration Serviceability Using the Finite Element Method

Barrett, Anthony R; Aug 21, 2006; 452 pp.; In English; Original contains color illustrations

Report No.(s): AD-A462460; No Copyright; Avail.: CASI: [A20](#), Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA462460>

The presented research examined three areas: best practices in high quality dynamic testing of in-situ floor systems, extensive dynamic testing of three bare (non-fit out) in-situ multi-bay steel composite floors to estimate their dynamic parameters/response and to identify trends in dynamic behavior, and development of a set of fundamental finite element (FE) modeling techniques to adequately represent the dynamic response of steel composite floors for the purpose of evaluating vibration serviceability. The measurement, analysis, and computation of a floor's accelerance frequency response function (FRF) is the core premise linking all areas of the presented research. The burst chirp signal using an electrodynamic shaker

is recommended as the most accurate and consistent source of excitation for acquiring high quality measurements suitable for use in parameter estimation, operating deflection shape animation, and calibration/validation of FE models. A reduced mid-bay testing scheme is recommended as a time-saving alternative to modal testing over a full coverage area, provided the only desired estimated parameters are frequencies, damping, and mid-bay acceleration response. Accelerance FRFs were measured with an electrodynamic shaker located within 23 unique bays on the three tested floors. Dominant frequencies ranged from 4.85 Hz to 9 Hz and measured estimates of damping varied considerably, ranging from 0.44% to 2.4% of critical (0.5%-1.15% was typical). Testing showed several mode shapes were localized to just a few bays and not all modes were adequately excited by forcing at a single location. The quality of the estimated mode shapes was significantly improved using multi-reference modal testing.

DTIC

Dynamic Tests; Finite Element Method; Floors; Vibration

20070010895 Carnegie-Mellon Univ., Pittsburgh, PA USA

Confidentiality Policies and Their Extraction from Programs

Tschantz, Michael C; Wing, Jeannette M; Feb 9, 2007; 38 pp.; In English

Contract(s)/Grant(s): DAAD19-02-1-0389

Report No.(s): AD-A462503; CMU-CS-07-108; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA462503>

We examine a well known confidentiality requirement called noninterference and argue that many systems do not meet this requirement despite maintaining the privacy of its users. We discuss a weaker requirement called incident-insensitive noninterference that captures why these systems maintain the privacy of its users while possibly not satisfying noninterference. We extend this requirement to depend on dynamic information in a novel way. Lastly, we present a method based on model checking to extract from program source code the dynamic incident-insensitive noninterference policy that the given program obeys.

DTIC

Computer Information Security; Extraction; Policies; Privacy

20070010924 Naval Postgraduate School, Monterey, CA USA

Development of a Three Dimensional Perfectly Matched Layer for Transient Elasto-Dynamic Analyses

Johnson, Anthony N; Dec 2006; 152 pp.; In English; Original contains color illustrations

Report No.(s): AD-A462592; No Copyright; Avail.: CASI: A08, Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA462592>

A time-dependent, three-dimensional finite element approach to the development of a perfectly matched layer for numerical calculations of surface wave radiation in a half space is presented. The development of this new element required the coupling of a system of linear, second-order, partial differential equations which describe elastic wave propagation into a single weak-form (Galerkin) wave equation, from which the characteristics of a composite finite element matching layer were derived. An important problem of interest, and the motivation for this work, is the optimization of a source for use in a seismo-acoustic sonar for the detection of buried mines. Various source excitations are presented which maximize the energy of the unidirectional Rayleigh wave while suppressing the energy of associated body waves. The hp-adaptive finite element code SAFE-T (Solid Adaptive Finite Element - Transient), a Finite Element Method (FEM) implementation developed by the author utilizing Altair Engineering's Prophlex kernel, is used to perform the numerical computations. Results for radial and vertical wave strengths are given. This work represents an important step forward in the development of tools needed to pursue seismo-acoustic sonar technology for buried mine detection, as well as for the analysis of all three-dimensional, time-dependent elasto-dynamic problems.

DTIC

Finite Element Method; Mine Detectors; Partial Differential Equations; Perfectly Matched Layers; Sonar

20070010929 Clemson Univ., SC USA

Multi-Scenario Multi-Criteria Optimization in Engineering Design

Wiecek, Margaret M; Singh, Vijay; Blouin, Vincent; Jan 2007; 26 pp.; In English

Report No.(s): AD-A462600; No Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA462600>

Motivated by applications in engineering design, a mathematical model of the multi-scenario multi-criteria optimization

problem is introduced. Theoretical results for the single-scenario case are presented to support a solution methodology developed for the bi-scenario bi-criteria case. Multi-scenario design problems are traditionally solved by aggregation of all objectives of all scenarios into a large multi-criteria problem. The difficulties that arise from this approach are highlighted. The proposed methodology is a scenario-based approach where a design problem is solved for each scenario resulting in multiple sets of solutions. The methodology is developed as an exploration tool of these solution sets in both the design and objective spaces. The methodology is applicable to problems with large numbers of scenarios and/or criteria. Mathematical and structural examples are included to illustrate the implementation of the methodology, its strengths and weaknesses.

DTIC

Design Analysis; Optimization; Systems Engineering

20070010930 Clemson Univ., SC USA

Cone Characterizations of Approximate Solutions in Real-Vector Optimization

Engau, Alexander; Wiecek, Margaret M; Oct 2005; 31 pp.; In English

Report No.(s): AD-A462602; TR2005_10_EW; No Copyright; Avail.: CASI: [A03](#), Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA462602>

Borrowing concepts from linear algebra and convex analysis, it has been shown how the feasible set for a general vector optimization problem can be mapped under a linear transformation so that Pareto points in the image correspond to nondominated solutions for the original problem. The focus of this paper is to establish corresponding results for approximate nondominated points, based on a new characterization of these solutions using the concept of translated cones. The problem of optimizing over this set of approximate solutions is addressed and possible applications are given in the references.

DTIC

Approximation; Optimization; Vector Analysis

20070010932 Clemson Univ., SC USA

A Lyapunov-Based Method for Estimation of Euclidean Position of Static Features Using a Single Camera

Chitrakaran, Vilas K; Dawson, Darren M; Jan 2006; 8 pp.; In English; Original contains color illustrations

Report No.(s): AD-A462605; CU/CRB/9/11/06/ 1; No Copyright; Avail.: CASI: [A02](#), Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA462605>

In this paper, we present the design of an adaptive nonlinear algorithm for estimation of Euclidean position of features in a static environment in the field of view of a monocular camera. The development of the geometric model and camera motion kinematics is based on our previous work in [2]. This paper presents a new alternate approach to estimation of 3D coordinates of feature points that is simpler in mathematical formulation and easier to implement.

DTIC

Cameras; Estimates; Euclidean Geometry; Liapunov Functions; Statics

20070011089 Naval Postgraduate School, Monterey, CA USA

Modeling Studies of the Coastal/Littoral Current System off Southern Australia

Miller, Henry A; Dec 2006; 430 pp.; In English; Original contains color illustrations

Report No.(s): AD-A462536; No Copyright; Avail.: CASI: [A19](#), Hardcopy

Both theoretical and numerical modeling studies of the current system off western and southern Australia are conducted to characterize the features of the current system, their temporal variability, and their impact on the sound speed structure. The theoretical study examines why boundary current separation occurs off Cape Leeuwin creating an area of enhanced eddy generation. It is shown that the beta effect, vortex stretching, and streamline curvature all act to decelerate the current and to thus enhance separation. The current is then turned left under the influence of Coriolis force and subsequently forms meanders which then detach from the current as eddies. The model results, using the Princeton Ocean Model (POM), reproduce the main features of the current system. They also provide insight into the generation of the main features. In particular, the current direction is caused by the thermohaline gradient, while topography is responsible for the location of the current along the shelf break. Current speed results from a combination of thermohaline gradient, the opposing wind, and topography, while meanders and eddies result from the opposition of the thermohaline and wind forcing. The gyre and upwelling in the Great Australian Bight are caused by the change in wind direction in summer. Daily wind experiments are shown to capture the seasonal variability of the current system with the Leeuwin Current along the western coast stronger in winter than in summer and mesoscale activity highest in summer. Seasonal and interannual variability are highlighted with the gyre and upwelling in the bight and along Kangaroo Island appearing intermittently but always in summer. Lastly mesoscale features in the current

system, advection of water by the surface current and undercurrent, eddies, and upwelling are all shown to cause significant changes in sound speed which can adversely affect sonar operations.

DTIC

Australia; Coastal Currents; Coasts; Ocean Currents; Ocean Models; Regions

20070011168 Woods Hole Oceanographic Inst., MA USA

Initial Results from a Cartesian Three-Dimensional Parabolic Equation Acoustical Propagation Code

Duda, Timothy F; Dec 2006; 20 pp.; In English

Contract(s)/Grant(s): N00014-05-1-0482

Report No.(s): AD-A462796; WHOI-2006-14; No Copyright; Avail.: CASI: [A03](#), Hardcopy

A three-dimensional (3D) parabolic equation acoustical propagation code has been developed and run successfully. The code is written in the MATLAB language and runs in the MATLAB environment. The code has been implemented in two versions, applied to: (1) Horizontal low-frequency (100 to 500 Hz) propagation through the shallow water waveguide environment; (2) Vertical high-frequency propagation (6 to 15 kHz) to study normal-incidence reflection from the lower side of the ocean surface. The first edition of the code reported on here does not implement refinements that are often found in 2D propagation models, such as allowing density to vary, optimally smoothing sound-speed discontinuities at the water/seabed interface, and allowing an omni-directional source. The code is part of a development effort to test the applicability of 2D (and N by 2D) models, which have more refinements than this model, to the study of fully 3D propagation problems, such as sound transiting steep nonlinear coastal-area internal waves and/or sloping terrain, and to provide a numerical tool when the full 3D solution is needed.

DTIC

Acoustic Propagation; Cartesian Coordinates; Equations; Parabolas; Parabolic Differential Equations; Sound Transmission

20070011243 Massachusetts Inst. of Tech., Cambridge, MA USA

Follow-on Effort of LAMP-QBEM Development: Large Amplitude Motion Program Using Quadratic Boundary Element Method

Yue, Dick K; Liu, Yuming; Jan 26, 2007; 4 pp.; In English

Contract(s)/Grant(s): N00014-06-1-0137

Report No.(s): AD-A462919; No Copyright; Avail.: CASI: [A01](#), Hardcopy

The objective is to further develop LAMP-QBEM, an efficient computational tool for the prediction of large amplitude ship motions and hydrodynamic loads. The key developments in this study include handling of complicated ship geometry and the development of a stable, accurate and efficient algorithm for free-surface time integration.

DTIC

Boundary Element Method; Hydrodynamics; Luminaires; Ships

65

STATISTICS AND PROBABILITY

Includes data sampling and smoothing; Monte Carlo method; time series analysis; and stochastic processes.

20070009623 Carnegie-Mellon Univ., Pittsburgh, PA USA

Diffusion Kernels on Statistical Manifolds

Lafferty, John; Lebanon, Guy; Jan 16, 2004; 40 pp.; In English

Contract(s)/Grant(s): MDA904-00-C-2106

Report No.(s): AD-A461122; CMU-CS-04-101; No Copyright; Avail.: CASI: [A03](#), Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA461122>

A family of kernels for statistical learning is introduced that exploits the geometric structure of statistical models. The kernels are based on the heat equation on the Riemannian manifold defined by the Fisher information metric associated with a statistical family, and generalize the Gaussian kernel of Euclidean space. As an important special case, kernels based on the geometry of multinomial families are derived, leading to kernel-based learning algorithms that apply naturally to discrete data. Bounds on covering numbers and Rademacher averages for the kernels are proved using bounds on the eigenvalues of the Laplacian on Riemannian manifolds. Experimental results are presented from document classification, for which the use of

multinomial geometry is natural and well motivated, and improvements are obtained over the standard use of Gaussian or linear kernels, which have been the standard for text classification.

DTIC

Diffusion; Learning; Statistical Analysis

20070009728 Computational Physics, Inc., Springfield, VA USA

A Statistical Approach to WindSat Ocean Surface Wind Vector Retrieval

Smith, Craig K; Bettenhausen, Michael; Gaiser, Peter W; Jan 2006; 6 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): N000WX04730023

Report No.(s): AD-A462183; No Copyright; Avail.: CASI: [A02](#), Hardcopy

WindSat is the first space-based polarimetric microwave radiometer. It is designed to evaluate the capability of polarimetric microwave radiometry to measure ocean surface wind vectors from space. The sensor provides risk reduction for the National Polar-orbiting Operational Environmental Satellite System Conical Scanning Microwave Imager/Sounder, which is planned to provide wind vector data operationally starting in 2010. The channel set also enables retrieval of sea surface temperature, and columnar water vapor and cloud liquid water over the oceans. We describe statistical algorithms for retrieval of these parameters, and a combined statistical/maximum-likelihood estimator algorithm for retrieval of wind vectors. We present a quantitative analysis of the initial wind vector retrievals relative to QuikSCAT wind vectors.

DTIC

Ground Wind; Ocean Surface; Polarimetry; Radiometers; Statistical Analysis; Wind Direction; Wind Velocity

20070009796 Library of Congress, Washington, DC USA

U.S. Assistance to North Korea: Fact Sheet

Manyin, Mark E; Feb 11, 2005; 5 pp.; In English

Report No.(s): AD-A461411; CRS-RS21834; No Copyright; Avail.: CASI: [A01](#), Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA461411>

Since 1995, the USA has provided over \$1 billion in foreign assistance to the Democratic Peoples Republic of North Korea (DPRK, also known as North Korea). About 60% has taken the form of food aid and about 40% was energy assistance channeled through the Korean Peninsula Energy Development Organization (KEDO), the multilateral organization established in 1994 to provide energy aid in exchange for North Korea's pledge of that year to halt its existing nuclear program. This report provides statistical details of U.S. aid to North Korea, including the \$100,000 pledged in April 2004 to help survivors of a massive train explosion in the northwestern town of Ryongchon. As the table in the report shows, U.S. assistance to North Korea has fallen significantly over the past two years. In the fall of 2004, the North Korean government began restricting the activities of many humanitarian activities, including some of those by the World Food Program (WFP). Administration officials, including President Bush, have indicated that USA assistance might be forthcoming if North Korea began dismantling its nuclear programs, a subject being discussed in the six-party talks. The 108th Congress passed, and President Bush signed, H.R. 4011 (P.L. 108-333), the North Korean Human Rights Act, which includes hortatory language calling for 'significant increases' above current levels of U.S. support for humanitarian assistance to be conditioned upon 'substantial improvements' in transparency, monitoring, and access. Pyongyang has cited the Act as evidence of the USA's 'hostile policy' toward North Korea and has used it as justification to suspend its participation in the six-party talks. This report will be updated periodically to track changes in U.S. provision of aid to North Korea.

DTIC

North Korea; United States

20070009911 Brown Univ., Providence, RI USA

Large Deviation Principle for General Occupancy Models (Preprint)

Zhang, Jim X; Dupuis, Paul; Dec 1, 2004; 25 pp.; In English

Contract(s)/Grant(s): DAAD19-02-1-0425

Report No.(s): AD-A461986; No Copyright; Avail.: CASI: [A03](#), Hardcopy

We use process level large deviation analysis to obtain the rate function for a general family of occupancy problems. Our interest is the asymptotics of the empirical distributions of various quantities (such as the fraction of urns that contain a given number of balls). In the general setting, balls are allowed to land in a given urn depending on the urn's contents prior to the throw. We discuss a parametric family of statistical models which includes Maxwell-Boltzmann, Bose-Einstein and Fermi-Dirac statistics as special cases. A process level large deviation analysis is conducted and the rate function for the

original problem is then characterized, via the contraction principle, by the solution to a calculus of variations problem. We conjecture that the solution to the variational problem coincides with that of a finite dimensional minimization problem.

DTIC

Statistical Tests; Statistical Mechanics; Mathematical Models

20070010860 Naval Postgraduate School, Monterey, CA USA

Residual-Mean Analysis of the Air-Sea Fluxes and Associated Oceanic Meridional Overturning

Dare, Pierre-Yves; Dec 2006; 101 pp.; In English; Original contains color illustrations

Report No.(s): AD-A462427; No Copyright; Avail.: CASI: [A06](#), Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA462427>

The dynamic response of the oceanic mixed-layer to the thermodynamic forcing at the sea surface is analyzed in order to describe the pattern of the oceanic meridional overturning. The technique proposed in this study is based on residual-mean theory, which takes into account the transport of buoyancy and tracers by transient eddies. From the observed air-sea density flux and mixed-layer density distributions, we estimate the two components of the Meridional Overturning Circulation (MOC) corresponding to the adiabatic (along-isopycnal) advection and the diabatic (cross-isopycnal) flux. Calculations are performed for the global ocean and, additionally, for each oceanic basin. The proposed method extends the Walin (1982) mass transformation theory, and permits, for the first time, assessment of the strength of the MOC adiabatic component from the sea surface data. This study offers a statistical description of the atmospheric and oceanic databases and gives some suggestions for the choice of specific datasets. In particular, the two most reliable atmospheric climatology databases (ECMWF and NCEP/NCAR re-analyses) are compared, and the impact of their inaccuracies on the MOC calculations is evaluated.

DTIC

Air Water Interactions; Data Bases; Oceanographic Parameters

20070010878 Florida Univ., Gainesville, FL USA

Legacy Status as a Signal in College Admissions

Cabrera, Leonard D; Jan 2006; 153 pp.; In English

Report No.(s): AD-A462454; No Copyright; Avail.: CASI: [A08](#), Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA462454>

Opponents of legacy admit policies claim such policies are inherently discriminatory and contrary to a merit-based system yet many universities award admissions points to legacy applicants. The term 'legacy' is used to describe a college student whose parent is an alumnus of the same university. This dissertation looks at measurable performance benefits to investigate the idea that legacy status provides some information to admissions offices. Empirical data from the Air Force Academy graduating classes of 1994 to 2005 are used. The variables of interest include traditional academic measures as well as student choices of academic major and career field and several post-educational measures. Logit or multinomial logistic regressions are run for each performance measure while controlling for high school performance standardized test scores and demographic data. Legacy status has no significant impact on grades order x of merit college major or Air Force rank. However legacy status is associated with a 0.10 increase in the probability of graduation and 0.04 point higher military performance average. The graduation figure results from legacy admits being less likely to voluntarily quit and the results are even more dramatic for less qualified students. For graduates legacy status leads to a 0.09 increase in the probability of being a rated officer and 0.11 increase in the probability of serving at least 8 years in the Air Force. These results are robust to model specification.

DTIC

Probability Theory; Statistical Analysis; Universities

20070010969 University Coll., London, UK

Modeling Random Walk Processes In Human Concept Learning

Young, Richard M; May 2006; 17 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): FA8655-04-1-3052

Report No.(s): AD-A462700; No Copyright; Avail.: CASI: [A03](#), Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA462700>

This report results from a contract tasking University College London as follows: The primary objective was to investigate the scope and implications of random-walk-like processes in human concept learning, and the construction of cognitive models of concept learning valid at the level of individual subjects. The project distinguished two levels of cognition deployed

in the task: passive (automatic) learning of stimuli and their classification, as against deliberative processes such as hypothesis testing. Although the focus of research was intended to be on deliberative processing, realistic baseline assumptions about passive processing needed to be tested which proved to be unexpectedly difficult. Eventually, the source of random walk effects were found, in the time subjects take to learn to distinguish between confusingly similar stimuli. It is predicted that allowing a longer interval between trials will allow subjects more time to carry out deliberative processes, leading to better task performance.

DTIC

Cognition; Learning; Random Walk; Simulation

20070011098 Naval Postgraduate School, Monterey, CA USA

Observed Statistics of Extreme Waves

Laird, Anne M; Dec 2006; 67 pp.; In English; Original contains color illustrations

Report No.(s): AD-A462573; No Copyright; Avail.: CASI: [A04](#), Hardcopy

Amphibious landings and small boat operations are normally conducted only in benign wave conditions. An unexpected encounter with an isolated freak wave may damage equipment and prevent mission accomplishment. This study examines the occurrence of unusually large waves using data sets obtained with bottom mounted pressure sensors and wave buoys in the DUCK 94, SHOWEX, and SAX 04 experiments. All of the experiments include wave records from high energy events. After correcting the raw pressure data for hydrodynamic attenuation over the water column, the statistics of wave heights were evaluated and compared with the theoretical Rayleigh distribution of a narrow-band linear wave field. Observations from deep water sites follow the Rayleigh distribution well, even in extreme sea states, indicating that strong nonlinearity does not have a major effect on wave height statistics. However, during high energy events at shallow water sites, there are significantly less measured wave heights in the right-hand tail of the distribution of wave heights than the theoretical Rayleigh distribution would predict. These results show that waves become more homogeneous in height as they propagate into shallower water, possibly owing to breaking and nonlinear effects. While the observed wave statistics do not suggest a frequent occurrence of freak waves, isolated large waves were indeed observed, even in benign conditions. Further studies are needed to assess their risk to Navy operations.

DTIC

Ocean Surface; Water Waves

20070011113 SRI International Corp., Menlo Park, CA USA

Reconstructing Binary Polygonal Objects From Projections: A Statistical View

Milanfar, Peyman; Karl, William C; Willsky, Alan S; Sep 1994; 35 pp.; In English

Contract(s)/Grant(s): N00014-91-J-1004; DAAL03-92-G-0115

Report No.(s): AD-A462710; No Copyright; Avail.: CASI: [A03](#), Hardcopy

In many applications of tomography, the fundamental quantities of interest in an image are geometric ones. In these instances, pixel based signal processing and reconstruction is at best inefficient, and at worst, nonrobust in its use of the available tomographic data. Classical reconstruction techniques such as Filtered Back-Projection tend to produce spurious features when data is sparse and noisy; and these 'ghosts' further complicate the process of extracting what is often a limited number of rather simple geometric features. In this paper we present a framework that, in its most general form, is a statistically optimal technique for the extraction of specific geometric features of objects directly from the noisy projection data. We focus on the tomographic reconstruction of binary polygonal objects from sparse and noisy data. In our setting, the tomographic reconstruction problem is essentially formulated as a (finite dimensional) parameter estimation problem. In particular, the vertices of binary polygons are used as their defining parameters. Under the assumption that the projection data are corrupted by Gaussian white noise, we use the Maximum Likelihood (ML) criterion, when the number of parameters is assumed known, and the Minimum Description Length (MDL) criterion for reconstruction when the number of parameters is not known. The resulting optimization problems are nonlinear and thus are plagued by numerous extraneous local extreme, making their solution far from trivial. In particular, proper initialization of any iterative technique is essential for good performance. To this end, we provide a novel method to construct a reliable yet simple initial guess for the solution. This procedure is based on the estimated moments of the object, which may be conveniently obtained directly from the noisy projection data.

DTIC

Image Reconstruction; Optimization; Pattern Recognition; Polygons; Tomography

SYSTEMS ANALYSIS AND OPERATIONS RESEARCH

Includes mathematical modeling of systems; network analysis; mathematical programming; decision theory; and game theory.

20070009664 Defence Science and Technology Organisation, Edinburgh, Australia

A Thermodynamically Complete Model for One-Dimensional Two-Phase Flows With Heat Exchange

Resnyansky, A D; May 2006; 38 pp.; In English

Report No.(s): AD-A461431; DSTO-TR-1862; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA461431>

This publication reports on a compact presentation of a one-dimensional model for the description of two-phase flows with heat exchange. This model was proposed earlier in the form of a system of equations, containing the heat conduction and entropy conservation equations for each phase. In this report the system is formulated in a form that is consistent with the formulation of the preceding report of the author. The present system of equations uniformly describes the evolution of averaged variables and interphase fluctuation parameters. The correctness of the model has been established for convex equations of state and for proper compaction dynamics kinetics.

DTIC

Heat Transfer; Kinetics; Mathematical Models; Multiphase Flow; Thermodynamics; Two Phase Flow

20070009682 Progeny Systems Corp., Manassas, VA USA

Adaptive Role-Play Exercises for a Leader Development Center

Hertz, Michael; Nov 2006; 56 pp.; In English

Contract(s)/Grant(s): W91FD3-06-P-0023; Proj-M770

Report No.(s): AD-A460360; No Copyright; Avail.: CASI: [A04](#), Hardcopy

This report describes work performed under a Phase I Small Business Innovation Research Contract. This report describes two research and development activities. One effort was the creation of a plan for the development of a Leader Development Center. Progeny Systems proposed to create a simulation or scenario-driven computer-based assessment of an individual's leadership performance. In order to create this computer-based assessment solution, the relevant literature had to be reviewed to develop the theoretical framework for the proof of concept solution. The other significant effort was the creation of a system to deliver content, capture user responses, and report results out to an external system. This Simulation Delivery System was created using XML, web services and the .Net 2.0 framework to minimize the client-side code and keep as much processing and functionality on the web server as possible. Moving the functionality out of the Simulation Environment also granted flexibility in which Simulation Engine could be used. These web services were further split into three different, but complementary functions, Get Leadership Data, Get Simulation Parameters, and Store Leadership Simulation Results.

DTIC

Computerized Simulation; Education; Leadership

20070009686 Naval Postgraduate School, Monterey, CA USA

Effects-Based Planning: An Empirical Examination of the Process

Kemple, William G; Hutchins, Susan G; Adamo, Ron; Boger, Dan; Crowson, Jeffrey J; May 1, 2002; 17 pp.; In English

Report No.(s): AD-A460883; No Copyright; Avail.: CASI: [A03](#), Hardcopy

Recent world events have demonstrated that future conflicts will not necessarily be between nation states. Transnational threats to U.S. national security include drug cartels and international criminal and terrorist organizations. In response, the U.S. Joint Forces Command (JFCOM) is leading a transition toward a new approach to warfare. A cornerstone of this new approach is the concept of Rapid Decisive Operations (RDO), which integrate knowledge, command and control, and Effects-Based Operations (EBO) to achieve the desired strategic outcome or 'effect' on the enemy through the synergistic application of the full range of military and nonmilitary capabilities at all levels of conflict. In preparing for and conducting a RDO, the military acts in concert with and leverages the other instruments of national power to understand and reduce the adversary's critical capabilities and coherence. Focusing on effects, rather than attrition, enables a highly coordinated level of inter-service, interagency, and international cooperation. An experiment entitled 'Effects Tasking Order-to-Actions Limited Objective Experiment' (ETO-to-Actions LOE) was conducted at the JFCOM, Joint Experimentation Center, Suffolk, VA, 3-14 December, 2001, to examine aspects of EBO, and to specifically assess and refine the effects-based planning and assessment (EBP&A) process. Three surveys were administered during the experiment to gather data on the effectiveness of the following: (1) the collaborative tools and the training provided to the participants for this experiment, (2) knowledge management and

collaboration as critical aspects of effects-based planning, and (3) the EBP&A process. This paper describes the results of a subset of the survey on the EBP&A process, which included 43 items that participants rated using a 5-point Likert scale. This is a companion paper to two other papers that discuss the results of the other two surveys that were administered.

DTIC

Command and Control; Decision Making; Information Management; Military Operations; Planning; System Effectiveness

20070009688 Naval Postgraduate School, Monterey, CA USA

Knowledge Management and Collaboration in an Effects-Based Operations Environment

Hutchins, Susan G; Kemple, William G; Adamo, Ron; Boger, Dan; May 1, 2002; 16 pp.; In English; Original contains color illustrations

Report No.(s): AD-A460884; No Copyright; Avail.: CASI: [A03](#), Hardcopy

New warfighting concepts are currently under development to improve the ability of future Joint Force Commanders (JFCOM) to rapidly and decisively conduct particularly challenging and important operational missions as they transition to the fighting force described in Joint Vision 2020. This paper describes one element that is part of these new concepts: knowledge management and collaboration as conducted to support Effects-Based Operations (EBO). Collaboration offers great potential to better enable warfighters to plan, monitor, execute, and assess activities across the spectrum of joint functional areas. Collaboration also is essential to develop a shared situational awareness among heterogeneous, distributed team members. EBO is defined as a 'process for obtaining a desired strategic outcome, or 'effect' on the enemy, through the synergistic and cumulative application of the full range of national (military and nonmilitary) capabilities at all levels of conflict.' An experiment entitled 'Effects Tasking Order-to-Actions Limited Objective Experiment' (ETO-to-Actions LOE), was conducted at the JFCOM, Joint Experimentation Center, Suffolk, VA, 3-14 December, 2001, to examine aspects of EBO, and to specifically assess and refine the effects-based planning and assessment (EBP&A) process. Three surveys were administered during the experiment to gather data on the effectiveness of the following: (1) the collaborative tools and the training provided to the participants for this experiment, (2) knowledge management and collaboration as critical aspects of effects-based planning, and (3) the EBP&A process. This paper describes the results of a subset of the knowledge management and collaboration survey, which included 29 items that participants rated using a 5-point Likert scale. This is a companion paper to two other papers that discuss the results of the other two surveys that were administered.

DTIC

Command and Control; Information Management; Military Operations; Planning; System Effectiveness

20070009795 Paine Coll., Augusta, GA USA

The Control of Multi-Agent Systems (MAS)

Lawless, W F; Bergman, Margo; Feltoovich, Nick; Sep 2004; 33 pp.; In English; Original contains color illustrations

Report No.(s): AD-A461835; No Copyright; Avail.: CASI: [A03](#), Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA461835>

No abstract available

Control Theory; Organizations; Systems Analysis; Game Theory

20070009806 Carnegie-Mellon Univ., Pittsburgh, PA USA

Multiagent Learning in the Presence of Agents with Limitations

Bowling, Michael; May 14, 2003; 173 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): F30602-98-2-0135; F30602-00-0549

Report No.(s): AD-A461188; CMU-CS-03-118; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA461188>

Learning to act in a multiagent environment is a challenging problem. Optimal behavior for one agent depends upon the behavior of the other agents, which are learning as well. A learning agent must effectively compensate for its own limitations while exploiting the limitations of the other agents. My thesis research focuses on these two challenges, namely multiagent learning and limitations, and includes four main contributions. First, the thesis introduces the novel concepts of a variable learning rate and the WoLF (Win or Learn Fast) principle to account for other learning agents. Second, the thesis contributes an analysis of the effect of limitations on the game-theoretic concept of Nash equilibria. The existence of equilibria is important if multiagent learning techniques, which often depend on the concept, are to be applied to realistic problems where limitations are unavoidable. The thesis introduces a general model for the effect of limitations on agent behavior. Third, the thesis introduces GraWoLF, a general-purpose, scalable, multiagent learning algorithm. Fourth, the thesis describes the

CMDragons robot soccer team strategy for adapting to an unknown opponent. The strategy uses a notion of plays as coordinated team plans. The selection of team plans is the decision point for adapting the team to its current opponent, based on the outcome of previously executed plays. The CMDragons were the first RoboCup robot team to employ online learning to autonomously alter its behavior during the course of a game. These four contributions demonstrate that it is possible to effectively learn to act in the presence of other learning agents in complex domains when agents may have limitations. The introduced learning techniques are proven effective in a class of small games, and demonstrated empirically across a wide range of settings that increase in complexity.

DTIC

Machine Learning; Domains; Algorithms

20070009820 Pennsylvania Univ., Philadelphia, PA USA

Automating Modular Verification

Alur, Rajeev; de Alfaro, Luca; Henzinger, Thomas A; Mang, Freddy Y; Jan 1999; 18 pp.; In English

Contract(s)/Grant(s): F33615-98-C-3614; DAAH04-96-1-0341

Report No.(s): AD-A461302; No Copyright; Avail.: CASI: [A03](#), Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA461302>

Modular techniques for automatic verification attempt to overcome the state-explosion problem by exploiting the modular structure naturally present in many system designs. Unlike other tasks in the verification of finite-state systems, current modular techniques rely heavily on user guidance. In particular, the user is typically required to construct module abstractions that are neither too detailed as to render insufficient benefits in state exploration, nor too coarse as to invalidate the desired system properties.

DTIC

Proving; Automation

20070009834 California Univ., Santa Cruz, CA USA

Node Activation with Polling Channel Access

Yang, Long; Garcia-Luna-Aceves, J J; Jan 2004; 6 pp.; In English

Contract(s)/Grant(s): F49620-00-1-0330

Report No.(s): AD-A461744; No Copyright; Avail.: CASI: [A02](#), Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA461744>

We present a new protocol for collision-free channel access in ad hoc networks called the Node Activation with Polling Access (NAPA) protocol. NAPA assumes a time-slotted channel and operates by having each node elect a transmitting node for each time slot based on the identifiers of the nodes in its two-hop neighborhood. In contrast to prior topology-dependent transmission scheduling schemes (e.g., Node Activation Multiple Access, or NAMA) in which time slots are wasted when nodes selected for transmission have no packets to send, NAPA complements the election of nodes by means of polling and carrier sensing to use time slots allocated to nodes with no data to send. When a node elected for transmission has no packets to send, it polls one or multiple one-hop neighbors, and each neighbor determines if it can transmit during the time slot based on the identifiers of its two-hop neighbors and sensing of the channel. We show that NAPA supports collision-free transmissions, and compare its performance against NAMA.

DTIC

Protocol (Computers); Multiple Access; Nodes (Standing Waves); Channels (Data Transmission)

20070009847 California Univ., Santa Cruz, CA USA

Efficient On-Demand Routing Using Source Tracing in Wireless Networks

Raju, Jyoti; Garcia-Luna-Aceves, J J; Jan 2000; 6 pp.; In English

Contract(s)/Grant(s): F30602-97-2-0338

Report No.(s): AD-A461748; No Copyright; Avail.: CASI: [A02](#), Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA461748>

With on-demand routing, a router maintains routing information for only those destinations that need to be reached by the router. The approaches used to date to eliminate long-term or permanent loops in on-demand routing consist of obtaining complete routes to destinations dynamically, or obtaining only the next hops to destinations and validating the information using sequence numbers or internodal synchronization. We present a new approach to on-demand routing, which we call the DST (dynamic source tree) protocol. To eliminate looping, routers in DST communicate paths to destinations; however, only

incremental updates to such paths are communicated by specifying the second-to-last hop and distance to each node in the subpath to the destination that must be updated. Simulations experiments are used to show that, in terms of control packet overhead, DST outperforms substantially the Dynamic Source Routing (DSR) protocol which is arguably one of the most efficient on-demand routing approaches to date, while achieving similar performance in terms of the average delay and throughput of data packets.

DTIC

Protocol (Computers); Wireless Communication; Communication Networks; Packets (Communication)

20070009848 Sun Microsystems Labs., Palo Alto, CA USA

Hierarchical Routing Using Link Vectors

Behrens, Jochen; Garcia-Luna-Aceves, J J; Jan 1998; 10 pp.; In English

Contract(s)/Grant(s): F19628-96-C-0038

Report No.(s): AD-A461749; No Copyright; Avail.: CASI: [A02](#), Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA461749>

An area-based link-vector algorithm (ALVA) is introduced for the distributed maintenance of routing information in very large internetworks. According to ALVA, destinations in an internetwork are aggregated in areas in multiple levels of hierarchy. Routers maintain a database that contains a subset of the topology at each level of the hierarchy. This subset corresponds to those links used in preferred paths to reach destinations (nodes inside the same immediate area or remote areas). ALVA is the first hierarchical routing algorithm based on link-state information that does not require complete topology information at each level in the hierarchy. The correctness of ALVA is verified. Simulation results are presented showing that ALVA outperforms OSPF in terms of communication and storage overhead.

DTIC

Algorithms; Vectors (Mathematics); Data Links

20070009851 SRI International Corp., Menlo Park, CA USA

Abduction vs. Closure in Causal Theories

Konolige, Kurt; Apr 1991; 27 pp.; In English

Contract(s)/Grant(s): N00014-89-C-0095

Report No.(s): AD-A461072; SRI-TR-505; No Copyright; Avail.: CASI: [A03](#), Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA461072>

There are two distinct formalizations for reasoning from observations to explanations, as in diagnostic tasks. The consistency based approach treats the task as a deductive one, in which the explanation is deduced from a background theory and a minimal set of abnormalities. In the other treatment, based on abduction, the explanations are considered to be sentences that, when added to the background theory, account for the observations. We show that there is a close connection between these two formalizations. Starting with a causal theory, explanations can be generated either by abductive reasoning, or by adding closure axioms and minimizing causation within a deductive framework. The latter method is strictly stronger than the former, but requires full knowledge of causation in a domain.

DTIC

Mathematical Logic; Consistency; Axioms

20070009854 SRI International Corp., Menlo Park, CA USA

Overloading Intentions for Efficient Practical Reasoning

Pollack, Martha E; Jan 1990; 36 pp.; In English

Contract(s)/Grant(s): N00014-89-C-005

Report No.(s): AD-A461073; SRI-TN-7363; No Copyright; Avail.: CASI: [A03](#), Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA461073>

Agents, whether biological or artificial, have bounded reasoning capabilities. As a result, they cannot make reasoned decision instantaneously; reasoning takes time. Agents in dynamic environments face a potential difficulty when they must make decisions what to do. They run the risk the world may change in ways that undermine the very assumptions upon which their reasoning is proceeding. Dynamic environments and computational resource bounds thus pose a challenge that has led some researchers in Artificial Intelligence (AI) to propose that artificial agents be designed to avoid execution-time practical reasoning. In this paper, the author argues that there is a way in which an agent's plans can be used to constrain practical reasoning; they can suggest solutions to means-end reasoning problems that the agent subsequently encounters. Moreover,

such solutions can often be accepted without further deliberation about possible alternatives. An agent will often be able to guide its search for a way to achieve some goal G by looking for an action A that it already intends that can also subserve G, or by looking for an intention that can be overloaded. If it is successful in this, it can typically avoid attempting to find alternative ways of achieving G; it need not weigh the solution involving A against competing options. The author argues such a strategy, fine-tuned in appropriate ways, is rational, despite the fact it may sometimes lead to suboptimal behavior.

DTIC

Decision Theory; Risk; Alternatives

20070009862 Carnegie-Mellon Univ., Pittsburgh, PA USA

Deciding Quantifier-Free Presburger Formulas using Finite Instantiation based on Parameterized Solution Bounds

Seshia, Sanjit A; Bryant, Randal E; Dec 2003; 20 pp.; In English

Contract(s)/Grant(s): DAAD19-01-1-0485

Report No.(s): AD-A461078; CMU-CS-03-210; No Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA461078>

Given a formula Φ in quantifier-free Presburger arithmetic, it is well known that, if there is a satisfying solution to Φ , there is one whose size, measured in bits, is polynomially bounded in the size of Φ . In this paper, we consider a special class of quantifier-free Presburger formulas in which most linear constraints are separation (difference-bound) constraints, and the non-separation constraints are sparse. This class has been observed to commonly occur in software verification problems. We derive a new solution bound in terms of parameters characterizing the sparseness of linear constraints and the number of non-separation constraints, in addition to traditional measures of formula size. In particular, the number of bits needed per integer variable is linear in the number of non-separation constraints and logarithmic in the number and size of non-zero coefficients in them, but is otherwise independent of the total number of linear constraints in the formula. The derived bound can be used in a decision procedure based on instantiating integer variables over a finite domain and translating the input quantifier-free Presburger formula to an equi-satisfiable Boolean formula, which is then checked using a Boolean satisfiability solver. We present empirical evidence indicating that this method can greatly outperform other decision procedures.

DTIC

Program Verification (Computers); Computer Programming

20070009891 Army Tank-Automotive and Armaments Command, Warren, MI USA

Synergistic Effects of Multiple Countermeasures and Their Implications for TOSOM Modeling

Hicks, Daniel; Jackson, William; Reed, Jack; Mar 23, 2004; 7 pp.; In English

Report No.(s): AD-A461927; No Copyright; Avail.: CASI: A02, Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA461927>

The Threat Oriented Survivability Optimization Model (TOSOM) treats multiple countermeasures as independent operators without either synergistic or anti-synergistic effects. This is accomplished simply by: Effectiveness (CM total) = $1 - ((1 - \text{Eff}(\text{CM}_1)) \times (1 - \text{Eff}(\text{CM}_2)) \times (1 - \text{Eff}(\text{CM}_3)) \times \dots \times (1 - \text{Eff}(\text{CM}_n)))$. While this methodology may be appropriate for some countermeasure combinations such as false target generator and Active Protection Systems, it is not for such combinations as a false target generator and smoke. This paper will examine various synergistic/anti-synergistic countermeasure combinations and how they would possibly contribute to a non-optimal survivability suite. The paper will also propose an intermediate step in the TOSOM modeling process to allow for the correction of some of these errors.

DTIC

Countermeasures; Optimization; Mathematical Models; Methodology

20070009907 California Univ., Santa Cruz, CA USA

Scalable Link-State Internet Routing

Garcia-Luna-Aceves, J J; Spohn, Marcelo; Jan 1998; 11 pp.; In English

Contract(s)/Grant(s): F30602-97-2-0338

Report No.(s): AD-A461655; No Copyright; Avail.: Defense Technical Information Center (DTIC)

We present and verify the Adaptive Link-State Protocol (ALP), a new link-state routing protocol that does not require the state of each link to be flooded to the entire internetwork, or to entire areas if hierarchical routing is used. A router in ALP disseminates link-state updates incrementally to its neighbors for only those links along paths used to reach destinations. Link-state updates are validated using time stamps and contain the same information used in other link-state protocols. For the case of neighbor routers connected through a broadcast medium, a designated router is distributedly elected for each link

state reported over the medium, rather than requiring a designated router to report every topology change over the broadcast medium, like OSPF does. Simulation experiments illustrate that ALP is as efficient as the Distributed-Bellman Ford algorithm when distances to destinations do not increase and resources do not fail, and more efficient than traditional link-state protocols based on flooding after distances increase or resources fail. ALP also outperforms the link-vector algorithm (LVA), which is the only prior routing algorithm based on selective dissemination of link states.

DTIC

Internets; Protocol (Computers); Topology

20070009908 California Univ., Santa Cruz, CA USA

Fast Dissemination of Link States Using Bounded Sequence Numbers With No Periodic Updates or Age Fields

Behrens, Jochen; Garcia-Luna-Aceves, J J; Jan 1997; 9 pp.; In English

Contract(s)/Grant(s): F19628-96-C-0038

Report No.(s): AD-A461751; No Copyright; Avail.: CASI: [A02](#), Hardcopy

Routing protocols based on the distribution of link-state information rely on sequence numbers to validate information that a router receives. A fundamental problem is to bound the sequence-number space. We propose a new sequence-number reset algorithm that needs neither periodic retransmissions nor age fields. It is based on a recursive query-response procedure and is designed to handle resource failures during operation. This new algorithm is applicable to routing protocols based on both flooding and selective distribution of link-state information. The correctness of the algorithm is verified in the context of selective dissemination of topology information, and its complexity analyzed. Because the reset algorithm does not use any aging, the distribution of new link-state information or the purging of old information is always done in a time proportional to the time it takes to traverse the network.

DTIC

Internets; Protocol (Computers); Selective Dissemination of Information

20070009913 Mitre Corp., Bedford, MA USA

Joint Synthetic Battlespace Integration Framework (JSB IF)

Kwak, S D; Andrew, Emily; Sep 2003; 10 pp.; In English; Original contains color illustrations

Report No.(s): AD-A460259; No Copyright; Avail.: CASI: [A02](#), Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA460259>

The Joint Synthetic Battlespace or JSB will support training, acquisition, test and evaluation, and research and development communities. To accomplish this, the JSB must operate at many levels of detail, including: engineering level; entity level; mission level; operational level; and strategic level. The JSB's broad scope makes it impractical to build all new simulation components. Instead, the JSB will rely on existing components as much as possible. Integrating legacy simulations is, therefore, one of the most critical issues for the JSB. The JSB Integration Framework (IF) is being designed to address this critical issue. It is hoped that JSB IF concepts will eventually reduce the effort required for large-scale simulation integration by an order of magnitude. If successful, the JSB IF would permit construction of complex test beds or experiments in one or two months rather than one or two years. This paper describes an approach to developing JSB's integration framework, which clearly separates integration syntax and semantics, with an emphasis on innovative ontological semantic integration.

DTIC

Computerized Simulation; Software Engineering

20070010786 Army Tank-Automotive Command, Warren, MI USA

Threat Trees, Platform Trees, and Their Connection

Jackson, William; Hicks, Daniel; Reed, Jack; Jul 13, 2004; 11 pp.; In English

Report No.(s): AD-A462316; TARDEC-14182; No Copyright; Avail.: CASI: [A03](#), Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA462316>

The Threat Oriented Survivability Optimization Model (TOSOM), is a simple, first-order model used to evaluate the worth of suites of countermeasures in protecting a combat platform. In a typical TOSOM study, one of the first steps is to develop the threats that the platform in question will encounter. These threats are arranged in threat tree form; that is, the threats are broken into classes of threats (for example, Direct Fire, Indirect Fire, Air), and then each class is divided into a subclass; this process continues until the actual threats encountered by the platform in question are enumerated. Each branch of the tree is also given a relative probability of occurrence (that is, the sum of the probabilities of all branches emanating from each node of the tree must be equal to 1). Thus, ignoring the special tree structure arrangement of the threats, a threat tree is

in essence the distribution of threats attacking a single platform. In a system-of-systems environment each platform will possess its own threat tree. Also of interest in such an environment is what will be called a platform tree; that is, the distribution of platforms that are attacked by a single type of threat. In this paper we wish to examine threat trees, platform trees, their connection, and how they might be combined in order to provide a comprehensive view of the battlefield threat situation encountered by a system-of-systems.

DTIC

Combat; Threat Evaluation

20070010788 California Inst. of Tech., Pasadena, CA USA

White Noise Rejection in a Deterministic Setting

Paganini, Fernando; Jan 1994; 31 pp.; In English

Report No.(s): AD-A462319; No Copyright; Avail.: CASI: [A03](#), Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA462319>

This paper provides a framework for analyzing white noise disturbances in linear systems. Rather than the usual stochastic approach noise signals are described as elements in sets and the disturbance rejection properties of the system are considered in a worst case setting. The description is based on constraints in signal space directly verifiable on experimental data. These constraints can be given a representation compatible with standard robust control, allowing the formulation of white noise rejection problems in the presence of other sources of uncertainty. It is also shown how the framework can capture as a special case the usual stochastic approach, with equivalent results.

DTIC

Linear Systems; White Noise

20070010805 Naval Postgraduate School, Monterey, CA USA

Systems Approach to Terrorism: Countering the Terrorist Training Subsystem

Celebi, Erdogan; Dec 2006; 109 pp.; In English; Original contains color illustrations

Report No.(s): AD-A462342; No Copyright; Avail.: CASI: [A06](#), Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA462342>

This study on terrorism training follows the logic that terrorism is a ‘wicked problem’ and that there are various strategies to cope with it. ‘Systems thinking’ is one of the coping strategies one can use to address ‘wicked problems.’ A system is a whole composed of complex organized elements (subsystems) interacting with each other and with their environment. The stability of a system depends on its components’ alignment. Misaligning one of the components will destabilize, or even disrupt, the whole system. The author defines terrorism and terrorist organizations in ‘systems’ terms, explains their components and interrelations, and concludes that the most important component of a terrorist system is the training subsystem. Thus, it is important to understand how this subsystem functions if one wishes to disrupt the whole system. This study reviews the types of terrorist training that are occurring right now, how the terrorists and their organizations learn (process), what the terrorists learn (content), and where the terrorists learn (location). The author concludes that the internet is the new safe haven for terrorist training. He also demonstrates the adaptive capability of terrorist systems to move from land-based to internet-based training. Almost every terrorist organization on the U.S. State Department’s designated terrorist organizations list exists on the Net. One example is the PKK (Kurdistan Workers Party) terrorist network. Its website network is analyzed by content and network structure using the social network analysis software program UCINET. The goal is to develop strategies to eliminate the web presence of the terrorist training subsystem.

DTIC

Countermeasures; Education; Internets; Network Analysis; Organizations

20070010811 California Inst. of Tech., Pasadena, CA USA

A State-Space Approach to Robustness Analysis and Synthesis for Nonlinear Uncertain Systems

Lu, Wei-Min; Doyle, John C; May 12, 1994; 38 pp.; In English

Report No.(s): AD-A462350; CIT-CDS-94-010; No Copyright; Avail.: CASI: [A03](#), Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA462350>

A state-space characterization of stability and performance robustness analysis and synthesis with some computationally attractive properties for nonlinear uncertain systems is proposed. The robust stability and robust performances for a class of nonlinear systems subject to bounded structured uncertainties are characterized in terms of various types of nonlinear matrix inequalities (NLMIs), which are natural generalizations of the linear matrix inequalities (LMIs) that appear in linear robustness

analysis. As in the linear case, scalings or multipliers are used to find storage functions that give sufficient conditions for robust performances; these are also necessary under certain assumptions about smoothness of the storage functions and structure of the uncertainty. The resulting NLMIs yield convex optimization problems. Unlike the linear case, these convex problems are not finite dimensional, so their computational benefits are far less immediate. Sufficient conditions for the solvability of robust synthesis problems are developed in terms of NLMIs as well. Some aspects of the computational issues are also discussed.

DTIC

Nonlinear Systems; Robustness (Mathematics); Uncertain Systems

20070010813 Swedish Defence Research Establishment, Stockholm, Sweden

Strategic Decision Support Modeling with Morphological Analysis

Jan 2005; 28 pp.; In English; Original contains color illustrations

Report No.(s): AD-A462354; No Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA462354>

Morphological analysis: a generalized method for structuring and analyzing complex problem fields which are inherently non-quantifiable, contain non-resolvable uncertainties, cannot be causally modelled or simulated and require a judgmental approach.

DTIC

Decision Support Systems; Morphology

20070010916 Clemson Univ., SC USA

2D Decision-Making for Multi-Criteria Design Optimization

Engau, A; Wiecek, M M; May 2006; 24 pp.; In English

Report No.(s): AD-A462566; TR2006-05-EW; No Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA462566>

The high dimensionality encountered in engineering design optimization due to large numbers of performance criteria and specifications leads to cumbersome and sometimes unachievable tradeoff analyses. To facilitate those analyses and enhance decision-making and design selection, we propose to decompose the original problem by considering only pairs of criteria at a time, thereby making tradeoff evaluation the simplest possible. For the final design integration, we develop a novel coordination mechanism that guarantees that the selected design is also preferred for the original problem. The solution of an overall large-scale problem is therefore reduced to solving a family of bi-criteria subproblems and allows designers to effectively use decision-making in merely two dimensions for multi-criteria design optimization.

DTIC

Decision Making; Design Optimization; Optimization; Systems Engineering

20070010921 Carnegie-Mellon Univ., Pittsburgh, PA USA

Multi-Robot Negotiation: Approximating the Set of Subgame Perfect Equilibria in General-Sum Stochastic Games

Murray, Chris; Gordon, Geoffrey; Oct 2006; 28 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): HR0011-06-1-0023; DARPA-55-00069

Report No.(s): AD-A462577; CMU-ML-06-114; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA462577>

In real-world planning problems, we must reason not only about our own goals, but about the goals of other agents with which we may interact. Often these agents' goals are neither completely aligned with our own nor directly opposed to them. Instead there are opportunities for cooperation: by joining forces, the agents can all achieve higher utility than they could separately. But, in order to cooperate, the agents must negotiate a mutually acceptable plan from among the many possible ones, and each agent must trust that the others will follow their parts of the deal. Research in multi-agent planning has often avoided the problem of making sure that all agents have an incentive to follow a proposed joint plan. On the other hand, while game theoretic algorithms handle incentives correctly, they often don't scale to large planning problems. In this paper we attempt to bridge the gap between these two lines of research: we present an efficient game-theoretic approximate planning algorithm, along with a negotiation protocol which encourages agents to compute and agree on joint plans that are fair and optimal in a sense defined below. We demonstrate our algorithm and protocol on two simple robotic planning problems.

DTIC

Game Theory; Robotics; Robots; Stochastic Processes

20070010922 Case Western Reserve Univ., Cleveland, OH USA

Observer Design for a Class of MIMO Nonlinear Systems (Preprint)

Lei, Hao; Wei, Jianfeng; Lin, Wei; Kolacinski, R M; Jun 2006; 9 pp.; In English

Contract(s)/Grant(s): FA8650-05-M-3540; Proj-A08W

Report No.(s): AD-A462578; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA462578>

Under the boundedness and observability conditions, we present a globally convergent observer for a class of multi-output nonlinear systems which covers the block-triangular observer forms studied previously in the literature. The result presented in this paper incorporates and generalizes the earlier work on the observer design for single-output observable systems. Extensions to detectable systems and controlled systems are also considered. Examples are given to illustrate the validity of proposed method.

DTIC

MIMO (Control Systems); Nonlinear Systems

20070010933 Naval Postgraduate School, Monterey, CA USA

Optimal Military Transportation in a Korean Theater

Jeong, Young-Sik; Dec 2006; 65 pp.; In English; Original contains color illustrations

Report No.(s): AD-A462606; No Copyright; Avail.: CASI: A04, Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA462606>

Due to their high dependency on highway transportation, Republic of Korea's (ROK's) military and industry suffer from congestion, shortfall of means (convoys in the military case), high cost and increase in environmental damage. Our research develops an optimization model to guide ROK's military planning using multi-modal transportation. We apply our Military Logistics Transportation Model (MLTM) to a realistic scenario. MLTM provides guidance on the optimal frequency of transportation services and the optimal routes for the freight. By comparing the solution of MLTM with current practice for Wartime Transportation Planning (represented by a heuristic method), our MLTM can reduce the transportation cost up to 29%. This is enabled by the activation of multi-modal transportation and service sharing by multiple demands. We also analyze scenarios in which either seaport of debarkation (SPOD) where the supply originates has been shut down by enemy attacks. We find that losing Busan SPOD is more damaging than losing Kwangyang SPOD.

DTIC

Logistics; Military Operations; Optimization; South Korea; Transportation

20070011163 RAM Labs., Inc., San Diego, CA USA

An Operational Dynamic Situational Assessment Capability

McGraw, Robert; Jan 2007; 37 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): FA8750-06-C-0014; Proj-459S

Report No.(s): AD-A462786; No Copyright; Avail.: CASI: A03, Hardcopy

The primary objective of the Dynamic Situation Assessment and Prediction (DSAP) infrastructure is to allow Commanders and their staff at Air Operations Centers the ability to perform what-if analysis of plans and alternatives on-the-fly while continuing augmenting the real-time picture sensor inputs with simulated state-estimated assessments. Enhancements to current DSAP Framework and software infrastructure were made to provide dynamic situational awareness and an improved predictive capability that can be applied to an operational setting. RAM integrated the DSAP Multiple Replication Framework utilizing Joint Semi-Automated Forces (JSAF) with real-time databases and data link simulation provided by Theater Battle Management Core System (TBMCS) and other C41 (Command, Control, Communications, Computers, and Intelligence) systems. RAM compared a real-time simulation with a simulation calibrated by real-time-picture inputs from TBMCS and integrated the current predictive analysis capability with the dynamic situational awareness capability for improved calibration of predictive inputs. They implemented interfaces between DSAP components that allow its use in a Service-Oriented Architecture (SOA). This infrastructure will allow commanders to dynamically evaluate and assess the situation in a timely fashion, incorporate prediction in real-time via faster than real-time simulation, support real-time dynamic planning to address targets of opportunity and support a SOA.

DTIC

Data Systems; Decision Support Systems

20070011167 North Carolina Agricultural and Technical State Univ., Greensboro, NC USA

Developing a Taxonomy of Characteristics and Features of Learning Systems and Internet Gaming Environments

Xu, Jinsheng; Sep 2006; 40 pp.; In English

Contract(s)/Grant(s): FA8650-05-1-6638; Proj-1123

Report No.(s): AD-A462795; No Copyright; Avail.: CASI: [A03](#), Hardcopy

There is currently a substantial amount of interest in the exploitation of online interactive gaming environments for training across a number of applied domains including military operations (e.g., the DARPA DARWARS program; US Army Future Combat Systems training program). However, there are no standardized guidelines or specifications related to what the key characteristics of a learning environment must possess and what features of current online gaming environments could facilitate efficiently modifying them to be training and learning environments. This project involved a review of the extant literatures in learning environments and in gaming environment development and application to develop a taxonomy of the key characteristics of instructional environments and the manner in which these characteristics map to existing Internet game architectures. The project deliverables included a review of the pertinent literatures and the development of a research-driven taxonomy of characteristics and the definition of a process whereby a candidate gaming environment could be modified to function as a distributed training environment for a military application. Potential future work in the area is discussed in terms of using the taxonomy to aid in the development of an authoring system for adding instructional components to games as well as the development of a synthetic task gaming environment for military and academic experimentation.

DTIC

Game Theory; Internets; Learning; On-Line Systems; Taxonomy

67

THEORETICAL MATHEMATICS

Includes algebra, functional analysis, geometry, topology, set theory, group theory and number theory.

20070009793 SRI International Corp., Menlo Park, CA USA

Actions, Processes, and Causality

Georgeff, Michael P; Feb 1987; 25 pp.; In English

Contract(s)/Grant(s): N00014-85-C-0251; NAS2-12521

Report No.(s): AD-A461779; SRI-TR-404; No Copyright; Avail.: CASI: [A03](#), Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA461779>

The purpose of this paper is to construct a model of actions and events that facilitates reasoning about dynamic domains involving multiple agents. Unlike traditional approaches, the proposed model allows for the simultaneous performance of actions, rather than use an interleaving approximation. A generalized situation calculus is constructed for describing and reasoning about actions in multiagent settings. Notions of independence and correctness are introduced, and it is shown how they can be used to determine the persistence of facts over time and whether or not actions can be performed concurrently. Unlike most previous formalisms in both single- and multiagent domains, the proposed law of persistence is monotonic and thus has a well-defined model-theoretic semantics. It is shown how the concept of causality can be employed to simplify the description of actions and to model arbitrarily complex machines and physical devices. Furthermore, it is shown how sets of causally interrelated actions can be grouped together in processes and how this structuring of problem domains can substantially reduce combinatorial complexity. Finally, it is indicated how the law of persistence, together with the notion of causality, makes it possible to retain a simple model of action while avoiding most of the difficulties associated with the frame problem.

DTIC

Mathematical Models; Domains; Semantics

20070009815 Naval Research Lab., Washington, DC USA

Advanced ESM Angle Tracker. Volume 1. Theoretical Foundations

Khoury, Edward N; Dec 29, 2006; 42 pp.; In English

Contract(s)/Grant(s): Proj-05584

Report No.(s): AD-A461280; NRL/FR/5741--06-10; 141-VOL-1; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA461280>

This report summarizes the NRL implementation of a filter used for ESM angle tracking. The filter is an Interactive

Multiple Model (IMM) filter that uses three standard Kalman filters as a basis for filtering and predicting emitter bearing angle. Filter selection for the IMM is based on the expected variation of emitter trajectories and the imposed spherical coordinate system. The derivation of the IMM is well documented and is not addressed in this report; only implementation aspects of the IMM are addressed here. The ESM angle tracker was developed to operate with the NRL ESM-ATD, which provides highly accurate but intermittent bearing and elevation reports. ESM parameters are tracked with first-order filters and provide the basis for associating intermittent bearing/elevation tracks in dense scenarios. The tracker is fully automatic, uses sequential Bayesian hypothesis testing for track initiation, and uses maximum likelihood association implemented across all filters to maximize single-event association probabilities.

DTIC

Angles (Geometry); Kalman Filters; Electronics

20070009852 SRI International Corp., Menlo Park, CA USA

Preliminary Report on a Theory of Plan Synthesis

Pednault, Edwin P; Aug 1985; 60 pp.; In English

Contract(s)/Grant(s): F49620-82-K-0031

Report No.(s): AD-A461770; SRI-TN-358; No Copyright; Avail.: CASI: [A04](#), Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA461770>

Classical planning problems have the following form: given a set of goals, a set of actions, and a description of the initial state of the world, find a sequence of actions that will transform the world from any state satisfying the initial-state description to one that satisfies the goal description. In principle, a problem of this type may be solved by a very simple procedure: merely enumerate all possible sequences of actions and test each until one is found that achieves the intended goals. By this procedure, we will eventually find a solution if one exists. However, in practice, not only do we want to find a solution, we want to do so expeditiously. Quick and efficient problem solving is desirable primarily for reasons of economy: the less time it takes to solve a problem, the more productive one can be. Furthermore, in some situations, the time it takes can mean the difference between success and failure, as is the case when the problem is part of a scholastic exam or when the problem is to prevent meltdown in a nuclear reactor. Previous work aimed at developing efficient planning techniques has been highly experimental in nature, the standard methodology being to explore ideas by constructing computer programs. For the most part, very little theoretical analysis has been done to determine why the programs work when they are applicable, and whether they can be generalized to solve larger classes of problems.

DTIC

Problem Solving; Goal Theory; Planning; Applications of Mathematics

20070009909 SRI International Corp., Menlo Park, CA USA

A Weak Logic of Knowledge and Belief: Epistemic and Doxastic Logic for the Yuppie Generation

Israel, David; Sep 1985; 33 pp.; In English

Contract(s)/Grant(s): F49620-82-K-0031

Report No.(s): AD-A461771; SRI-TN-359; No Copyright; Avail.: CASI: [A03](#), Hardcopy

Modern modal logic begins with the work of C.I. Lewis early on in the present century. We can think of Lewis thinking to himself as follows: 'Well, I can't analyze the notions of metaphysical or logical possibility and necessity; but I can sure formulate alternative axiomatizations of such notions. I can then compare and contrast such axiomatic systems and see what I learn.' Thus were born the Lewis Systems, S1-S5, axiomatizing increasingly strong conceptions of necessity. Another 40 or so years went by before the purely axiomatic approach was properly systematized and rendered fit for human consumption. In current lore, a certain axiomatic system, K, is central. The standard presentation of K consists of infinitely many axioms plus one axiom scheme and two rules of inference... It may be, then, that to take epistemic/doxastic logics seriously, one must both be working from within that conceptualization of cognitive states according to which they are either essentially or importantly language involving and, further, conceive of the language(s) in question on the model of standard formal languages, as consisting, that is, of eternal sentences only. This could be taken as an argument to the effect that the proper home of epistemic/doxastic logic is theoretical computer science -- precisely the locus of its greatest current vitality.

DTIC

Cognition; Sentences; Languages; Inference

20070009928 SRI International Corp., Menlo Park, CA USA

On the Relation Between Default and Autoepistemic Logic

Konolige, Kurt G; Nov 1987; 47 pp.; In English

Contract(s)/Grant(s): N00014-85-C-0251; N00014-84-C-0211

Report No.(s): AD-A461880; SRI-AIC-TN-407; No Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA461880>

Default logic is a formal means of reasoning about defaults: what normally is the case, in the absence of contradicting information. Autoepistemic logic, on the other hand, is meant to describe the consequences of reasoning about ignorance: what must be true if a certain fact is not known. Although the motivation and formal character of these two systems are different, a closer analysis shows that they share a common trait, which is the indexical nature of certain elements in the theory. In this paper we compare the expressive power of the two systems. First, we give an effective translation of default logic into autoepistemic logic; default theories can thus be embedded into autoepistemic logic. We also present a more surprising result: the reverse translation is also possible, so that every set of sentences in autoepistemic logic can be effectively rewritten as a default theory. The formal equivalence of these two differing systems is thus established. This analysis gives an interpretive semantics to default logic, and yields insight into the nature of defaults in autoepistemic reasoning.

DTIC

Mathematical Logic; Formalism

20070010937 Clemson Univ., SC USA

Coordination Control for Haptic and Teleoperator Systems

Tatlicioglu, E; McIntyre, M; Dawson, D; Burg, T; Jan 2006; 23 pp.; In English; Original contains color illustrations

Report No.(s): AD-A462616; CU/CRB/2/28/06/ 1; No Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA462616>

In this paper, two controllers are developed for nonlinear haptic and teleoperator systems for coordination of the master and slave systems. The first controller is proven to yield a semi-global asymptotic result in the presence of parametric uncertainty in the master and the slave dynamic models provided the user and the environmental input forces are measurable. The second controller yields a global asymptotic result despite unmeasurable user and environmental input forces provided the dynamic models of the master and slave are known. These controllers rely on a transformation and a flexible target system to allow the master system's impedance to be easily adjusted so that it matches a desired target system. This work also offers a structure to encode a velocity field assist mechanism to provide the user help in controlling the slave system in completing a pre-defined contour following task. For each controller, Lyapunov-based techniques are used to prove that both controllers provide passive coordination of the haptic/teleoperator system when the velocity field assist mechanism is disabled. When the velocity field assist mechanism is enabled, the analysis proves the coordination of the haptic/teleoperator system. Simulation results are presented for both controllers.

DTIC

Controllers; Coordination; Teleoperators; Touch

20070010938 Clemson Univ., SC USA

Adaptive Control of Flat MIMO Nonlinear Systems with Additive Disturbance

Tatlicioglu, Enver; Xian, Bin; Dawson, Darren M; Burg, Timothy; Jan 2006; 13 pp.; In English; Original contains color illustrations

Report No.(s): AD-A462618; CU/CRB/9/19/06/ 1; No Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA462618>

In this paper, two controllers are developed for flat multi-input/multi-output nonlinear systems. First, a robust adaptive controller is proposed and proven to yield semi-global asymptotic tracking in the presence of additive disturbances and parametric uncertainty. In addition to guaranteeing an asymptotic output tracking result, it is also proven that the parameter estimate vector is driven to a constant vector. In the second part of the paper, a learning controller is designed and proven to yield a semi-global asymptotic tracking result in the presence of additive disturbances where the desired trajectory is periodic. A continuous nonlinear integral feedback component is utilized in the design of both controllers and Lyapunov-based techniques are used to guarantee that the tracking error is asymptotically driven to zero. Numerical simulation results are presented for both controllers.

DTIC

Adaptive Control; Additives; Controllers; MIMO (Control Systems); Nonlinear Systems

20070010944 Clemson Univ., SC USA

Velocity and Structure Estimation of a Moving Object Using a Moving Monocular Camera

Chitrakaran, V K; Dawson, D M; Chen, J; Kannan, H; Jan 2006; 10 pp.; In English; Original contains color illustrations
Report No.(s): AD-A462627; CU/CRB/3/14/06/ 1; No Copyright; Avail.: CASI: [A02](#), Hardcopy
ONLINE: <http://hdl.handle.net/100.2/ADA462627>

In this paper, we present the development of a vision-based estimator for simultaneous determination of velocity and structure of an object (i.e., the Euclidean position of its feature points) for the general case where both the object and the camera are moving relative to an inertial frame of reference. The velocity estimation itself requires no explicit kinematic model, while the adaptive structure estimator, synthesized utilizing Lyapunov design methods, is built upon kinematic relationships that rely on homography-based techniques.

DTIC

Cameras; Detectors; Euclidean Geometry

70

PHYSICS (GENERAL)

Includes general research topics related to mechanics, kinetics, magnetism, and electrodynamics. For specific areas of physics see *categories 71 through 77*. For related instrumentation see *35 Instrumentation and Photography*; for geophysics, astrophysics, or solar physics see *46 Geophysics, 90 Astrophysics, or 92 Solar Physics*.

20070009655 Stanford Linear Accelerator Center, CA, USA

Measurement of Direct CP Asymmetries in Charmless Hadronic B Decays

Di Marco, E.; Oct. 06, 2006; 7 pp.; In English

Report No.(s): DE2006-893294; SLAC-PUB-12148; No Copyright; Avail.: National Technical Information Service (NTIS)

We present recent results on time integrated and time dependent CP violation for charmless hadronic B decays using BABAR detector at the PEP-II B-factory.

NTIS

Asymmetry; Hadrons; Mesons; Particle Decay; CP Violation; Beta Particles

20070009657 Stanford Linear Accelerator Center, CA, USA

CP Violation Measurements in B_s Charm Decays at BaBar

George, K.; January 2006; 7 pp.; In English

Report No.(s): DE2006-893295; SLAC-PUB-12145; No Copyright; Avail.: National Technical Information Service (NTIS)

This article summarizes measurements of time-dependent CP asymmetries in decays of neutral B mesons to charm final states using data collected by the BABAR detector at the PEP-II asymmetric-energy B factory. All results are preliminary unless otherwise stated.

NTIS

CP Violation; Mesons; Particle Decay

20070009695 Beyer Weaver and Thomas, LLP, Oakland, CA, USA

RF Pulses for Long T₂ Suppression in MRI

Larson, P. E.; Pauly, J. M.; Conolly, S. M.; 12 Jul 05; 19 pp.; In English

Contract(s)/Grant(s): NIH-R01EB002524

Patent Info.: Filed Filed 12 Jul 05; US-Patent-Appl-SN-11-180-339

Report No.(s): PB2007-101448; No Copyright; Avail.: CASI: [A03](#), Hardcopy

In imaging a first species having a short T₂ magnetic resonance parameter in the presence of a second and third species having longer T₂ parameters, a method of suppressing signals from the longer T₂ species comprises the steps of: (a) applying a RF saturation pulse with multiple suppression bands for the second and third species to excite nuclei spins of the longer T₂ species with the magnitude of the RF pulse being sufficiently low so as not to excite nuclei spins of the short T₂ species, the RF saturation pulse being sufficiently long to rotate the longer T₂ species nuclei spins into a transverse plane, and (b) dephasing the longer T₂ species nuclei spins in the transverse plane. An imaging pulse sequence is then applied to image the short T₂ species. Alternatively, the method can comprise the steps of (a) applying a first inversion pulse for selective inverting species of the second longer T₂ species, (b) obtaining first image signals after step a, (c) applying a second inversion pulse for selectively inverting species of the third longer T₂ species, (d) obtaining second image signals after step (c), and (e)

combining the first image signals and the second image signal to image the first short T2 species with the longer second and third species cancelling in the combination. In each of these methods, either the second or third longer T2 species can be suppressed without suppressing the other by applying the RF saturation or inversion pulse only to the species to be suppressed.

NTIS

Imaging Techniques; Radio Frequencies; Magnetic Resonance Spectroscopy

20070009705 Environmental Science and Research Foundation, Idaho Falls, ID, USA

Magnetic Elements

Hong, Y. K.; Park, M. Y.; Gee, S. H.; 31 Jan 06; 14 pp.; In English

Contract(s)/Grant(s): N00014-02-1-0991

Patent Info.: Filed Filed 31 Jan 06; US-Patent-Appl-SN-11-344-947

Report No.(s): PB2007-101454; No Copyright; Avail.: CASI: [A03](#), Hardcopy

There are disclosed magnetic elements having unique shapes. In one example, the magnetic element defines an outer peripheral profile and a center point, wherein the outer peripheral profile includes a substantially curviform section and a notch section. The notch section may be configured to radially extend to at least the center point. In another example, a substantially circular or oval-shaped magnetic element defines an outer periphery and a gap void having an open end facing the outer periphery so as to form a gap along the outer periphery. The magnetic element optionally may not include an annular void that is spatially isolated from the gap void.

NTIS

Magnetic Properties; Shapes

20070009725 Bruckner (John), P.C, Austin, TX, USA

Controlled Alignment Catalytically Grown Nanostructures

Merkulov, V. I.; Guillorn, M. A.; Melechko, A. V.; Simpson, M. L.; Lowndes, D. H.; 24 Mar 05; 15 pp.; In English

Patent Info.: Filed Filed 24 Mar 05; US-Patent-Appl-SN-11-089 099

Report No.(s): PB2007-102942; No Copyright; Avail.: CASI: [A03](#), Hardcopy

Systems and methods are described for controlled alignment of catalytically grown nanostructures in a large-scale synthesis process. A composition includes an elongated nanostructure including a first segment defining a first axis and a second segment coupled to the first segment, the second segment defining a second axis that is substantially nonparallel to the first axis. A method includes: generating an electric field proximate an edge of a protruding section of an electrode, the electric field defining a vector; and forming an elongated nanostructure located at a position on a surface of a substrate, the position on the surface of the substrate proximate the edge of the protruding section of the electrode, at least one tangent to the elongated nanostructure i) substantially parallel to the vector defined by the electric field and ii) substantially non-parallel to a normal defined by the surface of the substrate.

NTIS

Alignment; Catalytic Activity; Nanostructures (Devices); Fabrication

20070009726 Lawrence Livermore National Lab., Livermore, CA USA

Laser Driven Ion Accelerator

Tajima, T.; 1 Mar 05; 19 pp.; In English

Contract(s)/Grant(s): DE-W-7405-ENG-48

Patent Info.: Filed Filed 1 Mar 05; US-Patent-Appl-SN-11-070 074

Report No.(s): PB2007-102941; No Copyright; Avail.: CASI: [A03](#), Hardcopy

A system and method of accelerating ions in an accelerator to optimize the energy produced by a light source. Several parameters may be controlled in constructing a target used in the accelerator system to adjust performance of the accelerator system. These parameters include the material, thickness, geometry and surface of the target.

NTIS

Ion Accelerators; Lasers; Light Sources

20070009745 Fermi National Accelerator Lab., Batavia, IL, USA

Overview of Proton Drivers for Neutrino Super Beams and Neutrino Factories

Chou, W.; January 2006; 5 pp.; In English

Report No.(s): DE2006-892360; FERMILAB-CONF-06-213-AD; No Copyright; Avail.: National Technical Information Service (NTIS)

There has been a world-wide interest in Proton Drivers in the past decade. Numerous design proposals have been presented in Asia, Europe and North America, ranging from low energy rapid cycling synchrotrons, normal or superconducting linacs to high energy slow cycling synchrotrons and FFAGs. One thing in common is that all these machines provide MW beam power and are used primarily for neutrino experiments. This paper gives an overview of these activities. In the last section the author expresses his personal opinion on the future of this field.

NTIS

Neutrino Beams; Neutrinos; Protons

20070009746 Colorado Univ., Colorado Springs, CO, USA

Measuring the Branching Ratio of the Rare Decay $\pi^0 \rightarrow e^+ e^-$

Niclasen, R.; Feb. 01, 2006; 124 pp.; In English

Report No.(s): DE2006-892361; No Copyright; Avail.: National Technical Information Service (NTIS)

No abstract available

Elementary Particles; Particle Decay; Branching (Physics)

20070009748 Fermi National Accelerator Lab., Batavia, IL, USA, Argonne National Lab., IL USA

Measurement and Optimization of the Lattice Functions in the Debuncher Ring at Fermilab

Nagaslaev, V.; Gollwitzer, K.; Lebedev, V.; Valishev, A.; January 2006; 4 pp.; In English

Report No.(s): DE2006-892363; FERMILAB-CONF-06-200-AD; No Copyright; Avail.: National Technical Information Service (NTIS)

Tevatron Run-II upgrade requires substantial increase of antiproton production. The central step towards this goal is maximizing the Debuncher ring admittance which necessitates detailed understanding of the Debuncher optics and aperture limitations. The method of the response matrix optimization has been used to determine quadrupole errors and to build a model of machine optics. We estimate that the model predicts beta-functions with accuracy of about 5% mainly limited by Beam Position Monitor system resolution and small number of steering elements in the machine. The improvements of optics model were used to redesign Debuncher optics so that the beam envelopes would be minimized at regions with small aperture.

NTIS

Antiprotons; Optimization; Storage Rings (Particle Accelerators)

20070009749 Indiana Univ., Bloomington, IN, USA, Fermi National Accelerator Lab., Batavia, IL, USA

Analysis of Emittance Growth in the Fermilab Booster

Huang, X.; Lee, S. Y.; Ng, K. Y.; January 2006; 4 pp.; In English

Report No.(s): DE2006-892368; No Copyright; Avail.: National Technical Information Service (NTIS)

Multi-particle simulations are performed to study emittance growth in the Fermilab Booster. Analysis shows that the source of vertical emittance growth comes mostly from random errors in skew quadrupoles in the presence of a strong transverse space-charge force. (1) Random errors in dipole rolls and the Montague resonance do contribute but to lesser extent. The effect of random errors in the quadrupoles is small because the betatron envelope tunes are reasonably far away from the half-integer stopband.

NTIS

Emittance; Particle Accelerators

20070009750 Fermi National Accelerator Lab., Batavia, IL, USA

Tevatron Ionization Profile Monitoring

Jansson, A.; Bowie, K.; Fitzpatrick, T.; Kwarciany, R.; Lundberg, C.; January 2006; 4 pp.; In English

Report No.(s): DE2006-892369; FERMILAB-CONF-06-209-AD-CD-E; No Copyright; Avail.: National Technical Information Service (NTIS)

Ionization Profile monitors have been used in almost all machines at Fermilab. However, the Tevatron presents some particular challenges with its two counter-rotating, small beams, and stringent vacuum requirements. In order to obtain adequate beam size accuracy with the small signals available, custom made electronics from particle physics experiments was employed. This provides a fast (single bunch) and dead-timeless charge integration with a sensitivity in the femto-Coulomb range, bringing the system close to the single ionization electron detection threshold. The detector itself is based on a previous Main Injector prototype, albeit with many modifications and improvements. The first detector was installed at the end of 2005, and the second detector during the spring shutdown. The ultimate goal is to continuously monitor beam size oscillations at

injection, as well as the beam size evolution during ramp and squeeze. Initial results are very encouraging.
NTIS

Ionization; Monitors; Particle Accelerators

20070009751 Fermi National Accelerator Lab., Batavia, IL, USA, European Organization for Nuclear Research, Geneva, Switzerland

Measurement and Correction of the 3rd Order Resonance in the Tevatron

January 2006; 3 pp.; In English

Report No.(s): DE2006-892371; FERMILAB-CONF-06-202-AD; No Copyright; Avail.: National Technical Information Service (NTIS)

At Fermilab Tevatron BPM system has been recently upgraded resulting much better accuracy of beam position measurements and improvements of data acquisition for turn-by-turn measurements. That allows one to record the beam position at each turn for 8000 turns for all BPMs (118 in each plane) with accuracy of about 10-20 mm. In the last decade a harmonic analysis tool has been developed at CERN that allows relating each FFT line derived from the BPM data with a particular non-linear resonance in the machine. In fact, one can even detect the longitudinal position of the sources of these resonances. Experiments have been performed at the Tevatron in which beams have been kicked to various amplitudes to analyze the 3rd order resonance. It was possible to address this rather large resonance to some regular machine sextupoles. An alternative sextupole scheme allowed the suppression of this resonance by a good factor of 2. Lastly, the experimental data are compared with model calculations.

NTIS

Beams (Radiation); Particle Accelerators; Correction

20070009753 Fermi National Accelerator Lab., Batavia, IL, USA, Argonne National Lab., IL USA

Progress with Collision Optics of the Fermilab Tevatron Collider

Valishev, A.; Alexahin, Y.; Annala, J.; Lebedev, V.; Magaslaev, V.; January 2006; 3 pp.; In English

Report No.(s): DE2006-892372; FERMILAB-CONF-06-207-AD; No Copyright; Avail.: National Technical Information Service (NTIS)

Recent advances in the measurement and modeling of the machine parameters and lattice functions at the Tevatron allowed modifications of the collision optics to be performed in order to increase the collider luminosity. As the result, beta functions in the two collision points were decreased from 35cm to 29cm which resulted in 10% increase of the peak luminosity. In this report we describe the results of optics measurements and corrections. We also discuss planned improvements, including the new betatron tune working point and correction of the beta function chromaticity.

NTIS

Collisions; Particle Accelerators

20070009758 Fermi National Accelerator Lab., Batavia, IL, USA

New Algorithm for the Correction of the Linear Coupling at Tevatron

Alexahin, Y.; Gianfelice-Wendt, E.; January 2006; 3 pp.; In English

Report No.(s): DE2006-892373; No Copyright; Avail.: National Technical Information Service (NTIS)

The Fourier analysis of Turn by Turn (TBT) data provides valuable information about the machine linear and non-linear optics. A program for the measurement and correction of the linear coupling based on the TBT data analysis has been integrated in the TEVATRON control system. The new method is fast, allows the measurement of the coupling during acceleration and offers information about the sum coupling coefficient and the location of the sources of coupling.

NTIS

Algorithms; Particle Accelerators

20070009764 Fermi National Accelerator Lab., Batavia, IL, USA

Tevatron Operational Status and Possible Lessons for the LHC

Lebedev, V.; January 2006; 5 pp.; In English

Report No.(s): DE2006-892375; FERMILAB-CONF-06-204-AD; No Copyright; Avail.: National Technical Information Service (NTIS)

This paper provides an overview of the Tevatron Run II luminosity progress and plans, including SC magnet

measurements and modeling of field errors in view of the LHC operation. It also discusses antiproton production, stacking and cooling.

NTIS

Luminosity; Particle Accelerators

20070009765 Fermi National Accelerator Lab., Batavia, IL, USA

Transverse Digital Damper System for the Fermilab Anti-Proton Recycler

Eddy, N.; Crisp, J.; January 2006; 5 pp.; In English

Report No.(s): DE2006-892268; FERMILAB-CONF-06-100-AD; No Copyright; Avail.: National Technical Information Service (NTIS)

A transverse damping system is used in the Recycler at Fermilab to damp beam instabilities which arise from large beam intensities with electron cooling. Initial tests of electron cooling demonstrated beam loss due to transverse beam motion when the beam was cooled past the beam density threshold. The transverse damper system consists of two horizontal and two vertical pickups whose signals are amplified and passed into an analog hybrid to generate a difference signal from each pickup. The difference signals are input to a custom digital damper board which digitizes the analog signals at 212mhz, performs digital processing of the signals inside a large Altera Stratix II FPGA, then provides analog output at 212mhz via digital to analog converters. The digital damper output is sent to amplifiers which drive one horizontal and one vertical kicker. An initial prototype digital damper board has been successfully used in the Recycler for over six months. Currently, work is underway to replace the prototype board with an upgraded VME version.

NTIS

Antiprotons; Digital Systems

20070009769 Fermi National Accelerator Lab., Batavia, IL, USA, Liverpool Univ., UK

Rare Decays at the Tevatron

Farrington, S. M.; Jan. 01, 2006; 4 pp.; In English

Report No.(s): DE2006-892341; FERMILAB-CONF-05-621-E; No Copyright; Avail.: National Technical Information Service (NTIS)

The confidence level limits of the CDF and D0 searches for the $B(0)(s)$, $B(0)(d)\text{-}\gamma\mu^+\mu^-\phi$ rare decays are presented.

NTIS

Elementary Particles; Particle Accelerators; Quarks

20070009770 Fermi National Accelerator Lab., Batavia, IL, USA, Illinois Univ., Chicago, IL, USA

Top Quark Production Cross Section at the Tevatron

Shabalina, E.; May 01, 2006; 4 pp.; In English

Report No.(s): DE2006-892340; No Copyright; Avail.: National Technical Information Service (NTIS)

An overview of the preliminary results of the top quark pair production cross section measurements at a center-of-mass energy of 1.96 TeV carried out by the CDF and D0 collaborations is presented. The data samples used for the analyses are collected in the current Tevatron run and correspond to an integrated luminosity from the 360 pb⁻¹ up to 760 pb⁻¹.

NTIS

Elementary Particles; Pair Production; Particle Accelerators; Quarks

20070009771 Fermi National Accelerator Lab., Batavia, IL, USA, Delhi Univ., India

$B(0)(s)$ Mixing Studies at the Tevatron

Naimuddin, M. D.; May 01, 2006; 4 pp.; In English

Report No.(s): DE2006-892338; FERMILAB-CONF-06-112-E; No Copyright; Avail.: National Technical Information Service (NTIS)

Measurement of the $B(0)(s)$ oscillation frequency via $B(0)(s)$ mixing analysis provides a powerful constraint on CKM matrix elements. This note briefly reviews the motivation behind these analyses and describes the various steps that go into a mixing measurement. Recent results on $B(0)(s)$ mixing obtained by the CDF and D0 collaborations using the data samples collected at Tevatron Collider in the period 2002-2005 are presented.

NTIS

Frequencies; Oscillations; Particle Accelerators

20070009772 Fermi National Accelerator Lab., Batavia, IL, USA, Northeastern Univ., Boston, MA, USA
W and Z (Plus Jets) Production and Asymmetries at 1.96 TeV

Hesketh, G.; May 01, 2006; 4 pp.; In English

Report No.(s): DE2006-892331; FERMILAB-CONF-06-120-E; No Copyright; Avail.: National Technical Information Service (NTIS)

This paper reviews the latest results from the Tevatron on W and Z physics, and their use as probes of QCD.

NTIS

Asymmetry; Bosons; Particle Accelerators

20070009773 Fermi National Accelerator Lab., Batavia, IL, USA, California State Univ., Los Angeles, CA, USA
Measurement of the Top Quark Mass with a Matrix Element Method in the Lepton Plus Jets Channel at CDF

Mohr, B.; May 01, 2006; 4 pp.; In English

Report No.(s): DE2006-892330; FERMILAB-CONF-06-180-E; No Copyright; Avail.: National Technical Information Service (NTIS)

The authors present a measurement of the mass of the top quark from $pp(\bar{p})$ collisions at 1.96 TeV observed with the Collider Detector at Fermilab (CDF) at the Fermilab Tevatron Run II. The events have the decay signature of $pp(\bar{p}) \rightarrow \ell \bar{\nu} \ell \bar{\nu} \bar{t}(\bar{t})$ in the lepton plus jets channel in which at least one jet is identified as coming from a secondary vertex and therefore a b-hadron. The largest systematic uncertainty, the jet energy scale (JES), is convoluted with the statistical error using an in-situ measurement of the hadronic W boson mass. We calculate a likelihood for each event using leading-order $\bar{t}(\bar{t})$ and W+jets cross-sections and parameterized parton showering. The final measured top quark mass and JES systematic is extracted from a joint likelihood of the product of individual event likelihoods. From 118 events observed in 680 pb⁻¹ of data, we measure a top quark mass of 174.09 \pm 2.54 (stat+JES) \pm 1.35 (syst) GeV/c².

NTIS

Elementary Particles; Leptons; Matrix Methods; Quarks

20070009774 Fermi National Accelerator Lab., Batavia, IL, USA

Measurements of a Newly Designed BPM for the Tevatron Electron Len 2

Scarpine, V. E.; Fellenz, B.; Kuznetsov, G.; Kamerdzhev, V.; Olson, M.; January 2006; 7 pp.; In English

Report No.(s): DE2006-892312; FERMILAB-CONF-06-140-AD; No Copyright; Avail.: National Technical Information Service (NTIS)

Fermilab has developed a second electron lens (TEL-2) for beam-beam compensation in the Tevatron as part of its Run II upgrade program. Operation of the beam position monitors (BPMs) in the first electron lens (TEL-1) showed a systematic transverse position difference between short proton bunches (2 ns sigma) and long electron pulses ((approximately) 1 us) of up to (approximately) 1.5 mm. This difference was attributed to frequency dependence in the BPM system. The TEL-2 BPMs utilize a new compact four plate design with grounding strips between plates to minimize crosstalk. In-situ measurements of these new BPMs are made using a stretched wire pulsed with both proton and electron beam formats. In addition, longitudinal impedance measurements of the TEL-2 are presented. Signal processing algorithm studies indicate that the frequency dependent transverse position offset may be reduced to (approximately) 0.1 mm for the beam structures of interest.

NTIS

Monitors; Particle Accelerators

20070009888 Massachusetts Univ., Lowell, MA USA

Characterization of Material Properties at Terahertz Frequencies

Giles, Robert H; Jan 1995; 12 pp.; In English; Original contains color illustrations

Report No.(s): AD-A462276; No Copyright; Avail.: CASI: [A03](#), Hardcopy

In the realm of materials science, terahertz frequency measurement systems provide significant utility in the characterization of material properties. With support primarily from the U.S. Army National Ground Intelligence Center (NGIC), Submillimeter Technology Laboratory (STL) researchers have been advancing the field of terahertz technology to the application of modeling millimeter-wave and microwave radar for more than a decade. Research in modeling radar requires design of a wide range of measurements systems using current submillimeter-wave source/detector technology, establishment of precise calibration standards, production of high fidelity scale replicas of complex metallic structures, and scaling of millimeter-wave dielectric properties of composites at submillimeter-wave frequencies. This paper explores four measurement techniques typically employed by STL to perform the characterization of materials: (1) laser-based submillimeter-wave

ellipsometry; (2) high-precision reflectometry; (3) laser-based Brewster's angle measurements; and, (4) FIR Fourier transform spectroscopy (FTS).

DTIC

Submillimeter Waves; Mechanical Properties; Frequencies; Characterization

20070009932 Stanford Linear Accelerator Center, CA, USA

Search for Physics Beyond the Standard Model Using Measurements of CP Violating Asymmetries in Rare B Decays: B⁰ to K⁰(S) Pi⁰ and B⁰ to K⁰(S) Pi⁰ Gamma

Kovalskyi, D.; January 2006; 154 pp.; In English

Report No.(s): DE2006-892650; SLAC-R-844; No Copyright; Avail.: National Technical Information Service (NTIS)

This dissertation presents measurements of time-dependent CP violating asymmetries in the decays B^(sup 0) (yields) K^{(sub s)(sup 0)}(pi)^(sup 0) and B^(sup 0) (yields) K^{(sub s)(sup 0)}(pi)^(sup 0)(gamma) based on RUN 1-4 data collected with the BABAR detector at the (Upsilon)(4S) resonance operating at the PEP-II asymmetric e^(sup +)e^(sup -) collider at SLAC. It was found that the CP violating asymmetry parameters are S^{(sub K(sub s)(pi)(sup 0))} = 0.35^{(sub -0.33)(sup +0.30)(stat)} (+- 0.04^(syst)), C^{(sub K(sub g)(pi)(sup 0))} = 0.06 (+- 0.18^(stat)) (+- 0.03^(syst)), S^{(sub K(sub s)(pi)(sup 0)(gamma))} = 0.9 (+- 1.0^(stat)) (+- 0.2^(syst)) and C^{(sub K(sub s)(pi)(sup 0)(gamma))} = -1.0 (+- 0.5^(stat)) (+- 0.2^(syst)), where B^(sup 0) (yields) K^{(sup +0)(gamma)} decays correspond to the K^{(sub s)(pi)(sup 0)} invariant mass interval of (0.8,1.0) GeV and B^(sup 0) (yields) K^{(sub s)(sup 0)(pi)(sup 0)(gamma)} of (1.1,1.8) GeV. All results are consistent with the Standard Model predictions.

NTIS

Asymmetry; Invariance; Mesons; Standard Model (Particle Physics)

20070009936 Iowa State Univ. of Science and Technology, Ames, IA USA

Magnetic Tools for Lab-on-a-Chip Technologies

Pekas, N. S.; January 2005; 88 pp.; In English

Report No.(s): DE2006-892722; No Copyright; Avail.: Department of Energy Information Bridge

This study establishes a set of magnetics-based tools that have been integrated with microfluidic systems. The overall impact of the work begins to enable the rapid and efficient manipulation and detection of magnetic entities such as particles, picoliter-sized droplets, or bacterial cells. Details of design, fabrication, and theoretical and experimental assessments are presented. The manipulation strategy has been demonstrated in the format of a particle diverter, whereby micron-sized particles are actively directed into desired flow channels at a split-flow junction by means of integrated microelectromagnets. Magnetic detection has been realized by deploying Giant Magnetoresistance (GMR) sensors--microfabricated structures originally developed for use as readout elements in computer hard-drives. We successfully transferred the GMR technology to the lab-on-a-chip arena, and demonstrated the versatility of the concept in several important areas: real-time, integrated monitoring of the properties of multiphase droplet flows; rapid quantitative determination of the concentration of magnetic nanoparticles in droplets of ferrofluids; and high-speed detection of individual magnetic microparticles and magnetotactic bacteria. The study also includes novel schemes for hydrodynamic flow focusing that work in conjunction with GMR-based detection to ensure precise navigation of the sample stream through the GMR detection volume, therefore effectively establishing a novel concept of a microfabricated magnetic flow cytometer.

NTIS

Magnetoresistivity; Microfluidic Devices; Magnetic Materials; Technology Utilization

20070009939 Iowa State Univ. of Science and Technology, Ames, IA USA

Coupled Magnetic and Structural Transitions in High-purity Dy and Gd₅Sb_xGe_{4-x}

Chernyshov, A. S.; January 2006; 130 pp.; In English

Report No.(s): DE2006-892728; No Copyright; Avail.: Department of Energy Information Bridge

Magnetic materials exhibiting magnetic phase transitions simultaneously with structural rearrangements of their crystal lattices hold a promise for numerous applications including magnetic refrigeration, magnetomechanical devices and sensors. We undertook a detailed study of a single crystal of dysprosium metal, which is a classical example of a system where magnetic and crystallographic sublattices can be either coupled or decoupled from one another. Magnetocaloric effect, magnetization, ac magnetic susceptibility, and heat capacity of high purity single crystals of dysprosium have been investigated over broad temperature and magnetic field intervals with the magnetic field vector parallel to either the a- or c-axes of the crystal. Notable differences in the behavior of the physical properties when compared to Dy samples studied in the past have been observed between 110 K and 125 K, and between 178 K and (approx)210 K. A plausible mechanism based

on the formation of antiferromagnetic clusters in the impure Dy has been suggested in order to explain the reduction of the magnetocaloric effect in the vicinity of the Neel point. Experimental and theoretical investigations of the influence of commensurability effects on the magnetic phase diagram and the value of the magnetocaloric effect have been conducted. The presence of newly found anomalies in the physical properties has been considered as evidence of previously unreported states of Dy. The refined magnetic phase diagram of dysprosium with the magnetic field vector parallel to the a-axis of a crystal has been constructed and discussed. The magnetic and crystallographic properties of $Gd_{5-x}Sb_xGe_{4-x}$ pseudo-binary system were studied by x-ray diffraction (at room temperature), heat capacity, ac-magnetic susceptibility, and magnetization in the temperature interval 5-320 K in magnetic fields up to 100 kOe. The magnetic properties of three composition ($x = 0.5, 1, 2$) were examined in detail. The $Gd_5Sb_2Ge_2$ compound that adopts $Tm_5Sb_2Si_2$ -type of structure (space group is $Cmca$), shows a second order FM-PM transition at 200 K, whereas $Gd_5Sb_xGe_{4-x}$ compounds for $x = 0.5$ and $x = 1$ (Sm_5Ge_4 -type of structure, space group is $Pnma$) exhibit first order phase transformations at 45 K and 37 K, respectively.

NTIS

Crystal Lattices; Dysprosium; Magnetic Fields; Magnetic Materials; Purity; Gadolinium; Germanium; Antimony

20070009942 Rutherford Appleton Lab., Chilton, UK, Academy of Sciences (Russia), Lebedev., Russian Federation, Heidelberg Univ., Heidelberg, Germany, Max-Planck-Inst. fuer Physik und Astrophysik, Munich, Germany

Heavy Quarks. Working Group 3. Summary Report for the HERA-LHC Workshop Proceedings

Baines, J.; Baranov, S. P.; Behnke, O.; Bracinik, J.; Cacciari, M.; Mar. 27, 2006; 101 pp.; In English
Report No.(s): DE2006-892945; LBNL-54394; No Copyright; Avail.: National Technical Information Service (NTIS)

We review some of the main theoretical aspects of heavy quark production at HERA that will be important for understanding similar processes at the LHC.

NTIS

Conferences; Quarks; Particle Production

20070009943 Stanford Linear Accelerator Center, CA, USA, Cornell Univ., Ithaca, NY, USA, California Univ., Lawrence Berkeley National Lab., Berkeley, CA, USA, Liverpool Univ., UK

Accelerator Markup Language and the Universal Accelerator Parser

Sagan, D.; Forster, M.; Bates, D. A.; Wolski, A.; Schmidt, F.; Oct. 01, 2006; 3 pp.; In English
Report No.(s): DE2006-892968; SLAC-PUB-11918; No Copyright; Avail.: Department of Energy Information Bridge

A major obstacle to collaboration on accelerator projects has been the sharing of lattice description files between modeling codes. To address this problem, a lattice description format called Accelerator Markup Language (AML) has been created. AML is based upon the standard eXtensible Markup Language (XML) format; this provides the flexibility for AML to be easily extended to satisfy changing requirements. In conjunction with AML, a software library, called the Universal Accelerator Parser (UAP), is being developed to speed the integration of AML into any program. The UAP is structured to make it relatively straightforward (by giving appropriate specifications) to read and write lattice files in any format. This will allow programs that use the UAP code to read a variety of different file formats. Additionally, this will greatly simplify conversion of files from one format to another. Currently, besides AML, the UAP supports the MAD lattice format.

NTIS

Document Markup Languages; Parsing Algorithms

20070009945 Stanford Linear Accelerator Center, CA, USA, Texas Univ., Austin, TX, USA

Shape Determination for Deformed Cavities

Lee, L. Q.; Akcelik, V.; Chen, S.; Ge, L.; Li, Z.; Sep. 01, 2006; 4 pp.; In English
Report No.(s): DE2006-892969; SLAC-PUB-12141; No Copyright; Avail.: National Technical Information Service (NTIS)

A realistic superconducting RF cavity has its shape deformed comparing to its designed shape due to the loose tolerance in the fabrication process and the frequency tuning for its accelerating mode. A PDE-constrained optimization problem is proposed to determine the deformation of the cavity. A reduce space method is used to solve the PDE-constrained optimization problem where design sensitivities were computed using a continuous adjoint approach. A proof-of-concept example is given in which the deformation parameters of a single cavity-cell with two different types of deformation were computed.

NTIS

Cavities; Deformation; Shapes; Superconducting Cavity Resonators

20070009948 Stanford Linear Accelerator Center, CA, USA

Updated Measurement of the CKM Angle α Using $B^0 \rightarrow \rho^+ \rho^-$ Decays

Jul. 28, 2006; 21 pp.; In English

Report No.(s): DE2006-892617; SLAC-PUB-12012; No Copyright; Avail.: National Technical Information Service (NTIS)

The authors present results from an analysis of B^0 ($\rho^+ \rho^-$) decays observed with the BABAR detector at the PEP-II asymmetric-energy B Factory at SLAC. They measure the B^0 ($\rho^+ \rho^-$) branching fraction, longitudinal polarization fraction f_L , and the CP-violating parameters S_{long} and C_{long} : $(\text{Beta}(B^0 \rightarrow \rho^+ \rho^-)) = (23.5 (+-) 2.2(\text{stat}) (+-) 4.1(\text{syst})) \times 10^{-6}$, $f_L = 0.977 (+-) 0.024(\text{stat})(-0.013)(+0.015)(\text{syst})$, $S_{\text{long}} = -0.19 (+-) 0.21(\text{stat})(-0.07)(+0.05)(\text{syst})$, $C_{\text{long}} = -0.07 (+-) 0.15(\text{stat}) (+-) 0.06(\text{syst})$. Using an isospin analysis of B^0 ($\rho^+ \rho^-$) decays they determine the angle (α) of the unitarity triangle. One of the two solutions, (α) (74,117) at 68% CL, is compatible with the standard model. All results presented here are preliminary.

NTIS

High Energy Interactions; Mesons; Particle Decay

20070009950 Stanford Linear Accelerator Center, CA, USA

Ξ^0 Production at BABAR

Jul. 27, 2006; 27 pp.; In English

Report No.(s): DE2006-892620; SLAC-PUB-12024; No Copyright; Avail.: National Technical Information Service (NTIS)

Using 232 fb of data collected by the BABAR detector, the Ξ^0 (Ξ^0) and Ξ^0 (Ξ^0) baryons are reconstructed through the decays: $\Xi^0 \rightarrow \gamma \Xi^0$ and $\Xi^0 \rightarrow \gamma \Xi^0$, where $\Xi^0 \rightarrow \pi^+ \pi^-$ and $\Xi^0 \rightarrow \pi^+ \pi^-$. By measuring the efficiency-corrected yields in different intervals of the center-of-mass momentum, the production rates from B decays and from the continuum are extracted. For production from B decays, the branching fractions are found to be $(\text{Beta}(B \rightarrow \Xi^0 X)) \times (\text{Beta}(\Xi^0 \rightarrow \pi^+ \pi^-)) = (1.69 (+-) 0.17 (\text{exp.}) (+-) 0.10 (\text{model})) \times 10^{-4}$ and $(\text{Beta}(B \rightarrow \Xi^0 X)) \times (\text{Beta}(\Xi^0 \rightarrow \pi^+ \pi^-)) = (0.67 (+-) 0.07 (\text{exp.}) (+-) 0.03 (\text{model})) \times 10^{-4}$. For production from the continuum the cross-sections are found to be $(\sigma(e^+ e^- \rightarrow \Xi^0 X)) \times (\text{Beta}(\Xi^0 \rightarrow \pi^+ \pi^-)) = 141 (+-) 24 (\text{exp.}) (+-) 19 (\text{model}) \text{ fb}$ and $(\sigma(e^+ e^- \rightarrow \Xi^0 X)) \times (\text{Beta}(\Xi^0 \rightarrow \pi^+ \pi^-)) = 70 (+-) 11 (\text{exp.}) (+-) 6 (\text{model}) \text{ fb}$. The helicity angle distributions of Ξ^0 decays are studied and found to be consistent with $J = 1/2$.

NTIS

Baryons; Particle Production; Detectors; Particle Decay

20070009951 Stanford Linear Accelerator Center, CA, USA

Measurement of CP Asymmetries and Branching Fractions in $B \rightarrow \pi^+ \pi^-$ and $B \rightarrow K^+ \pi^-$ Decays

Jul. 29, 2006; 25 pp.; In English

Report No.(s): DE2006-892618; SLAC-PUB-12032; No Copyright; Avail.: National Technical Information Service (NTIS)

The authors present preliminary measurements of the CP asymmetries and branching fractions for $B \rightarrow \pi^+ \pi^-$ and $B \rightarrow K^+ \pi^-$ decays. A total of 347 million B^0 events collected by the BABAR detector at the PEP-II asymmetric-energy $e^+ e^-$ collider at SLAC are used for these results.

NTIS

Asymmetry; Invariance; Mesons; CP Violation; Particle Decay

20070009952 Stanford Linear Accelerator Center, CA, USA

Search for D^0 - \bar{D}^0 Mixing in the Decays $D^0 \rightarrow K^+ \pi^- \pi^+$

Jul. 28, 2006; 15 pp.; In English

Report No.(s): DE2006-892622; SLAC-PUB-12019; No Copyright; Avail.: Department of Energy Information Bridge

We present a search for D^0 - \bar{D}^0 mixing in the decays $D^0 \rightarrow K^+ \pi^- \pi^+$ using 230.4 fb of data collected with the BABAR detector at the PEP-II $e^+ e^-$ collider at SLAC. Assuming CP conservation, we measure the time-integrated mixing rate $R_M = (0.019(\text{sub } -0.015)(\text{sub } +0.016)(\text{stat.}) (+-) 0.002(\text{syst.}))\%$, and $R_M \leq 0.048\%$ at the 95% confidence level. Using a frequentist method, we estimate that the data are consistent with no mixing at the 4.3% confidence level. We present results both with and without the assumption of CP

conservation. By combining the value of $R(\text{sub } M)$ from this analysis with that obtained from an analysis of the decays $D(\text{sup } 0)$ (yields) $K(\text{sup } +)(\pi)(\text{sup } -)(\pi)(\text{sup } 0)$, we find $R(\text{sub } M) = (0.020(\text{sub } -0.010)(\text{sup } +0.011))\%$, where the uncertainty is statistical only. We determine the upper limit $R(\text{sub } M) \leq 0.042\%$ at the 95% confidence level, and we find the combined data are consistent with the no-mixing hypothesis at the 2.1% confidence level.

NTIS

Mesons; Particle Decay; High Energy Interactions

20070009953 Fermi National Accelerator Lab., Batavia, IL, USA

Design of an 8 GeV H⁻ transport and multi-turn injection system

Johnson, D. E.; January 2006; 3 pp.; In English

Report No.(s): DE2006-892479; FERMILAB-CONF-06-275-AD; No Copyright; Avail.: National Technical Information Service (NTIS)

An 8 GeV superconducting linear accelerator (SCL) has been proposed as a single stage H⁻ injector into the Main Injector (MI) synchrotron. This could be a multi-use facility which would, among other things, support a 2 MW Neutrino program at Fermi National Accelerator Lab (FNAL) (1,2,3,4). This paper describes a solution for a transport line which is capable of low loss transmission of an H⁻ beam from the linac to the MI, transverse and momentum collimation, and provides for flexible matching into the MI lattice. The required modifications to the MI accelerator complex to accommodate the transfer line and multi-turn injection utilizing carbon foil stripping (and/or potentially laser stripping) and the injection layout are discussed.

NTIS

Linear Accelerators; Beam Injection

20070009954 Fermi National Accelerator Lab., Batavia, IL, USA, Argonne National Lab., IL USA

Initial OTR Measurements of 150 GeV Protons in the Tevatron at FNAL

Scarping, V. E.; Lumpkin, A. H.; Tassotto, G. R.; May 01, 2006; 8 pp.; In English

Report No.(s): DE2006-892270; FERMILAB-CONF-06-103-AD; No Copyright; Avail.: National Technical Information Service (NTIS)

Fermilab has developed standard optical transition radiation (OTR) detectors as part of its Run II upgrade program for measuring intense proton and antiproton beams. These detectors utilize radiation-hardened CID cameras to image the OTR and produce high-resolution two-dimensional beam profiles. One of these detectors has been installed in the Tevatron next to the new ionization profile monitor (IPM). Initial OTR measurements are presented for 150 GeV injected coalesced and uncoalesced proton bunches. OTR images are taken for one-turn and two-turn injections over an intensity range of 1.5×10^{11} to 3.5×10^{11} protons. Preliminary profile measurements give uncoalesced beam size sigmas of 1.0 mm horizontally by 0.7 mm vertically and coalesced beam size sigmas of 1.8 mm horizontally by 0.70 mm vertically. OTR images are also presented for changes in the Tevatron skew quadrupole magnet currents, which produce a rotation to the OTR image, and for changes to the Tevatron RF, which can be used to measure single-turn dispersion. Operational aspects of this detector for beam studies and Tevatron tune-up are also discussed.

NTIS

Particle Accelerators; Protons

20070009955 Fermi National Accelerator Lab., Batavia, IL, USA

Preliminary Studies of a Phase Modulation Technique for Measuring Chromaticity

Tan, C. Y.; Apr. 01, 2006; 9 pp.; In English

Report No.(s): DE2006-892276; FERMILAB-CONF-06-080-AD; No Copyright; Avail.: National Technical Information Service (NTIS)

The classical method for measuring chromaticity is to slowly modulate the RF frequency and then measuring the betatron tune excursion. The technique that is discussed in this paper modulates instead the phase of the RF and then the chromaticity is obtained by phase demodulating the betatron tune. However, this technique requires knowledge of the betatron frequency in real time in order for the phase to be demodulated. Fortunately, the Tevatron has a tune tracker based on the phase locked loop principle which fits this requirement. A preliminary study with this technique has showed that it is a promising method for doing continuous chromaticity measurement and raises the possibility of doing successful chromaticity feedback with it.

NTIS

Color; Phase Modulation

20070009956 Stanford Linear Accelerator Center, CA, USA

Coherent X-ray Production by Cascading Stages of High Gain Harmonic Generation Free Electron Lasers Seeded by IR Laser Driven High-Order Harmonic Generation

Wu, J.; Bolton, P. R.; Aug. 2006; 5 pp.; In English

Report No.(s): DE2006-891834; SLAC-PUB-12124; No Copyright; Avail.: National Technical Information Service (NTIS)

Coherent x-ray production achieved by a seeded free electron laser (FEL) with cascaded high gain harmonic generation (HG) is important for next generation development of synchrotron light sources. We examine the feasibility and some features of FEL emission seeded by a high order harmonic of an intense infrared conventional laser source (HHG). In addition to the intrinsic FEL chirp phenomenon, the longitudinal profile and spectral bandwidth of the HHG seed are modified significantly by the FEL interaction well before saturation occurs. This smears out original attosecond pulse structure. As an example, we describe a cascaded HG scheme for coherent x-ray FEL generation that is seeded by the twenty-seventh harmonic of an ultrashort 800 nm laser pulse with 10 fs rms duration. By cascading two stages of HG, 15 GW peak power FEL emission at 0.3 nm can be produced with 90 MW peak power radiation at 0.1 nm via the non-linear harmonic generation.

NTIS

Free Electron Lasers; Harmonic Generations; High Gain; Infrared Lasers; X Rays

20070009957 Fermi National Accelerator Lab., Batavia, IL, USA

Bc at CDF

Wester, W.; Apr. 27, 2006; 5 pp.; In English

Report No.(s): DE2006-892282; FERMILAB-CONF-06-074-E; No Copyright; Avail.: National Technical Information Service (NTIS)

The study of the B-(sub c) meson relies on the large production cross section at hadron colliders, triggerable low background decay modes, and the powerful capabilities of the modern multipurpose collider detectors.

NTIS

Mesons; Particle Production; Quantum Chromodynamics

20070009958 Stanford Linear Accelerator Center, CA, USA

Electron Signal Detection for the Beam-Finder Wire of the Linac Coherent Light Source Undulator

Wu, J.; Emma, P.; Field, R. C.; Aug. 2006; 3 pp.; In English

Report No.(s): DE2006-891835; SLAC-PUB-12120; No Copyright; Avail.: National Technical Information Service (NTIS)

The Linac Coherent Light Source (LCLS) is a SASE x-ray Free-Electron Laser (FEL) based on the final kilometer of the Stanford Linear Accelerator. The tight tolerances for positioning the electron beam close to the undulator axis calls for the introduction of Beam Finder Wire (BFW) device. A BFW device close to the upstream end of the undulator segment and a quadrupole close to the downstream end of the undulator segment will allow a beam-based undulator segment alignment. Based on the scattering of the electrons on the BFW, we can detect the electron signal in the main dump bends after the undulator to find the beam position. We propose to use a threshold Cherenkov counter for this purpose. According to the signal strength at such a Cherenkov counter, we then suggest choice of material and size for such a BFW device in the undulator.

NTIS

Alignment; Coherent Light; Detection; Electron Beams; Electrons; Free Electron Lasers; Light Sources; Linear Accelerators; Signal Detection; Wire

20070009960 Fermi National Accelerator Lab., Batavia, IL, USA

Searching for T in the Little Higgs Model Using Jet Based Information at CMS

Han, T.; Kunori, S.; Lueking, I.; Wu, W.; Yetkin, T.; Jan. 29, 2006; 28 pp.; In English

Report No.(s): DE2006-892434; FERMILAB-FN-0786-E; No Copyright; Avail.: National Technical Information Service (NTIS)

Recently, the Little Higgs Model has been introduced to try to solve the hierarchy problem. This note describes a study of the Little Higgs Model using jet and E(T) based information with the CMS detector at the LHC. The study used Monte Carlo simulations of the physics and CMS detector to explore the capability of CMS to search for T approximate Z + t, and t approximate W + b, W approximate two jets with T masses of separation. To deal with such closely spaced hadronic showers, a special jet algorithm was used that was developed to improve the mass resolution and help reduce the background contamination. The focus of this algorithm was to reconstruct parent particles from two hadronic jets in the final state, so the algorithm was modified to work for three jets. A selection criteria was also developed to reduce Z plus multi-jets background.

Using the reconstructed top quark, the transverse mass of the T was formed for Z approximate neutrinos. The signal significance was calculated for an integrated luminosity of (approximate 300 fb⁻¹) and for a T mass of 1.0 TeV.

NTIS

Higgs Bosons; Mathematical Models; Hadrons

20070009961 Minnesota Univ., Minneapolis, MN, USA

CPT Conservation and Atmospheric Neutrinos in the MINOS Far Detector

Becker, B. R.; Feb. 2006; 359 pp.; In English

Report No.(s): DE2006-892437; No Copyright; Avail.: National Technical Information Service (NTIS)

The MINOS Far Detector is a 5400 ton iron calorimeter located at the Soudan state park in Soudan Minnesota. The MINOS far detector can observe atmospheric neutrinos and separate charge current $\nu(\mu)$ and $\bar{\nu}(\mu)$ interactions by using a 1.4 T magnetic field to identify the charge of the produced muon. The CPT theorem requires that neutrinos and anti-neutrinos oscillate in the same way. In an fiducial exposure of 5.0 kilo-ton years a total of 41 candidate neutrino events are observed with an expectation of $53.1 \pm 7.6(\text{system.}) \pm 7.2(\text{stat.})$ unoscillated events or $31.6 \pm 4.7(\text{system.}) \pm 5.6(\text{stat.})$ events with $\Delta m^2 = 2.4 \times 10^{-3} \text{eV}^2$, $\sin^2(2\theta) = 1.0$ as oscillation parameters. These include 28 events which can have their charge identified with high confidence. These 28 events consist of 18 events consistent with being produced by $\nu(\mu)$ and 10 events being consistent with being produced by $\bar{\nu}(\mu)$. No evidence of CPT violation is observed.

NTIS

Conservation; Neutrinos; CP Violation; Detectors; Calorimeters

20070009962 Minnesota Univ., Minneapolis, MN, USA

Cosmic Ray Muon Charge Ratio in the MINOS Far Detector

Beall, E. B.; Dec. 2005; 154 pp.; In English

Report No.(s): DE2006-892438; No Copyright; Avail.: National Technical Information Service (NTIS)

The MINOS Far Detector is a 5.4 kiloton (5.2 kt steel plus 0.2 kt scintillator plus aluminum skin) magnetized tracking calorimeter located 710 meters underground in the Soudan mine in Northern Minnesota. MINOS is the first large, deep underground detector with a magnetic field and thus capable of making measurements of the momentum and charge of cosmic ray muons. Despite encountering unexpected anomalies in distributions of the charge ratio ($N_+ = N_-$) of cosmic muons, a method of cancelling systematic errors is proposed and demonstrated. The result is $R_{\text{eff}} = 1.346 \pm 0.002(\text{stat}) \pm 0.016(\text{syst})$ for the averaged charge ratio, and a result for a rising t to slant depth of $R(X) = 1.300 \pm 0.008(\text{stat}) \pm 0.016(\text{syst}) + (1.8 \pm 0.3) \times 10^{-5} X$, valid over the range of slant depths from 2000 to 6000 MWE. This slant depth range corresponds to minimum surface muon energies between 750 GeV and 5 TeV.

NTIS

Cosmic Rays; Muons

20070009965 Stanford Linear Accelerator Center, CA, USA

Search for the Rare Decay B to $a_0 + \pi^0$

Jul. 26, 2006; 17 pp.; In English

Report No.(s): DE2006-892639; SLAC-PUB-11979; No Copyright; Avail.: National Technical Information Service (NTIS)

A search for the decay $B(\pm)$ (yields) $a_0(\pm) \pi^0$ with the $a_0(\pm)$ decaying to an (η) and a (π^0) was carried out at the Stanford Linear Accelerator Center using the BABAR detector coupled with the PEP-II collider. The analysis used a data sample comprised of approximately 252 million $B(\bar{B})$ pairs collected at the $(\Upsilon(4S))$ resonance. No signal was observed and a 90% confidence level upper limit on the branching fraction was set at 1.32×10^{-6} .

NTIS

Mesons; Linear Accelerators; Particle Decay

20070009967 Stanford Linear Accelerator Center, CA, USA

Search for the Decays $B(\pm)$ to $e(\pm) \nu_e$ and $B(\pm)$ to $\mu(\pm) \nu_\mu$ Using Hadronic-tag Reconstruction

Aug. 02, 2006; 19 pp.; In English

Report No.(s): DE2006-892642; SLAC-PUB-12026; No Copyright; Avail.: National Technical Information Service (NTIS)

The authors report on a search for the rare decay modes $B(\pm) \rightarrow e(\pm) \nu_e$ and $B(\pm) \rightarrow \mu(\pm) \nu_\mu$

$(\mu)^+(\nu)$ with data collected from the BABAR detector at the PEP-II e^+e^- storage ring. This search utilizes a new technique in which they fully reconstruct the accompanying B^- in $(\Upsilon(4S))$ B^+B^- events, and look for a mono-energetic lepton in B^+ rest frame. No signal candidates observed in either of the channels, consistent with the expected background, in a data sample of approximately 229 million $B\bar{B}$ pairs. The branching-fraction upper limits are set at $\text{Br}(B^+ \rightarrow e^+\nu)$ $\leq 7.9 \times 10^{-6}$ and $\text{Br}(B^+ \rightarrow \mu^+\nu)$ $\leq 6.2 \times 10^{-6}$ at the 90% confidence level.

NTIS

Hadrons; Mesons; Particle Decay

20070009968 Stanford Linear Accelerator Center, CA, USA

Measurement of the Pseudoscalar Decay Constant f_D s using Charm-Tagged Events in e^+e^- Collisions at the $\Upsilon(4S)$

Stelzer, J.; May 2006; 261 pp.; In English

Report No.(s): DE2006-893296; SLAC-R-825; No Copyright; Avail.: National Technical Information Service (NTIS)

The decay constant $f_{D(s)}$ of the pseudoscalar strange charm meson $D(s)^+$ is an important benchmark test of the theoretical methods that quantitatively describe the nonperturbative low-energy regime of QCD, the theory of the strong interaction. A confirmation of the validity of these predictive methods, foremost lattice QCD, in the sector of heavy-light meson decay constants increases trust in the calculation of f_B , which is an important number for the measurement of the CKM matrix element V_{td} in $B^0\bar{B}^0$ -mixing events. From October 1999 through July 2004, the BABAR experiment, located at the PEP-II storage ring at the Stanford Linear Accelerator Center, collected 230.2 fb $^{-1}$ of data in e^+e^- collision at $\sqrt{s} = 10.58$ GeV. In this thesis, these data are searched for $e^+e^- \rightarrow c\bar{c}$ events by identifying sets of charged and neutral pions and charged kaons, consistent with the decay of a charm meson, D^0 , D^+ , $D(s)^+$, or D^{*+} . A sample of 510,000 charmed mesons with a momentum consistent with $e^+e^- \rightarrow c\bar{c}$ events is identified.

NTIS

Charm (Particle Physics); Collisions; Half Life; Mesons; Quantum Chromodynamics

20070009969 Stanford Linear Accelerator Center, CA, USA

State of the Art in EM Field Computation

Ng, C.; Akcelik, V.; Candel, A.; Chen, S.; Folwell, N.; Aug. 2006; 5 pp.; In English

Report No.(s): DE2006-892643; SLAC-PUB-12020; No Copyright; Avail.: National Technical Information Service (NTIS)

This paper presents the advances in electromagnetic (EM) field computation that have been enabled by the US DOE SciDAC Accelerator Science and Technology project which supports the development and application of a suite of electromagnetic codes based on the higher-order finite element method. Implemented on distributed memory supercomputers, this state of the art simulation capability has produced results which are of great interest to accelerator designers and with realism previously not possible with standard codes. Examples from work on the International Linear Collider (ILC) project are described.

NTIS

Computation; Electromagnetic Fields; Technologies

20070009970 Warwick Univ., Coventry, UK

Study of Multi-body Charmless B Decays with the BaBar Experiment

Latham, T. E.; Oct. 01, 2006; 6 pp.; In English

Report No.(s): DE2006-893761; SLAC-PUB-12159; No Copyright; Avail.: Department of Energy Information Bridge

The authors report recent measurements of charmless B decays to the final states $K^+K^+K^-$, $(\phi)\phi K$, $(\eta)'\eta K$, $M_S^0K_S^0K_L^0$, $(\bar{\Lambda})p(\pi)^+$, $K^*h^+h^-$ and KX (inclusive). The results were obtained using a data sample of up to 288.5 fb $^{-1}$ recorded by the BABAR detector at the PEP-II asymmetric B factory at SLAC.

NTIS

Mesons; Particle Decay; Asymmetry

20070009971 Stanford Linear Accelerator Center, CA, USA

Semileptonic B Decays at the B Factories

Bozzi, C.; Sep. 25, 2006; 9 pp.; In English

Report No.(s): DE2006-892644; SLAC-PUB-11871; No Copyright; Avail.: National Technical Information Service (NTIS)

Recent results on inclusive and exclusive semileptonic B decays from B Factories are presented. The status and perspectives of the determination of the CKM matrix elements V_{ub} and V_{cb} with semileptonic B decays is discussed.

NTIS

Industrial Plants; Mesons; Particle Decay; Leptons

20070009972 Stanford Linear Accelerator Center, CA, USA

Measurement of the Relative Branching Fractions for $B \rightarrow D D^* D^{}(\pi)$ $\ell \bar{\nu}(\underline{\nu})$ with a Large Sample of Tagged B Mesons**

Jul. 27, 2006; 20 pp.; In English

Report No.(s): DE2006-892631; SLAC-PUB-12004; No Copyright; Avail.: National Technical Information Service (NTIS)

We present a study of B semileptonic decays into charm final states based on 211.7 fb⁻¹ of data collected at the $(\Upsilon)(4S)$ resonance with the BABAR detector at the PEP-II e^+e^- storage ring. Using a novel technique based on the simultaneous fit of a set of variables reconstructed on the recoil of a B tagged in an hadronic decay mode, we measure the relative branching fractions $(\Lambda)(B \rightarrow D \ell \bar{\nu}(\underline{\nu})) = 0.611 (+- 0.022 \text{ (stat.) } (+- 0.027 \text{ (syst.)})$ and $(\Lambda)(B \rightarrow D^* \ell \bar{\nu}(\underline{\nu})) / (\Lambda)(B \rightarrow D \ell \bar{\nu}(\underline{\nu})) = 0.173 (+- 0.017 \text{ (stat.) } (+- 0.021 \text{ (syst.)})$.

NTIS

Mesons; Particle Decay; Branching (Physics)

20070009973 Stanford Linear Accelerator Center, CA, USA

Z Phenomenology and the LHC

Rizzo, T. G.; Oct. 2006; 40 pp.; In English

Report No.(s): DE2006-893766; SLAC-PUB-12129; No Copyright; Avail.: National Technical Information Service (NTIS)

A brief pedagogical overview of the phenomenology of Z gauge bosons is presented. Such particles can arise in various electroweak extensions of the Standard Model (SM). We provide a quick survey of a number of Z models, review the current constraints on the possible properties of a Z and explore in detail how the LHC may discover and help elucidate the nature of these new particles. We provide an overview of the Z studies that have been performed by both ATLAS and CMS. The role of the ILC in determining Z properties is also discussed.

NTIS

Bosons; Phenomenology; Standard Model (Particle Physics)

20070009974 Stanford Linear Accelerator Center, CA, USA

Search for CPT and Lorentz Violation in B_0 - B_0 Oscillations with Inclusive Dilepton Events

Jul. 29, 2006; 19 pp.; In English

Report No.(s): DE2006-892632; SLAC-PUB-12003; No Copyright; Avail.: National Technical Information Service (NTIS)

We report preliminary results of a search for CPT and Lorentz violation in B_0 - B_0 oscillations using an inclusive dilepton sample collected by the BABAR experiment at the PEP-II B Factory. Using a sample of 232 million B_0 pairs, we search for time-dependent variations in the complex CPT parameter $z = z_0 + z_1 \cos((\Omega)(cft) + \phi)$ where Ω is the Earth's sidereal frequency and cft is sidereal time. We measure $\text{Im}z_0 = (-14.1 (+- 7.3 \text{ (stat.) } (+- 2.4 \text{ (syst.)}) \times 10^{\text{sup } -3})$, $(\Delta)(\Lambda) \times \text{Re}z_0 = (-7.2 (+- 4.1 \text{ (stat.) } (+- 2.1 \text{ (syst.)}) \times 10^{\text{sup } -3}) \text{ ps}^{\text{sup } -1}$, $\text{Im}z_1 = (-24.0 (+- 10.7 \text{ (stat.) } (+- 5.9 \text{ (syst.)}) \times 10^{\text{sup } -3})$, and $(\Delta)(\Lambda) \times \text{Re}z_1 = (-18.8 (+- 5.5 \text{ (stat.) } (+- 4.0 \text{ (syst.)}) \times 10^{\text{sup } -3}) \text{ ps}^{\text{sup } -1}$, where $(\Delta)(\Lambda)$ is the difference between the decay rates of the neutral B mass eigenstates. The statistical correlation between the measurements of $\text{Im}z_0$ and $(\Delta)(\Lambda) \times \text{Re}z_0$ is 76%; between $\text{Im}z_1$ and $(\Delta)(\Lambda) \times \text{Re}z_1$ it is 79%. These results are used to evaluate expressions involving coefficients for Lorentz and CPT violation in the general Lorentz-violating standard-model extension. In a complementary approach, we examine the spectral power of periodic variations in z over a wide range of frequencies and find no significant signal.

NTIS

Mesons; Oscillations; CP Violation; Leptons

20070009975 Stanford Linear Accelerator Center, CA, USA

Suppression of Secondary Emission in a Magnetic Field Using a Sawtooth and Isosceles Triangle Surface

Wang, L.; Raubenheimer, T.; Stupakov, G.; Aug. 2006; 11 pp.; In English

Report No.(s): DE2006-892634; SLAC-PUB-12001; No Copyright; Avail.: National Technical Information Service (NTIS)

The effect of surface roughness on the secondary electron emission from a sawtooth and isosceles triangle surface in a magnetic field under electron bombardment is investigated using a Monte-Carlo method. Some of the secondary electrons emitted from the surface return to the surface within their first few gyrations, resulting in a low effective secondary electron yield. Both sawtooth and isosceles triangle surface in magnetic field can significantly reduce the secondary emission yield below the multipacting threshold with weak dependence on the size of surface and magnetic field.

NTIS

Electron Emission; Magnetic Fields; Secondary Emission; Triangles

20070009976 Stanford Linear Accelerator Center, CA, USA

Measurement of CP-Violating Asymmetries in B^0 to $(\rho\pi)^0$ Using a Time-Dependent Dalitz Plot Analysis

Jul. 31, 2006; 32 pp.; In English

Report No.(s): DE2006-892616; SLAC-PUB-12035; No Copyright; Avail.: National Technical Information Service (NTIS)

We report a measurement of CP-violating asymmetries in B^0 ($\rho\pi$) ($\pi^+\pi^-\pi^0$) decays using a time-dependent Dalitz plot analysis. The results are obtained from a data sample of 347 million $(\Upsilon(4S) \rightarrow B\bar{B})$ decays, collected by the BABAR detector at the PEP-II asymmetric-energy B Factory at SLAC. We measure 26 coefficients of the bilinear form factor terms occurring in the time-dependent decay rate of the B^0 meson and derive the physically relevant quantities from these coefficients. In particular we find a three standard deviation evidence of direct CP-violation in the B^0 ($\rho^+\pi^-\pi^0$) decays, with systematic uncertainties included. We also achieve a constraint of the angle (α) of the Unitarity Triangle. All results presented are preliminary.

NTIS

Asymmetry; Invariance; Time Dependence

20070009977 Stanford Linear Accelerator Center, CA, USA

Precision Measurement of the $D_{s1}(2536)^+$ Meson Mass and Decay Width

Jul. 28, 2006; 19 pp.; In English

Report No.(s): DE2006-892636; SLAC-PUB-11998; No Copyright; Avail.: Department of Energy Information Bridge

The decay width and the mass of the $D_{s1}(2536)^+$ have been measured via the decay channel $D_{s1}^+(\rho^-\pi^0)$ using 232 fb⁻¹ of data collected with the BABAR detector at the PEP-II asymmetric-energy e^+e^- storage ring. The result for the decay width is $\Gamma(D_{s1}^+(\rho^-\pi^0)) = (1.03^{(+)}_{(-)} 0.05^{(+)}_{(-)} 0.12)$ MeV/c², with the first error denoting the statistical uncertainty and the second one the systematic uncertainty. For the mass, a value of $m(D_{s1}^+(\rho^-\pi^0)) = (2534.85^{(+)}_{(-)} 0.02^{(+)}_{(-)} 0.40)$ MeV/c² has been obtained. The systematic error is dominated by the uncertainty on the $D_{s1}^+(\rho^-\pi^0)$ mass. The mass difference between the $D_{s1}^+(\rho^-\pi^0)$ and $D_{s1}^+(\pi^+\pi^0)$ has been measured to be $(\Delta)m = (524.85^{(+)}_{(-)} 0.02^{(+)}_{(-)} 0.04)$ MeV/c².

NTIS

Mesons; Particle Decay; Precision

20070009979 Stanford Linear Accelerator Center, CA, USA, Grenoble-1 Univ., Annecy, France, Barcelona Univ., Spain, Bari Univ., Italy

Measurements of Branching Fractions, Polarizations, and Direct CP-Violation Asymmetries in B to ρK^* and B to $f_0(980) K^*$ Decays

Aubert, B.; Sep. 26, 2006; 7 pp.; In English

Report No.(s): DE2006-892637; SLAC-PUB-11997; No Copyright; Avail.: National Technical Information Service (NTIS)

The authors report searches for B-meson decays to the charmless final states $(\rho)K^*$ and $f_0(980)K^*$ with a sample of 232 million $B\bar{B}$ pairs collected with the BABAR detector at the PEP-II asymmetric-energy e^+e^- collider at SLAC.

NTIS

Asymmetry; CP Violation

20070009980 Fermi National Accelerator Lab., Batavia, IL, USA

Determining neutrino mass hierarchy by precise measurements of two Δm^2 in electron-neutrino and muon-neutrino disappearance experiments

Minakata, H.; Nunokawa, H.; Parke, S.; Funchal, R. Z.; January 2006; 2 pp.; In English

Report No.(s): DE2006-892469; FERMILAB-CONF-06-320-T; No Copyright; Avail.: National Technical Information Service (NTIS)

In this talk, we discuss the possibility of determining the neutrino mass hierarchy by comparing the two effective atmospheric neutrino mass squared differences measured, respectively, in electron, and in muon neutrino disappearance oscillation experiments. If the former, is larger (smaller) than the latter, the mass hierarchy is of normal (inverted) type. We consider two very high precision (a few per mil) measurements of such mass squared differences by the phase II of the T2K (Tokai-to-Kamioka) experiment and by the novel Moessbauer enhanced resonant $\bar{\nu}e$ absorption technique. Under optimistic assumptions for the systematic errors of both measurements, we determine the region of sensitivities where the mass hierarchy can be distinguished. Due to the tight space limitation, we present only the general idea and show of few most important plots.

NTIS

Hierarchies; Neutrinos; Muons

20070009981 Stanford Linear Accelerator Center, CA, USA

Measurement of the CP-violating Asymmetries in $B^0 \rightarrow K^0 \pi^0$ and of the Branching Fraction of $B^0 \rightarrow K^0 \pi^0$

Aug. 16, 2006; 14 pp.; In English

Report No.(s): DE2006-892638; SLAC-PUB-11982; No Copyright; Avail.: Department of Energy Information Bridge

The authors present a measurement of the time-dependent CP-violating asymmetries in B^0 (yields) K^0_S (π^0) (π^0) decays based on 348 million ($\Upsilon(4S)$ (yields) B^0) events collected by the BABAR experiment at the PEP-II asymmetric-energy B Factory at SLAC. They measure the direct CP-violating asymmetry $C_{CP}(K^0_S \pi^0) = 0.20 (+) 0.16 (+) 0.03$ and the CP-violating asymmetry in the interference between mixing and decay $S_{CP}(K^0_S \pi^0) = 0.33 (+) 0.26 (+) 0.04$ where the first error is statistical and the second systematic. On the same sample, they measure the decay branching fraction, obtaining $(\text{Br})(B^0 \rightarrow K^0_S \pi^0) = (10.5 (+) 0.7 (+) 0.5) \times 10^{-6}$. All results presented here are preliminary.

NTIS

Asymmetry; Invariance; Mesons

20070009982 Paris VI Univ., Orsay, France

Higgs Searches at Tevatron

Sonnenschein, L.; January 2006; 6 pp.; In English

Report No.(s): DE2006-892470; FERMILAB-CONF-06-314-E; No Copyright; Avail.: National Technical Information Service (NTIS)

SM and MSSM Higgs Searches at the proton anti-proton collider Tevatron in Run II are presented. The performance of the collider and the two experiments D0 and CDF is shown. No deviation from SM background expectation and no MSSM Higgs signal has been observed.

NTIS

Higgs Bosons; Particle Accelerators

20070009983 Fermi National Accelerator Lab., Batavia, IL, USA, Illinois Univ., Urbana-Champaign, IL, USA, Istituto Nazionale di Fisica Nucleare, Pisa, Italy, Ohio State Univ., Columbus, OH, USA

CDF II Extremely Fast Tracker Upgrade

Abulencia, A.; Azzurri, P.; Cochran, E.; Dittmann, J.; Donati, S.; January 2006; 3 pp.; In English

Report No.(s): DE2006-892472; FERMILAB-CONF-06-280-E; No Copyright; Avail.: Department of Energy Information Bridge

The CDF II extremely Fast Tracker is the trigger track processor which reconstructs charged particle tracks in the transverse plane of the CDF II central outer tracking chamber. The system is now being upgraded to perform a three dimensional track reconstruction. A review of the upgrade is presented here.

NTIS

Charged Particles; Detectors

20070009984 Fermi National Accelerator Lab., Batavia, IL, USA, Zurich Univ., Switzerland

Testing the SUSY-QCD Yukawa Coupling in a Combined LHC/ILC Analysis

Freitas, A.; Skands, P. Z.; January 2006; 4 pp.; In English

Report No.(s): DE2006-892473; FERMILAB-CONF-06-266-T; No Copyright; Avail.: Department of Energy Information Bridge

In order to establish supersymmetry (SUSY) at future colliders, the identity of gauge couplings and the corresponding Yukawa couplings between gauginos, sfermions and fermions needs to be verified. Here a first phenomenological study for determining the Yukawa coupling of the SUSY-QCD sector is presented, using a method which combines information from LHC and ILC.

NTIS

Quantum Chromodynamics; Supersymmetry; Yukawa Potential

20070009985 Osaka Univ., Japan

Study of the decay $K(L) \rightarrow \pi^+ e^+ \nu_e e^-$ to probe the semileptonic $K\pi$ structure

Kotera, K.; Sep. 2006; 145 pp.; In English

Report No.(s): DE2006-892477; No Copyright; Avail.: National Technical Information Service (NTIS)

We observed a new neutral kaon decay mode, $KL \rightarrow \pi^+ e^+ e^- e^-$ for the first time. Based on the 20225 events including 1018-25 background events, we determined the branching ratio, $B(KL \rightarrow \pi^+ e^+ e^- e^-; M_{e^+e^-} > 5 \text{ MeV}/c^2, E_{e^+e^-} > 30 \text{ MeV}) = (1.281-0.041) \times 10^{-5}$. This branching ratio agrees with a theoretical prediction based on the chiral perturbation theory (ChPT) calculation at $O(p^4)$. Most of the kinematical distributions agree with the ChPT $O(p^4)$ calculation. We also measured one of the low energy coupling constants for the ChPT $O(p^4)$, $L_9 = (8.0 - 1.6) \times 10^{-3}$. The $M_{e^+e^-}$ distribution below 100 MeV showed a 3 σ deviation from the ChPT $O(p^4)$ calculation. This requires further studies in theory and experiments.

NTIS

Particle Decay; Leptons; Particle Theory

20070009986 Fermi National Accelerator Lab., Batavia, IL, USA, California Univ., Lawrence Berkeley National Lab., Berkeley, CA, USA, National High Magnetic Field Lab., Tallahassee, FL, USA, Michigan State Univ., East Lansing, MI, USA

Superconducting Magnets in High-Radiation Environment at Supercolliders

Mokhov, N. V.; Chichili, D. R.; Gourlay, S. A.; Van Sciver, S.; Zeller, A.; Jul. 17, 2006; 12 pp.; In English

Report No.(s): DE2006-892474; FERMILAB-CONF-06-244-AD; No Copyright; Avail.: National Technical Information Service (NTIS)

The principal challenges arising from beam-induced energy deposition in superconducting (SC) magnets at high-energy high-luminosity hadron and lepton colliders are described. Radiation constraints are analyzed that include quench stability, dynamic heat loads on the cryogenic system, radiation damage limiting the component lifetime, and residual dose rates related to hands-on maintenance. These issues are especially challenging for the interaction regions (IR), particularly for the considered upgrade layouts of the Large Hadron Collider. Up to a few kW of beam power can dissipate in a single SC magnet, and a local peak power density can substantially exceed the quench levels. Just formally, the magnet lifetime is limited to a few months under these conditions. Possible solutions and the ways to mitigate these problems are described in this paper along with R&D needed.

NTIS

Superconducting Magnets; Superconducting Super Collider

20070009987 Massachusetts Inst. of Tech., Cambridge, MA, USA

Analysis of $B(s)$ Flavor Oscillations at CDF

Leonardo, N.; Sep. 2006; 299 pp.; In English

Report No.(s): DE2006-892478; No Copyright; Avail.: National Technical Information Service (NTIS)

The search for and study of flavor oscillations in the neutral $B(s)B(\bar{s})$ meson system is an experimentally challenging task. It constitutes a flagship analysis of the Tevatron physics program. In this dissertation, we develop an analysis of the time-dependent $B(s)$ flavor oscillations using data collected with the CDF detector.

NTIS

Calibrating; Oscillations; Flavor (Particle Physics)

20070009993 Georgetown Univ., Washington, DC, USA, Stanford Univ., CA, USA

Charm and Charmonium Spectroscopy

Petersen, B. A.; Oct. 01, 2006; 4 pp.; In English

Report No.(s): DE2006-893763; SLAC-PUB-12166; No Copyright; Avail.: Department of Energy Information Bridge

The last few years have seen a revival of interest in charm spectroscopy with more than a dozen new states being reported and hundreds of new theoretical investigations being published. The advent of the B-factories (1,2), with their large, charm-rich data samples, has proven crucial to the discovery and investigation of new charm hadron states, but other experiments have confirmed and complemented the B-factory observations. Much interest has been generated by several new states that do not appear to be easily incorporated in the conventional picture of charm and charmonium mesons. Here, the focus is on the latest experimental results in charm spectroscopy and the determination of the nature of the recently discovered states. Recent experimental results in charm and charmonium spectroscopy are reviewed.

NTIS

Charm (Particle Physics); Mesons; Spectroscopy

20070010002 Stanford Linear Accelerator Center, CA, USA

Measurement of the Mass and Width and Study of the Spin of the $\Xi(1690)^0$ Resonance from $\Lambda_b^0 \rightarrow \Lambda_c^+ \bar{K}^0$ Decay at BaBar

Jul. 20, 2006; 21 pp.; In English

Report No.(s): DE2006-892647; SLAC-PUB-11990; No Copyright; Avail.: National Technical Information Service (NTIS)

The $\Xi(1690)^0$ resonance is observed in the $\Lambda_b^0 \rightarrow \Lambda_c^+ \bar{K}^0$ channel in the decay $\Lambda_b^0 \rightarrow \Lambda_c^+ \bar{K}^0$ (yields $\Lambda_b^0 \rightarrow \Lambda_c^+ \bar{K}^0$), from a data sample corresponding to a total integrated luminosity of (approx) 200 fb (sup -1) recorded by the BABAR detector at the PEP-II asymmetric-energy e+e- collider operating at (approx) 10.58 GeV and (approx) 10.54 GeV center-of-mass energies. A fit to the Dalitz plot intensity distribution corresponding to the coherent superposition of amplitudes describing $\Lambda_b^0 \rightarrow \Lambda_c^+ \bar{K}^0$ and $\Xi(1690)^0 \rightarrow \Lambda_c^+ \bar{K}^0$ production yields mass and width values of 1684.7 (+-) 1.3(stat.) (sub -1.6)(sup +2.2)(syst.) MeV/c (sup 2), and 8.1 (sub -3.5)(sup +3.9)(stat.) (sub -0.9)(sup +1.0)(syst.) MeV, respectively, for the $\Xi(1690)^0$, while the spin is found to be consistent with value of 1/2 on the basis of studies of the $(\Lambda_b^0 \rightarrow \Lambda_c^+ \bar{K}^0)$ angular distribution.

NTIS

Spin Resonance; Amplitudes; Decay; Asymmetry

20070010004 Stanford Linear Accelerator Center, CA, USA

Measurement of the q^2 Dependence of the Hadronic Form Factor in $D^0 \rightarrow K^- e^+ \nu_e$ Decays

Jul. 27, 2006; 23 pp.; In English

Report No.(s): DE2006-892624; SLAC-PUB-12016; No Copyright; Avail.: National Technical Information Service (NTIS)

A preliminary measurement of the q^2 dependence of the $D^0 \rightarrow K^- e^+ \nu_e$ decay rate is presented. This rate is proportional to the hadronic form factor squared, specified by a single parameter. This is either the mass in the simple pole ansatz $m(\text{sub pole}) = (1.854 (+-) 0.016 (+-) 0.020)$ GeV/c (sup 2) or the scale in the modified pole ansatz $(\alpha)(\text{sub pole}) = 0.43 (+-) 0.03 (+-) 0.04$. The first error refers to the statistical, the second to the systematic uncertainty.

NTIS

Form Factors; Hadrons; Decay Rates

20070010005 Stanford Linear Accelerator Center, CA, USA

Time-dependent CP-violation Parameters in $B^0 \rightarrow \eta K^0$ Decay

Aug. 01, 2006; 15 pp.; In English

Report No.(s): DE2006-892628; SLAC-PUB-12009; No Copyright; Avail.: National Technical Information Service (NTIS)

The authors present measurements of time-dependent CP-violation asymmetries for the decays $B^0 \rightarrow \eta K^0$ (yields $B^0 \rightarrow \eta K^0$). The data sample corresponds to 347 million $B^0 \bar{B}^0$ pairs produced by e^+e^- annihilation at the $(\Upsilon(4S))$ resonance in the PEP-II collider, and collected with the BABAR detector. The preliminary results are $S = 0.55 (+-) 0.11 (+-) 0.02$, and $C = -0.015 (+-) 0.07 (+-) 0.03$, where the first error quoted is statistical, the second systematic.

NTIS

CP Violation; Invariance; Mesons; Time Dependence

20070010006 Stanford Linear Accelerator Center, CA, USA

Search for Inclusive Charmless B to K+X and B to K0X Decays

Jul. 25, 2006; 15 pp.; In English

Report No.(s): DE2006-892629; SLAC-PUB-12008; No Copyright; Avail.: National Technical Information Service (NTIS)

We present preliminary results from a search for inclusive charmless B (yields) KX decays. These decays occur dominantly via one-loop b (yields) s penguin transitions, and can provide useful information about these processes. Using a sample of 288.5 fb(sup -1) collected with the BABAR detector at the PEP-II asymmetric-energy e(sup +)e(sup -) B Factory at SLAC, we search for high-energy kaons recoiling against fully reconstructed B decays. We measure the partial branching fractions for kaons with momentum p*(K) \gtrsim 2.34 GeV in the B rest frame, and obtain (in units of 10(sup -6)): (Beta)(B (yields) K(sup +)X, p* \gtrsim 2.34 GeV) = 1.96(sub -34)(sup +37)(stat.)(sub -30)(sup +31)(syst.) and (Beta)(B (yields) K(sup 0)X, p* \gtrsim 2.34 GeV) = 154(sub -48)(sup +55)(stat.)(sub -41)(sup +55)(syst.) (\gtrsim 266 at 90% C.L.).

NTIS

Mesons; Momentum; Kaons

20070010007 Stanford Linear Accelerator Center, Stanford, CA, USA

Measurement of CP-Violating Asymmetries in the B0 to K+K-K0 Dalitz Plot

Jul. 31, 2006; 27 pp.; In English

Report No.(s): DE2006-892625; SLAC-PUB-12015; No Copyright; Avail.: National Technical Information Service (NTIS)

The authors present a preliminary measurement of CP-violation parameters in the decay B(sup 0) (yields) K(sup +)K(sup -)K(sup 0), using approximately 347 million B(bar B) events collected by the BABAR detector at SLAC. Reconstructing the neutral kaon as K(sub S)(sup 0) (yields) (pi)(sup +)(pi)(sup -), K(sub S)(sup 0) (yields) (pi)(sup 0)(pi)(sup 0), or K(sub L)(sup 0), they analyze the Dalitz plot distribution and measure fractions to intermediate states. They extract CP parameters from the asymmetries in amplitudes and phases between B(sup 0) and (bar B)(sup 0) decays across the Dalitz plot. For decays to (phi)K(sup 0), they find (beta)(sub eff) = 0.06 (+-) 0.16 (+-) 0.05, A(sub CP) = -0.18 (+-) 0.20 (+-) 0.10, where the first uncertainty is statistical and the second one is systematic. For decays to f(sub 0)K(sup 0), they find (beta)(sub eff) = 0.18 (+-) 0.19 (+-) 0.04, A(sub CP) = 0.45 (+-) 0.28 (+-) 0.10. Combining all K(sup +)K(sup -)K(sup 0) events and taking account of the different CP eigenvalues of the individual Dalitz plot components, they find (beta)(sub eff) = 0.361 (+-) 0.079 (+-) 0.037, A(sub CP) = -0.034 (+-) 0.079 (+-) 0.025. The trigonometric reflection at (pi)/2 - (beta)(sub eff) is disfavored at 4.6(sigma). They also study angular distributions in B(sup 0) (yields) K(sup +)K(sup -)K(sub S)(sup 0) and B(sup +) (yields) (phi)K(sup +) decays and measure the direct CP asymmetry in B(sup +) (yields) (phi)K(sup +) decays, A(sub CP) = 0.046 (+-) 0.046 (+-) 0.017.

NTIS

Asymmetry; Invariance; Kaons

20070010009 Stanford Linear Accelerator Center, Stanford, CA, USA

Search for the Rare Decay B to pi l+ l-

Jul. 24, 2006; 20 pp.; In English

Report No.(s): DE2006-892626; SLAC-PUB-11994; No Copyright; Avail.: National Technical Information Service (NTIS)

The authors present results of a search for the rare flavor-changing neutral-current decay B (yields) (pi)(ell)(sup +)(ell)(sup -), based on a data sample corresponding to 209 fb(sup -1) of integrated luminosity collected with the BABAR detector at the PEP-II B Factory. They reconstruct the four exclusive B decay modes B(sup +) (yields) (pi)(sup +)(ell)(sup +)(ell)(sup -) and B(sup 0) (yields) (pi)(sup 0)(ell)(sup +)(ell)(sup -), where (ell) is either an e or (mu). They find no evidence for a signal, and they obtain the upper limit at 90% confidence level on the lepton-flavor-averaged branching fraction to be (Beta)(B(sup +) (yields) (pi)(sup +)(ell)(sup +)(ell)(sup -)) = 2 x (tau)B(sup +)/(tau)B(sup 0) (Beta)(B(sup 0) (yields) (pi)(sup 0)(ell)(sup +)(ell)(sup -)) \lesssim 7.9 x 10(sup -8). The authors also obtain an upper limit at 90% confidence level on the lepton-flavor-violating decay B (yields) (pi)e(mu) of (Beta)(B (yields) (pi)e(mu)) \lesssim 9.8 x 10(sup -8).

NTIS

Mesons; Particle Decay; Neutral Currents

20070010011 Stanford Linear Accelerator Center, CA, USA

Measurement of the B0 to pi l nu Form Factor Shape and Branching Fraction, and Determination of (Vub) with a Loose Neutrino Reconstruction Technique

Jul. 26, 2006; 25 pp.; In English

Report No.(s): DE2006-892630; SLAC-PUB-12005; No Copyright; Avail.: National Technical Information Service (NTIS)

The authors report the results of a study of the exclusive charmless semileptonic B^0 ($\rightarrow \pi^-\ell^+\nu$) decay undertaken with approximately 227 million $B\bar{B}$ pairs collected at the $(\Upsilon(4S))$ resonance with the BABAR detector. The analysis uses events in which the signal B mesons are reconstructed with a novel loose neutrino reconstruction technique. We obtain partial branching fractions in 12 bins of q^2 , the $(\ell^+\nu)$ invariant mass squared, from which we extract the $f(q^2)$ form factor shape and the total branching fraction: $\mathcal{B}(B^0 \rightarrow \pi^-\ell^+\nu) = 1.44^{(+0.08)}_{(-0.10)} \times 10^{-4}$. Based on a recent theoretical calculation of the form factor, we find the magnitude of the CKM matrix element $|V_{ub}|$ to be $(4.1^{(+0.2)}_{(-0.2)}) \times 10^{-3}$, where the last uncertainty is due to the normalization of the form factor.

NTIS

Form Factors; Mesons; Neutrinos; Nu Factor; Shapes

20070010442 Lawrence Livermore National Lab., Livermore, CA USA

Indirect Methods for Nuclear Reaction Data

Escher, J. E.; Dietrich, F. S.; Nov. 30, 2005; 10 pp.; In English

Report No.(s): DE2006-894793; UCRL-PROC-217429; No Copyright; Avail.: National Technical Information Service (NTIS)

Several indirect approaches for obtaining reaction cross sections are briefly reviewed. The Surrogate Nuclear Reactions method, which aims at determining cross sections for compound-nuclear reactions, is discussed in some detail. The validity of the Weisskopf-Ewing approximation in the Surrogate approach is studied for the example of neutron-induced fission of an actinide nucleus.

NTIS

Nuclear Physics; Nuclear Reactions

20070010445 Lawrence Livermore National Lab., Livermore, CA USA

Application of FLeck Effective Scattering to the Difference Formulation for Photon Transport

Daffin, F.; Oct. 18, 2006; 7 pp.; In English

Report No.(s): DE2006-894796; UCRL-TR-225368; No Copyright; Avail.: Department of Energy Information Bridge

We introduce a new treatment of the difference formulation for photon radiation transport without scattering in 1-d slab geometry that is closely analogous to that of Fleck and Cummings for the traditional formulation. The resulting form is free of implicit source terms and has the familiar effective scattering of the field of transport.

NTIS

Photons; Scattering

20070010497 Stanford Linear Accelerator Center, Stanford, CA, USA

SLAC Comparator for the Calibration of Digital Leveling Equipment

Gassner, G. L.; Ruland, R. E.; Oct. 2006; 11 pp.; In English

Report No.(s): DE2006-894929; SLAC-PUB-12181; No Copyright; Avail.: National Technical Information Service (NTIS)

At SLAC digital levels are used for precise leveling, both for setting out and monitoring. A very high precision of 30 micron is required, which can only be achieved by regularly calibrating the leveling equipment. The calibration facility is also used for detailed investigations to refine the SLAC leveling procedure. In this paper the setup of the SLAC vertical comparator is described. In order to also perform traditional staff calibration a CCD camera was integrated into the SLAC comparator. Finally an overview of further investigations of our leveling equipment is presented.

NTIS

Calibrating; Comparators; Leveling; Linear Accelerators; Particle Accelerators

20070010505 Stanford Linear Accelerator Center, Stanford, CA, USA, California Univ., Davis, CA, USA, Stanford Linear Accelerator Center, Stanford, CA, USA

Solving Large Scale Nonlinear Eigenvalue Problems in Next-Generation Accelerator Design

Liao, B. S.; Bai, Z.; Lee, L. Q.; Ko, K.; Sep. 01, 2006; 16 pp.; In English

Report No.(s): DE2006-892592; SLAB-PUB-12137; No Copyright; Avail.: National Technical Information Service (NTIS)

A number of numerical methods, including inverse iteration, method of successive linear problem and nonlinear Arnoldi algorithm, are studied in this paper to solve a large scale nonlinear eigenvalue problem arising from finite element analysis of resonant frequencies and external Q_e values of a waveguide loaded cavity in the next-generation accelerator design.

They present a nonlinear Rayleigh-Ritz iterative projection algorithm, NRRIT in short and demonstrate that it is the most promising approach for a model scale cavity design. The NRRIT algorithm is an extension of the nonlinear Arnoldi algorithm due to Voss. Computational challenges of solving such a nonlinear eigenvalue problem for a full scale cavity design are outlined.

NTIS

Eigenvalues; Nonlinearity; Accelerators; Iteration

20070010508 California Univ., Riverside, CA USA

Search for t-Channel Single Top Quark Production in pp(\bar{p}) Collisions at 1.96 TeV

Perea, P. M.; Jun. 2006; 225 pp.; In English

Report No.(s): DE2006-892492; No Copyright; Avail.: National Technical Information Service (NTIS)

I have performed a search for t-channel single top quark production in pp collisions at 1.96 TeV on a 366 pb⁻¹ dataset collected with the DO detector from 2002-2005. The analysis is restricted to the leptonic decay of the W boson from the top quark to an electron or muon, $t \rightarrow b l \bar{q} b$ ($l = e, \mu$). A powerful b-quark tagging algorithm derived from neural networks is used to identify b jets and significantly reduce background. I further use neural networks to discriminate signal from background, and apply a binned likelihood calculation to the neural network output distributions to derive the final limits. No direct observation of single top quark production has been made, and I report expected/measured 95% confidence level limits of 3.5/8.0 pb.

NTIS

Quarks; Pair Production; Particle Collisions

20070010509 Fermi National Accelerator Lab., Batavia, IL, USA

Mitigating radiation loads in Nb₃Sn quadrupoles for LHC upgrades

Mokhov, N. V.; Rakhno, I. L.; Jul. 24, 2006; 12 pp.; In English

Report No.(s): DE2006-892496; FERMILAB-FN-0789-AD; No Copyright; Avail.: National Technical Information Service (NTIS)

Challenging beam-induced energy deposition issues are addressed for the next generation of the LHC high-luminosity interaction regions based on Nb₃Sn quadrupoles. Detailed MARS15 Monte Carlo energy deposition calculations are performed for various coil diameters, thicknesses and materials of the inner absorber at a field gradient of 200 T/m. It is shown that using the inner absorber made of tungsten-based materials can make the final focus superconducting quadrupoles compatible with a luminosity of 10³⁵ cm⁻²s⁻¹.

NTIS

Loads (Forces); Quadrupoles

20070010516 Fermi National Accelerator Lab., Batavia, IL, USA, Academia Sinica, Beijing, China, Michigan State Univ., East Lansing, MI, USA, Joint Inst. for Nuclear Research, Dubna, Russian Federation

Finding the Charge of the Top Quark in the Dilepton Channel

Beretvas, A.; Antos, J.; Chen, Y. C.; Gunay, Z.; Sorin, V.; January 2006; 3 pp.; In English

Report No.(s): DE2006-892480; FERMILAB-CONF-06-251-E; No Copyright; Avail.: Department of Energy Information Bridge

There is a question about the identity of the top quark. Is it the top quark of the Standard Model (SM) with electric charge (two thirds) or is it an exotic quark with charge $-\frac{4}{3}$. An exotic quark has been proposed by D. Chang et al (1). This analysis will use the standard CDF run II dilepton sample. The key ingredients of this analysis are the correct pairing of the lepton and b-jet, the determination of the charge of the b-jet. The analysis proceeds by using a binomial distribution and is formulated so that rejecting one hypothesis means support for the other hypothesis.

NTIS

Quarks; Standard Model (Particle Physics)

20070010517 Michigan State Univ., East Lansing, MI, USA

Measurement of the Top Quark Mass in the Dilepton Decay Channel at CDF II

Jayatilaka, B. A.; January 2006; 130 pp.; In English

Report No.(s): DE2006-892485; No Copyright; Avail.: National Technical Information Service (NTIS)

The top quark, the most recently discovered quark, is the most massive known fundamental fermion. Precision

measurements of its mass, a free parameter in the Standard Model of particle physics, can be used to constrain the mass of the Higgs Boson. In addition, deviations in the mass as measured in different channels can provide possible evidence for new physics. We describe a measurement of the top quark mass in the decay channel with two charged leptons, known as the dilepton channel, using data collected by the CDF II detector from pp collisions with $\sqrt{s} = 1.96$ TeV at the Fermilab Tevatron. The likelihood in top mass is calculated for each event by convolving the leading order matrix element describing $q\bar{q} t\bar{t} b\bar{b} 0$ with detector resolution functions. The presence of background events in the data sample is modeled using similar calculations involving the matrix elements for major background processes. In a data sample with integrated luminosity of 1.0 fb⁻¹, we observe 78 candidate events and measure $M_t = 164.5 - 3.9(\text{stat.}) - 3.9(\text{syst.})$ GeV/c², the most precise measurement of the top quark mass in this channel to date.

NTIS

Particle Accelerators; Quarks; Particle Decay

20070010518 Fermi National Accelerator Lab., Batavia, IL, USA

Calculating Emittance for Gaussian and Non-Gaussian Distributions by the Method of Correlations for Slits

Tan, C.; January 2006; 27 pp.; In English

Report No.(s): DE2006-892489; FERMILAB-TM-2354-AD; No Copyright; Avail.: National Technical Information Service (NTIS)

One common way for measuring the emittance of an electron beam is with the slits method. The usual approach for analyzing the data is to calculate an emittance that is a subset of the parent emittance. This paper shows an alternative way by using the method of correlations which ties the parameters derived from the beamlets to the actual parameters of the parent emittance. For parent distributions that are Gaussian, this method yields exact results. For non-Gaussian beam distributions, this method yielded an effective emittance that can serve as a yardstick for emittance comparisons.

NTIS

Correlation; Emittance; Normal Density Functions; Slits

20070010519 Rochester Univ., NY USA

Status of the Top Quark: Top Production Cross Section and Top Properties

Boisvert, V.; January 2006; 12 pp.; In English

Report No.(s): DE2006-892491; FERMILAB-CONF-06-264-E; No Copyright; Avail.: National Technical Information Service (NTIS)

This report describes the latest cross section and property measurements associated with the top quark at the Tevatron Run II. The largest data sample used is 760 pb⁻¹ of integrated Luminosity. Due to its large mass, the top quark might be involved in the process of electroweak symmetry breaking, making it a useful probe for signs of new physics.

NTIS

Quarks; Cross Sections

20070010549 Jefferson (Thomas) Lab. Computer Center, Newport News, VA, USA

Realistic Aspects of Few-Body Physics

Gross, F.; Aug. 01, 2006; 9 pp.; In English

Report No.(s): DE2006-894017; No Copyright; Avail.: Department of Energy Information Bridge

After a brief review of alternative approaches to the relativistic treatment of few-body problems, I discuss (1) recent progress in the study of NN and NNN systems, (2) a new method for solving the Bethe-Salpeter equation in Minkowski space, (3) new relativistic treatment of spin 3/2 fields, and (4) construction of conserved electromagnetic currents in a relativistic optical model.

NTIS

Many Body Problem; Nuclear Physics

20070010551 Lawrence Livermore National Lab., Livermore, CA USA

Floret Test, Numerical Simulations of the Dent, Comparison with Experiments

Lefrancois, A.; Cutting, J.; Gagliardi, F.; Traver, C.; Tran, T.; Feb. 17, 2006; 11 pp.; In English

Report No.(s): DE2006-894775; UCRL-TR-219116; No Copyright; Avail.: National Technical Information Service (NTIS)

The Floret test has been developed as a screening test to study the performance of a small amount of HE. Numerical simulations have been performed recently using CTH. The objective of this study is to perform numerical simulations in order

to better understand the shock waves interactions, involved in the dent formation. Different 3D wedge configurations have been tested using the Ignition and Growth reactive flow model for the HE receptor with Ls-Dyna.

NTIS

Deformation; Shock Waves; Simulation

20070010553 Stanford Linear Accelerator Center, CA, USA

Measurement of the Hadronic Form Factors in D_s to $\phi e \nu$ Decays

Jul. 27, 2006; 21 pp.; In English

Report No.(s): DE2006-892623; SLAC-PUB-12017; No Copyright; Avail.: National Technical Information Service (NTIS)

Based on the measured four-dimensional rate for $D_s^+ \rightarrow \phi e^+ \nu_e$ decays, they have determined the ratios of the three hadronic form factors, $(\tau_V) = V(0)/A(1)(0) = 1.636 (+-) 0.067 (+-) 0.038$ and $(\tau_2) = A(2)(0)/A(1)(0) = 0.705 (+-) 0.056 (+-) 0.029$, using a simple pole ansatz for the q^2 dependence, with fixed values of the pole masses for both the vector and axial form factors. By a separate fit to the same data, they have also extracted the pole mass for the axial form factors, m_A : $(\tau_V) = V(0)/A(1)(0) = 1.633 (+-) 0.081 (+-) 0.068$, $(\tau_2) = A(2)(0)/A(1)(0) = 0.711 (+-) 0.111 (+-) 0.096$ and $m_A = (2.53(-0.35)(+0.54) (+-) 0.54) \text{GeV}/c^2$.

NTIS

Form Factors; Hadrons; Mesons

20070010568 Stanford Univ., Stanford, CA, USA, Stanford Linear Accelerator Center, Menlo Park, CA, USA

Discovering Chiral Higgsinos at the LHC

Arvanitaki, A.; Nov. 01, 2006; 11 pp.; In English

Report No.(s): DE2006-895273; SLAC-PUB-12196; No Copyright; Avail.: National Technical Information Service (NTIS)

The concept of chirality is extended to the Minimal Supersymmetric Standard Model (MSSM) and the (micro) term is forbidden by a gauged $U(1)_{\text{prime}}$ symmetry. R-parity automatically emerges after symmetry breaking, suppressing proton decay and protecting the LSP. Exotics charged under the SM pose a challenge to traditional $SU(5)$ unification, but unification is still implemented in deconstructed GUTs. Because of the multitude of additional states to the MSSM, the Z_{prime} has a large width, and the SM background, neglected in previous theoretical studies, becomes important for Z_{prime} discovery. As a result, the LHC reach is reduced from 3.2 TeV, for a Z_{prime} with SM decays, to 1.5 TeV, when additional decay channels are included. This model also predicts possibly long-lived colored and electroweak exotics.

NTIS

Chirality; Exploration; Supersymmetry; Higgs Bosons

20070010572 Duke Univ., Durham, NC, USA

Towards the Chiral Limit in QCD. Final Report

January 2006; 7 pp.; In English

Report No.(s): DE2006-877383; No Copyright; Avail.: Department of Energy Information Bridge

Computing hadronic observables by solving QCD from first principles with realistic quark masses is an important challenge in fundamental nuclear and particle physics research. Although lattice QCD provides a rigorous framework for such calculations many difficulties arise. Firstly, there are no good algorithms to solve lattice QCD with realistically light quark masses. Secondly, due to critical slowing down, Monte Carlo algorithms are able to access only small lattice sizes on coarse lattices. Finally, due to sign problems it is almost impossible to study the physics of finite baryon density.

NTIS

Chirality; Quantum Chromodynamics; Hadrons

20070010583 Stanford Linear Accelerator Center, CA, USA

Studies of Helium Based Gas Mixtures Using a Small Cell Drift Chamber

Heise, J.; January 2006; 161 pp.; In English

Report No.(s): DE2006-885540; SLAC-R-830; No Copyright; Avail.: Department of Energy Information Bridge

An international collaboration is currently working on the construction and design of an asymmetric B Factory at the Stanford Linear Accelerator Center that will be ready to collect data in 1999. The main physics motivation for such a facility is to test the description and mechanism of CP violation in the Standard Model of particle physics and provide insight into the question of why more matter than antimatter is observed in the universe today. In particular, this experiment will measure

CP violation in the decay of B mesons. In the early stages of this effort, the Canadian contingent proposed to build the central tracking chamber for the BaBar detector. Presently, a prototype drift chamber is in operation and studies are being performed to test some of the unique features of drift chamber design dictated by the conditions of the experiment. Using cosmic muons, it is possible to study tracking and pattern recognition in the prototype chamber, and therefore calculate the efficiency and spatial resolution of the prototype chamber cells. These performance features will be used to test whether or not the helium-based gas mixtures proposed for the BaBar drift chamber are a viable alternative to the more traditional argon-based gases.

NTIS

Antimatter; Construction; Gas Mixtures; Helium; Mesons

20070010609 Lawrence Livermore National Lab., Livermore, CA USA

Void Coalescence Processes Quantified Through Atomistic and Multiscale Simulation

Rudd, R. E.; Seppala, E. T.; Dupuy, L. M.; Belak, J.; Jan. 04, 2006; 9 pp.; In English

Report No.(s): DE2006-895081; UCRL-CONF-217946; No Copyright; Avail.: National Technical Information Service (NTIS)

Simulation of ductile fracture at the atomic scale reveals many aspects of the fracture process including specific mechanisms associated with void nucleation and growth as a precursor to fracture and the plastic deformation of the material surrounding the voids and cracks. Recently we have studied void coalescence in ductile metals using large-scale atomistic and continuum simulations. Here we review that work and present some related investigations. The atomistic simulations involve three-dimensional strain-controlled multi-million atom molecular dynamics simulations of copper. The correlated growth of two voids during the coalescence process leading to fracture is investigated, both in terms of its onset and the ensuing dynamical interactions. Void interactions are quantified through the rate of reduction of the distance between the voids, through the correlated directional growth of the voids, and through correlated shape evolution of the voids. The critical inter-void ligament distance marking the onset of coalescence is shown to be approximately one void radius based on the quantification measurements used, independent of the initial separation distance between the voids and the strain-rate of the expansion of the system. No pronounced shear flow is found in the coalescence process.

NTIS

Coalescing; Multiscale Models; Voids; Computerized Simulation

20070010612 Lawrence Livermore National Lab., Livermore, CA USA

Exploring Prompt Measurement Methods for (n,2n) Cross Sections on Radioactive Targets

Ahle, L.; Jan. 09, 2006; 13 pp.; In English

Report No.(s): DE2006-895087; UCRL-TR-216021; No Copyright; Avail.: Department of Energy Information Bridge

This report summarizes a study of possible neutron detection technologies for performing prompt (n,2n) measurements on radioactive targets of the type that could be made at the Rare Isotope Accelerator (RIA). The report recommends conducting further research on high-pressure (sup 3)He gas scintillators as it is the best candidate technology. These detectors meet the requirements of a fast response time (fall times around 5-10 ns), gamma ray suppression, (all gamma rays below about 900 keV can be easily discriminated against), and can be easily configured into a 4(pi) array. The one requirement that these detectors fall short is efficiency, but less than a factor of 10 improvement is needed. The possibility of pulse shape discrimination should also be explored for these detectors as this would help to distinguish gamma rays above 900 keV from neutrons. In addition to R&D work on these detectors, Monte Carlo simulations and target development are also recommended areas of further study.

NTIS

Radioactivity; Targets

20070010622 Paris XI Univ., Orsay, France, California Univ., Lawrence Berkeley National Lab., Berkeley, CA, USA

Dynamics of Neutralizing Electrons during the Focusing of Intense Heavy Ions Beams Inside a Heavy Ion Fusion Reactor Chamber

Lifschitz, A. F.; Maynard, G.; Vay, J.; Lenglet, A.; January 2006; 3 pp.; In English

Report No.(s): DE2006-889265; LBNL-61286; HIFAN-1472; No Copyright; Avail.: National Technical Information Service (NTIS)

The efficiency of a Heavy Ion Fusion reactor heavily depends on the maximum value for the density of energy (DoE) that can be deposited by the ion beams. In order to reduce the final beam radius, and thus to increase the DoE inside the target,

the beam spatial charge has to be neutralized. Therefore the dynamics of the neutralizing electrons (DNE) play a central role in optimizing the DoE deposited in solid targets by the high current of the high energy heavy ion beams. We present results on some aspects of the DNE, which was performed using the Monte-Carlo 2D1/2 PIC code BPIC.

NTIS

Electrons; Fusion Reactors; Ion Beams; Ionization Chambers

20070010623 Fermi National Accelerator Lab., Batavia, IL, USA

B(s) Mixing at the Tevatron

Gomez-Ceballos, G.; January 2006; 14 pp.; In English

Report No.(s): DE2006-891078; FERMILAB-CONF-06-076-E; No Copyright; Avail.: National Technical Information Service (NTIS)

The Tevatron collider at Fermilab provides a very rich environment for the study of B(s) mesons. B(s) Mixing is the most important analysis within the B Physics program of both experiments. In this paper we summarize the most recent results on this topic from both D0 and CDF experiments. There were very important updates in both experiments after I gave my talk, hence the organizers warmly recommended me to include the latest available results on B(s) mixing, instead of what I presented there.

NTIS

Mesons; Particle Accelerators

20070010626 Fermi National Accelerator Lab., Batavia, IL, USA, Brookhaven National Lab., Upton, NY USA, California Univ., Lawrence Berkeley National Lab., Berkeley, CA, USA

US-LARP Progress on LHC IR Upgrades

Sen, T.; Johnstone, J.; Mokhov, N.; Fischer, W.; Gupta, R.; January 2006; 8 pp.; In English

Report No.(s): DE2006-891082; FERMILAB-CONF-06-053-AD; No Copyright; Avail.: National Technical Information Service (NTIS)

We review the progress on LHC IR upgrades made by the US-LARP collaboration since the last CARE meeting in November 2004. We introduce a new optics design with doublet focusing, and discuss energy deposition calculations with an open mid-plane dipole. We present the results of a beam-beam experiment at RHIC. This experiment was the first phase of a planned test of the wire compensation principle at RHIC.

NTIS

Hadrons; Energy Transfer

20070010633 Fermi National Accelerator Lab., Batavia, IL, USA

Preliminary Studies of a Chromaticity Tracker

Tan, C.; January 2006; 53 pp.; In English

Report No.(s): DE2006-891085; FERMILAB-TM-2346-AD; No Copyright; Avail.: National Technical Information Service (NTIS)

A chromaticity tracker based on a method by D. McGinnis is proposed. This method starts with the slow modulation of the accelerating RF which causes the beam to respond to it. This beam modulation can be detected transversely with a Schottky pickup which after phase demodulation, the chromaticity can be calculated from it. However, to perform phase demodulation, the carrier frequency which is the betatron tune needs to be identified. The identification of the carrier frequency falls naturally onto the phase locked loop tune tracker which when locked to the betatron tune outputs this value in real time.

NTIS

Color; Radio Frequencies; Carrier Frequencies; Phase Locked Systems; Demodulation

20070010636 Los Alamos National Lab., NM, USA

Field Enhanced Electrodes for Additive -Injecton Non-Thermal Plasma (NTP) Processor

Rosocha, L. A.; Ferreri, V.; Kim, Y.; 20 Dec 04; 7 pp.; In English

Contract(s)/Grant(s): W-7405ENG-36

Patent Info.: Filed Filed 20 Dec 04; US-Patent-Appl-SN-11-017 392

Report No.(s): PB2007-103083; No Copyright; Avail.: CASI: [A02](#), Hardcopy

The present invention comprises a field enhanced electrode package for use in a non-thermal plasma processor. The field enhanced electrode package includes a high voltage electrode and a field-enhancing electrode with a dielectric material layer

disposed in-between the high voltage electrode and the field-enhancing electrode. The field-enhancing electrode features at least one raised section that includes at least one injection hole that allows plasma discharge streamers to occur primarily within an injected additive gas.

NTIS

Additives; Electrodes; Thermal Plasmas

20070010638 Massachusetts Inst. of Tech., Cambridge, MA, USA, Brookhaven National Lab., Upton, NY USA
Conversion of Oxyfluoride Based Coated Conductors Covering Period: September 1, 2003 through August 31, 2006

Suenaga, M.; Nov. 29, 2006; 14 pp.; In English

Report No.(s): DE2006-895036; No Copyright; Avail.: Department of Energy Information Bridge

Direct measurements of HF pressure in equilibrium with the film during the BaF₂ process are sorely needed. It is the HF partial pressure that governs the rate at which the film composition is changing and is, therefore, an important factor in controlling the composition/time trajectory of the film. Establishing the composition/time trajectory of both MOD-derived and e-beam derived films for a given set of conditions is another goal for the project. These studies will provide a fundamental understanding of the ex situ process for producing coated conductors.

NTIS

Coatings; Conductors; Oxyfluorides

20070010647 College of William and Mary, Williamsburg, VA, USA, Jefferson (Thomas) Lab. Computer Center, Newport News, VA, USA

Hadronic Interactions Front Lattice OCD

Orginos, K.; January 2006; 4 pp.; In English

Report No.(s): DE2006-895054; No Copyright; Avail.: National Technical Information Service (NTIS)

In this talk I discuss a few recent results on lattice calculations of scattering lengths in hadronic processes. In particular, I present the scattering length of the pion-pion scattering in the I=2 channel and the nucleon-nucleon (sup 1)S(sub 0) channel and (sup 3)S(sub 1)-(sup 3)D(sub 1) coupled channels.

NTIS

Hadrons; Quantum Chromodynamics

20070010649 College of William and Mary, Williamsburg, VA, USA, Jefferson (Thomas) Lab. Computer Center, Newport News, VA, USA

Innovations in Lattice QCD Algorithms

Orginos, K.; January 2006; 10 pp.; In English

Report No.(s): DE2006-895055; No Copyright; Avail.: Department of Energy Information Bridge

Lattice QCD calculations demand a substantial amount of computing power in order to achieve the high precision results needed to better understand the nature of strong interactions, assist experiment to discover new physics, and predict the behavior of a diverse set of physical systems ranging from the proton itself to astrophysical objects such as neutron stars. However, computer power alone is clearly not enough to tackle the calculations we need to be doing today. A steady stream of recent algorithmic developments has made an important impact on the kinds of calculations we can currently perform. In this talk I am reviewing these algorithms and their impact on the nature of lattice QCD calculations performed today.

NTIS

Algorithms; Quantum Chromodynamics; Astrophysics

20070010652 College of William and Mary, Williamsburg, VA, USA, Jefferson (Thomas) Lab. Computer Center, Newport News, VA, USA

Recent and Lattice QCD Results on Nucleon Structure

Orginos, K.; Jul. 28, 2006; 26 pp.; In English

Report No.(s): DE2006-895057; No Copyright; Avail.: National Technical Information Service (NTIS)

The author reviews recent developments in lattice calculations of nucleon structure. In particular, I cover the calculations of nucleon matrix elements related to generalized parton distribution functions, structure functions and form factors.

NTIS

Nucleons; Quantum Chromodynamics

20070010654 College of William and Mary, Williamsburg, VA, USA, Jefferson (Thomas) Lab. Computer Center, Newport News, VA, USA

Lattice QCD and Nuclear Physics Computation of Hadron-Hadron Scattering

Orginos, K.; January 2006; 5 pp.; In English

Report No.(s): DE2006-895058; No Copyright; Avail.: National Technical Information Service (NTIS)

A steady stream of developments in Lattice QCD have made it possible today to begin to address the question of how nuclear physics emerges from the underlying theory of strong interactions. Central role in this understanding play both the effective field theory description of nuclear forces and the ability to perform accurate non-perturbative calculations in low energy QCD. Here I present some recent results that attempt to extract important low energy constants of the effective field theory of nuclear forces from lattice QCD.

NTIS

Nuclear Physics; Quantum Chromodynamics; Scattering; Lattice Parameters

20070010655 Thomas Jefferson National Accelerator Facility, Newport News, VA, USA

Spin Sum Rules and Polarizabilities: Results from Jefferson Lab

Chen, J.; Nov. 13, 2006; 12 pp.; In English

Report No.(s): DE2006-895061; No Copyright; Avail.: National Technical Information Service (NTIS)

The nucleon spin structure has been an active, exciting and intriguing subject of interest for the last three decades. Recent experimental data on nucleon spin structure at low to intermediate momentum transfers provide new information in the confinement regime and the transition region from the confinement regime to the asymptotic freedom regime. New insight is gained by exploring moments of spin structure functions and their corresponding sum rules (i.e. the generalized Gerasimov-Drell-Hearn, Burkhardt-Cottingham and Bjorken). The Burkhardt-Cottingham sum rule is verified to good accuracy. The spin structure moments data are compared with Chiral Perturbation Theory calculations at low momentum transfers. It is found that chiral perturbation calculations agree reasonably well with the first moment of the spin structure function g_1 at momentum transfer of 0.05 to 0.1 GeV² but fail to reproduce the neutron data in the case of the generalized polarizability α_{LT} (the α_{LT} puzzle). New data have been taken on the neutron (³He), the proton and the deuteron at very low Q^2 down to 0.02 GeV². They will provide benchmark tests of Chiral dynamics in the kinematic region where the Chiral Perturbation theory is expected to work.

NTIS

Nucleons; Sum Rules

20070010656 Smith Coll., Northampton, MA, USA

How Strange is the Proton

Nov. 15, 2005; 11 pp.; In English

Report No.(s): DE2006-895063; No Copyright; Avail.: National Technical Information Service (NTIS)

The paper discusses application of parity violating polarized electron scattering off nucleons to study strange form factors of the nucleon. The results from the recent HAPPEX experiment are discussed in more detail.

NTIS

Protons; Electron Scattering; Parity

20070010659 Jefferson (Thomas) Lab. Computer Center, Newport News, VA, USA

Status and Future Developments in Large Accelerator Control Systems

White, K. S.; January 2006; 6 pp.; In English

Report No.(s): DE2006-894266; No Copyright; Avail.: Department of Energy Information Bridge

Over the years, accelerator control systems have evolved from small hardwired systems to complex computer controlled systems with many types of graphical user interfaces and electronic data processing. Today's control systems often include multiple software layers, hundreds of distributed processors, and hundreds of thousands of lines of code. While it is clear that the next generation of accelerators will require much bigger control systems, they will also need better systems. Advances in technology will be needed to ensure the network bandwidth and CPU power can provide reasonable update rates and support the requisite timing systems. Beyond the scaling problem, next generation systems face additional challenges due to growing cyber security threats and the likelihood that some degree of remote development and operation will be required. With a large number of components, the need for high reliability increases and commercial solutions can play a key role towards this goal. Future control systems will operate more complex machines and need to present a well integrated, interoperable set of tools

with a high degree of automation. Consistency of data presentation and exception handling will contribute to efficient operations.

NTIS

Control Systems Design; Complex Systems; Particle Accelerators

20070010662 Lawrence Livermore National Lab., Livermore, CA USA

Hybrid FEM-BEM Unified Boundary Condition with Sub-Cycling for Electromagnetic Radiation

Fasenfest, B.; White, D.; Stowell, M.; Rieben, R.; Sharpe, R.; Jan. 18, 2006; 4 pp.; In English

Report No.(s): DE2006-894336; UCRL-CONF-218239; No Copyright; Avail.: Department of Energy Information Bridge

Hybrid solutions to time-domain electromagnetic problems offer many advantages when solving open-region scattering or radiation problems. Hybrid formulations use a finite-element or finite-difference discretization for the features of interest, then bound this region with a layer of planar boundary elements. The use of volume discretization allows for intricate features and many changes in material within the structure, while the boundary-elements provide a highly accurate radiating boundary condition. This concept has been implemented previously, using the boundary elements to set the E-field, H-field, or both for an FDTD grid, for example in (1)(2)(3), or as a mixed boundary condition for the second order wave equation solved by finite elements (4). Further study has focused on using fast methods, such as the Plane Wave Time Domain method (3)(4) to accelerate the BEM calculations. This paper details a hybrid solver using the coupled first-order equations for the E and H fields in the finite-element region.

NTIS

Boundary Conditions; Boundary Element Method; Cycles; Electromagnetic Radiation; Finite Element Method

20070010676 Politecnico di Milano, Milan, Italy

Measurements of the CKM Angle Beta in Charmless Loop-dominated B Meson Decays at BaBar

Lazzaro, A.; Oct. 2006; 6 pp.; In English

Report No.(s): DE2006-893762; BABAR-PROC-06/90; No Copyright; Avail.: Department of Energy Information Bridge

We report on preliminary measurements of time-dependent CP-violation asymmetries in charmless neutral B meson decays to $K^+K^-K^0$ including resonant decays $(\phi)K^0$ and $f_0(980)K^0$, $(\eta)K^0$, $(\eta)K^0$, $(\pi)K^0$, $K^0K^0K^0$, $K^0K^0K^0$, $(\rho)K^0$, $(\omega)K^0$. The results are obtained from a data sample of up to 347 million $B\bar{B}$ pairs produced by e^+e^- annihilation at the $(\Upsilon(4S))$ resonance collected with the BABAR detector at the PEP-II asymmetric-energy B-meson Factory at SLAC.

NTIS

Mesons; Particle Decay

20070010680 Stanford Linear Accelerator Center, Stanford, CA, USA, Deutsches Elektronen-Synchrotron, Hamburg, Germany, Fermi National Accelerator Lab., Batavia, IL, USA, Commissariat a l'Energie Atomique, France

Electronics and Algorithms for HOM Based Beam Diagnostics

Frisch, J.; Baboi, N.; Eddy, N.; Nagaitsev, S.; Hensler, O.; January 2006; 12 pp.; In English

Report No.(s): DE2006-893771; SLAC-PUB-12161; FERMILAB-CONF-06-132-AD; No Copyright; Avail.: National

Technical Information Service (NTIS)

The signals from the Higher Order Mode (HOM) ports on superconducting cavities can be used as beam position monitors and to do survey structure alignment. A HOM-based diagnostic system has been installed to instrument both couplers on each of the 40 cryogenic accelerating structures in the DESY TTF2 Linac. The electronics uses a single stage down conversion from the 1.7 GHz HOM spectral line to a 20MHz IF which has been digitized. The electronics is based on low cost surface mount components suitable for large scale production. The analysis of the HOM data is based on Singular Value Decomposition. The response of the OM modes is calibrated using conventional BPMs.

NTIS

Algorithms; Beams (Radiation); Diagnosis

20070010706 Iowa State Univ. of Science and Technology, Ames, IA, USA, Brookhaven National Lab., Upton, NY, USA

Factorization for Hadronic Heavy Quarkonium Production

Qiu, J.; January 2006; 10 pp.; In English

Report No.(s): DE2006-894610; BNL-77090-2006-CP; No Copyright; Avail.: Department of Energy Information Bridge

We briefly review several models of heavy quarkonium production in hadronic collisions, and discuss the status of QCD factorization for these production models.

NTIS

Factorization; Hadrons; Collisions

20070010707 Brookhaven National Lab., Upton, NY, USA

Nucleon Structure in Lattice QCD with Dynamical Domain-Wall Fermions Quarks

Lin, H.; Ohta, S.; Oct. 2006; 9 pp.; In English

Report No.(s): DE2006-894611; BNL-77092-2006-CP; No Copyright; Avail.: Department of Energy Information Bridge

We report RBC and RBC/UKQCD lattice QCD numerical calculations of nucleon electroweak matrix elements with dynamical domain-wall fermions (DWF) quarks. The first, RBC, set of dynamical DWF ensembles employs two degenerate flavors of DWF quarks and the DBW2 gauge action. Three sea quark mass values of 0.04, 0.03 and 0.02 in lattice units are used with 220 gauge configurations each. The lattice cutoff is $a^{(\text{sup } -1)}$ (approx.) 1.7GeV and the spatial volume is about $(1.9\text{fm})^{(\text{sup } 3)}$. Despite the small volume, the ratio of the isovector vector and axial charges $g^{(\text{sub } A)}/g^{(\text{sub } V)}$ and that of structure function moments $\int dx g^{(\text{sub } u-d)}/\int dx g^{(\text{sub } (\Delta)u-(\Delta)d)}$ are in agreement with experiment, and show only very mild quark mass dependence. The second, RBC/UK, set of ensembles employs one strange and two degenerate (up and down) dynamical DWF quarks and Iwasaki gauge action. The strange quark mass is set at 0.04, and three up/down mass values of 0.03, 0.02 and 0.01 in lattice units are used. The lattice cutoff is $a^{(\text{sup } -1)}$ (approx.) 1.6GeV and the spatial volume is about $(3.0\text{fm})^{(\text{sup } 3)}$. Even with preliminary statistics of 25-30 gauge configurations, the ratios $g^{(\text{sub } A)}/g^{(\text{sub } V)}$ and $\int dx g^{(\text{sub } u-d)}/\int dx g^{(\text{sub } (\Delta)u-(\Delta)d)}$ are consistent with experiment and show only very mild quark mass dependence. Another structure function moment, $d^{(\text{sub } 1)}$, though yet to be renormalized, appears small in both sets.

NTIS

Domain Wall; Fermions; Nucleons; Quantum Chromodynamics; Quarks

20070010708 Brookhaven National Lab., Upton, NY, USA

Quarkonium at Finite Temperatures

Umeda, T.; Oct. 2006; 10 pp.; In English

Report No.(s): DE2006-894613; BNL-77106-2006-CP; No Copyright; Avail.: Department of Energy Information Bridge

Lattice QCD studies on charmonium at finite temperature are presented. After a discussion about problems for the Maximum Entropy Method applied to finite temperature lattice QCD, the author shows several results on charmonium spectral functions. The 'wave function' of charmonium is also discussed to study the spatial correlation between quark and anti-quark in deconfinement phase.

NTIS

Charm (Particle Physics); Quantum Chromodynamics; Maximum Entropy Method

20070010709 Brookhaven National Lab., Upton, NY, USA

So You Want to Be a Lattice Theorist

Creutz, M.; Oct. 2006; 8 pp.; In English

Report No.(s): DE2006-894614; BNL-77110-2006-CP; No Copyright; Avail.: Department of Energy Information Bridge

For this after dinner talk the author intersperses images of real lattices with a discussion of the motivations for lattice gauge theory and some current unresolved issues.

NTIS

Lattices (Mathematics); Lattice Parameters

20070010710 Brookhaven National Lab., Upton, NY, USA

Calculation of and $AZ = 3/2$ Kaon and Weak Matrix and Elements Including Two-Poion Interaction and Effects in Finite

Yamazaki, T.; Oct. 28, 2006; 9 pp.; In English

Report No.(s): DE2006-894993; BNL-7711332006-CP; No Copyright; Avail.: National Technical Information Service

(NTIS)

We calculate $(\Delta)I = 3/2$ kaon decay matrix elements using domain wallfermions and the DBW2 gauge action at one coarse lattice spacing corresponding to $a^{(\text{sup } -1)} = 1.3$ GeV. We employ the Lellouch and Luescher formula and its extension for non-zero total momentum to extract the infinite volume, center-of-mass frame decay amplitudes. The decay amplitudes

obtained from the methods correspond to those from the indirect method with full order chiral perturbation theory. We confirm that the result is consistent with the previous result calculated with H-parity (anti-periodic) boundary condition by investigating the relative momentum dependence. We evaluate the decay amplitude $\text{Re}A(\text{sub } 2)$ at the physical point by a chiral extrapolation with a polynomial function of $m(\text{sub } (\pi))(\text{sup } 2)$ and the relative momentum as well as the $(\Delta)I = 3/2$ electroweak penguin contributions to $(\text{var-}\epsilon)(\text{prime})/(\text{var-}\epsilon)$. We found that the result of $\text{Re}A(\text{sub } 2)$ reasonably agrees with the experiment.

NTIS

Boundary Conditions; Kaons

20070010715 Lawrence Livermore National Lab., Livermore, CA USA

Prospects for CUORE and Latest Results from CUORICINO

Norman, E. B.; Jan. 09, 2006; 5 pp.; In English

Report No.(s): DE2006-894339; UCRL-PROC-218022; No Copyright; Avail.: National Technical Information Service (NTIS)

CUORE (Cryogenic Underground Observatory for Rare Events) is a proposed next generation experiment designed to search for the neutrinoless DBD of $(\text{sup } 130)\text{Te}$ using a bolometric technique. The present status of the CUORE is presented along with the latest results from its operating prototype, CUORICINO.

NTIS

Cryogenics; Prototypes

20070010718 Jefferson (Thomas) Lab. Computer Center, Newport News, VA, USA

Prototype of a Beam Steering Assistant Tool for Accelerator Operations

Bickley, M.; Chevtsov, P.; January 2006; 3 pp.; In English

Report No.(s): DE2006-893787; No Copyright; Avail.: National Technical Information Service (NTIS)

The CEBAF accelerator provides nuclear physics experiments at Jefferson Lab with high quality electron beams. Three experimental end stations can simultaneously receive the beams with different energies and intensities. For each operational mode, the accelerator setup procedures are complicated and require very careful checking of beam spot sizes and positions on multiple beam viewers. To simplify these procedures and make them reproducible, a beam steering assistant GUI tool has been created. The tool is implemented as a multi-window control screen. The screen has an interactive graphical object window, which is an overlay on top of a digitized live video image from a beam viewer. It allows a user to easily create and edit any graphical objects consisting of text, ellipses, and lines, right above the live beam viewer image and then save them in a file that is called a beam steering template. The template can show, for example, the area within which the beam must always be on the viewer. Later, this template can be loaded in the interactive graphical object window to help accelerator operators steer the beam to the specified area on the viewer.

NTIS

Beam Steering; Electron Beams; Prototypes; Linear Accelerators

20070010719 Thomas Jefferson National Accelerator Facility, Newport News, VA, USA, Yale Univ., New Haven, CT, USA, Inst. for Theoretische Physik, Garching, Germany, Carnegie-Mellon Univ., Pittsburgh, PA, USA

Hadron Spectrum with Domain-wall Valence Quarks on an Improved Staggered Sea

Edwards, R. G.; Fleming, G.; Haegler, P.; Morningstar, C.; Negele, J. W.; January 2006; 7 pp.; In English

Report No.(s): DE2006-894264; No Copyright; Avail.: National Technical Information Service (NTIS)

The hadron spectrum is computed in full QCD using domain-wall valence fermions on an improved staggered sea, for pion masses down to around 350 MeV. Emphasis is laid on the low-lying baryon spectrum. All possible baryon correlators obtainable from local and quasi-local quark sources are computed, using lattice group-theory methods. Results are presented for the lowest-lying states in each isospin channel.

NTIS

Domain Wall; Quarks; Seas; Spectra; Valence

20070010720 Jefferson (Thomas) Lab. Computer Center, Newport News, VA, USA

Operational Experience with Synchrotron Light Interferometers for CEBAF Experimental Beam Lines

Chevtsov, P.; January 2006; 3 pp.; In English

Report No.(s): DE2006-893789; No Copyright; Avail.: Department of Energy Information Bridge

Beam size and energy spread monitoring systems based on Synchrotron Light Interferometers (SLI) have been in operations at Jefferson Lab for several years. A non-invasive nature and a very high (a few mm) resolution of SLI make these instruments valuable beam diagnostic tools for the CEBAF accelerator. This presentation describes the evolution of the Synchrotron Light Interferometer at Jefferson Lab and highlights our extensive experience in the installation and operation of the SLI for CEBAF experimental beam lines.

NTIS

Interferometers; Linear Accelerators; Synchrotrons

20070010721 Jefferson (Thomas) Lab. Computer Center, Newport News, VA, USA

Users Perspective

Carlino, I. T.; January 2006; 4 pp.; In English

Report No.(s): DE2006-893788; No Copyright; Avail.: National Technical Information Service (NTIS)

The user is often the most overlooked component of control system design. At Jefferson Lab the control system is almost entirely digital in nature, with little feedback except that which is deliberately designed into the control system. In the complex control room environment a good design can enhance the user's abilities to perform good science. A bad design can leave the user frustrated and contribute significantly to down time, when science is not being done. Key points of use and design from the user's perspective are discussed, along with some techniques which have been adopted at Jefferson Lab to improve the user experience and produce better, more usable software.

NTIS

Control Systems Design; Systems Analysis; User Requirements; Human-Computer Interface

20070010729 Lawrence Livermore National Lab., Livermore, CA USA

GIFFT: A Fast Solver for Modeling Sources in a Metamaterial Environment of Finite Size

Capolino, F.; Basilio, L.; Fasenfest, B. J.; Wilton, D. R.; Feb. 14, 2006; 6 pp.; In English

Report No.(s): DE2006-894343; UCRL-CONF-218954; No Copyright; Avail.: National Technical Information Service (NTIS)

Due to the recent explosion of interest in studying the electromagnetic behavior of large (truncated) periodic structures such as phased arrays, frequency-selective surfaces, and metamaterials, there has been a renewed interest in efficiently modeling such structures. Since straightforward numerical analyses of large, finite structures (i.e., explicitly meshing and computing interactions between all mesh elements of the entire structure) involve significant memory storage and computation times, much effort is currently being expended on developing techniques that minimize the high demand on computer resources. One such technique that belongs to the class of fast solvers for large periodic structures is the GIFFT algorithm (Green's function interpolation and FFT), which is first discussed in (1). This method is a modification of the adaptive integral method (AIM) (2), a technique based on the projection of subdomain basis functions onto a rectangular grid. Like the methods presented in (3)-(4), the GIFFT algorithm is an extension of the AIM method in that it uses basis-function projections onto a rectangular grid through Lagrange interpolating polynomials. The use of a rectangular grid results in a matrix-vector product that is convolutional in form and can thus be evaluated using FFTs. Although our method differs from (3)-(6) in various respects, the primary differences between the AIM approach (2) and the GIFFT method (1) is the latter's use of interpolation to represent the Green's function (GF) and its specialization to periodic structures by taking into account the reusability properties of matrices that arise from interactions between identical cell elements.

NTIS

Electromagnetic Fields; Phased Arrays; Matrix Materials

20070010761 California Univ., Berkeley, CA, USA

Highly Compact Accelerator-Driven Subcritical Assembly for Medical and Industrial Applications

Vujic, J.; Kastenber, W.; Greenspan, E.; Leung, K. N.; Jul. 31, 2006; 89 pp.; In English

Report No.(s): DE2006-895020; No Copyright; Avail.: National Technical Information Service (NTIS)

A novel, highly compact, fusion neutron source (CNS) based on a coaxial electrostatic accelerator is under development at the Lawrence Berkeley National Laboratory. This source is designed to generate up to approx. $10(\text{sup } 12)$ D-D n/s. This source intensity is an order of magnitude too small for Boron Neutron Capture Therapy (BNCT) applications. The objective of this project is to assess the feasibility of using a small, safe and inexpensive subcritical fission assembly to multiply the fusion neutrons by a factor of $k = 30$. The overall design objective is to get a treatment time for deep seated brain tumors that does not significantly increase beyond one hour when the effective multiplication factor of the SCM is $k(\text{sub eff}) = 0.98$.

There are two major parts to this study: the optimization of the Sub-Critical Multiplier (SCM) and the optimization of the Beam Shaping Assembly (BSA), including the reflector for both subsystems. The SCM optimization objective is to maximize the current of neutrons that leak out from the SCM in the direction of the patient, without exceeding the maximum permissible keff. Minimizing the required uranium inventory is another objective. SCM design variables considered include the uranium enrichment level in the range not exceeding 20% (sup 235)U (for proliferation concerns), SCM geometry and dimensions, fuel thickness and moderator thickness. The objective of the BSA optimization is to maximize the tumor dose rate using the optimal SCM while maintaining a tumor-to-normal tissue dose ratio of at least 20 to 12.5 (corresponding to the tumor control dose and to the healthy tissue dose limit). The BSA design variables include its shape, dimensions and composition. The reflector optimization is, in fact, an integral part of the SCM optimization and of the BSA optimization. The reflector design variables are composition and thickness.

NTIS

Neutron Sources; Design Analysis

20070010894 Illinois Univ. at Urbana-Champaign, Urbana, IL USA

Multilevel Multipole-Free Fast Algorithm For Electromagnetic Scattering Problems In Layered Media

Saville, Michael A; Sep 29, 2006; 161 pp.; In English; Original contains color illustrations

Report No.(s): AD-A462501; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA462501>

A multilevel multipole-free algorithm is presented for solving electromagnetic scattering problems in the vicinity of a half space or layered medium. By replacing the multipole expansion in the fast inhomogeneous plane wave algorithm (FIPWA) with a multipole-free expansion, this new algorithm is simpler to derive and retains $O(N \log N)$ scaling in memory and processing time. To develop this new algorithm, known as the multipole-free fast inhomogeneous plane wave algorithm (MF-FIPWA), error control is established for arbitrary accuracy. In addition, comparison of the memory usage and simulation time is presented for FIPWA and MF-FIPWA for moderate to large scale problems. Various alternate approaches to implementing MF-FIPWA are discussed in terms of how the fast algorithms set up translation matrices and where gains can be made. Finally, details of the advantages of using non-uniform sampling are provided. Results show 30% savings in memory usage and up to 20% savings in computing the matrix-vector product.

DTIC

Algorithms; Electromagnetic Scattering; Multipoles

20070011109 Naval Postgraduate School, Monterey, CA USA

Cellular Automata: An Approach to Wave Propagation and Fracture Mechanics Problems

Hosoglu, Selcuk; Dec 2006; 81 pp.; In English; Original contains color illustrations

Report No.(s): AD-A462598; No Copyright; Avail.: CASI: A05, Hardcopy

The Cellular Automata (CA) method is based on the idea that the macroscopic behavior of a system can be captured by using simple local rules running at a microscopic level. In other words, a system can be modeled by means of simple local rules that govern the behavior of the whole system. In this thesis a local CA rule set is introduced and a methodology is developed to model physical systems that are governed by one and two dimensional wave equations. One dimensional systems are also successfully modeled by using CA and FEM techniques working as coupled, whereas two dimensional systems could only be modeled in an error margin due to the variation of the introduced time scaling factor when external forces are involved. Also, the applicability of the CA method to fracture mechanics problems is investigated.

DTIC

Fracture Mechanics; Wave Propagation

20070011173 North Carolina State Univ., Raleigh, NC USA

AC Coupled Interconnect for Low Power Spaceborne Electronics

Franzon, Paul D; Sep 30, 2006; 14 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): F29601-03-2-0135; Proj-5108/5108

Report No.(s): AD-A462801; No Copyright; Avail.: CASI: A03, Hardcopy

The primary objective of this effort was to establish that AC Coupled Interconnect could be used to create multiple solutions to contactless chip-to-chip communications. Towards this goal, we took an experimental approach, developing and conducting a set of experiments showing this can be successfully achieved. In this final report, we summarize the outcomes

of those experiments and list the papers, graduate students and technology transfer outcomes of this activity.

DTIC

Alternating Current; Electric Connectors

20070011237 California Univ., Berkeley, CA USA

High Bandwidth Atomic Detection at the Single-Atom Level and Cavity Quantum Electrodynamics on an Atom Chip

Stamper-Kurn, Dan M; Jul 26, 2006; 12 pp.; In English

Contract(s)/Grant(s): FA9550-04-1-0461

Report No.(s): AD-A462890; No Copyright; Avail.: CASI: [A03](#), Hardcopy

The overall objective of this seedling grant was to integrate high-finesse optical cavities onto atom chips so as to advance the application of cavity quantum electrodynamics (CQED) to ultracold atoms for applications in sensing quantum information technology exploration and basic science. We have accomplished all of the experimental objectives for this project. Extensive research and testing of various microfabrication methods yielded a robust recipe for integrating small-scale high-finesse mirrors onto sapphire and glass substrates. The challenges of temperature variations on and vibrational coupling to the chip were addressed effectively. We fabricated a sapphire-substrate atom chip with integrated Fabry-Perot cavity and a temperature stabilization system. The high-finesse cavity achieving the single-atom strong-coupling regime for rubidium atoms, and was kept locked during a simulated operation of the atom chip.

DTIC

Atoms; Bandwidth; Cavities; Chips; Quantum Electrodynamics

20070011238 Princeton Univ., NJ USA

Picosecond Coherent and Incoherent Dynamics in Proteins

Austin, Robert H; Xie, Aihua; Sep 1, 2006; 10 pp.; In English

Contract(s)/Grant(s): FA9550-05-1-0431

Report No.(s): AD-A462891; No Copyright; Avail.: CASI: [A02](#), Hardcopy

There are two critical questions in the quantum protein dynamics: (1) the time scale of decoherence of coherent vibrational excitations of proteins, and (2) the rate of transport of quantum vibrations along the amide I polymer chain. We have carried out a series of experiments at FELIX, a free-electron laser (FEL) in the Netherlands which attacked these critical questions. We found that there does not exist a highly narrow and long-lived coherent state in the amide I band, in spite of Austin's initial excitement that he had stumbled upon this effect. It remains a mystery why this large and narrow scattering signal appears exactly where one would NOT expect to see a temperature grating signal, namely at the temperature isosbestic point.

DTIC

Incoherence; Proteins

71 ACOUSTICS

Includes sound generation, transmission, and attenuation. For noise pollution see *45 Environment Pollution*. For aircraft noise see also *02 Aerodynamics* and *07 Aircraft Propulsion and Power*.

20070009905 Natural Environmental Research Council, Nottingham, UK

Science, Technical Innovation and Applications in Bioacoustics: Summary of a Workshop

Rees, John G; Jul 1, 2004; 575 pp.; In English; Original contains color illustrations

Report No.(s): AD-A460812; CR/04/201; No Copyright; Avail.: CASI: [A24](#), Hardcopy

The Science, Technical Innovation and Applications in Bioacoustics Workshop was held at the Marine Hotel, North Berwick, East Lothian, Scotland between 4-5 May 2004. focused upon three main topics: 1) The state of our understanding of the basic science of bioacoustics - summarizing what we know, and what we don't know, about acoustic signals produced by animals and how they acquire knowledge about their environment. 2) The conceptual basis for bioacoustics-based engineered systems - addressing the question of how bioacoustics signals can meet human information needs, what will be the characteristics of an engineered bioacoustics system? 3) Science and technology gaps - identifying research needs and priorities. This report details the key results from the workshop and provides an initial statement from delegates about each of these topics. Instead of reproducing what was said by delegates (the presentations of whom are contained in Appendix 3) the written report summarises the main findings of the meeting in a precised form. The report effectively is the joint product

of all of the delegates who attended and contributed, not only with presentations and discussion at the time, but in writing subsequently.

DTIC

Bioacoustics; Research and Development; Identifying; Signal Transmission

20070010023 NASA Johnson Space Center, Houston, TX, USA

Acoustics

Goodman, Jerry R.; Grosveld, Ferdinand; [2007]; 14 pp.; In English; No Copyright; Avail.: CASI: [A03](#), Hardcopy
ONLINE: <http://hdl.handle.net/2060/20070010023>

The acoustics environment in space operations is important to maintain at manageable levels so that the crewperson can remain safe, functional, effective, and reasonably comfortable. High acoustic levels can produce temporary or permanent hearing loss, or cause other physiological symptoms such as auditory pain, headaches, discomfort, strain in the vocal cords, or fatigue. Noise is defined as undesirable sound. Excessive noise may result in psychological effects such as irritability, inability to concentrate, decrease in productivity, annoyance, errors in judgment, and distraction. A noisy environment can also result in the inability to sleep, or sleep well. Elevated noise levels can affect the ability to communicate, understand what is being said, hear what is going on in the environment, degrade crew performance and operations, and create habitability concerns. Superfluous noise emissions can also create the inability to hear alarms or other important auditory cues such as an equipment malfunctioning. Recent space flight experience, evaluations of the requirements in crew habitable areas, and lessons learned (Goodman 2003; Allen and Goodman 2003; Pilkinton 2003; Grosveld et al. 2003) show the importance of maintaining an acceptable acoustics environment. This is best accomplished by having a high-quality set of limits/requirements early in the program, the ‘designing in’ of acoustics in the development of hardware and systems, and by monitoring, testing and verifying the levels to ensure that they are acceptable.

Author

Acoustic Measurement; Auditory Defects; Acoustics; Human Performance; Noise Intensity; Crews; Sound Pressure; Habitability

20070010450 NASA Glenn Research Center, Cleveland, OH, USA

Jet Measurements for Development of Jet Noise Prediction Tools

Bridges, James E.; [2006]; 53 pp.; In English; 10th CEAS-ASC Workshop on Jet Noise Prediction Methodologies, 28-29 Sep. 2006, Dublin, Ireland; Original contains color and black and white illustrations
Contract(s)/Grant(s): WBS 984754.02.07.03.04.01; No Copyright; Avail.: CASI: [A04](#), Hardcopy
ONLINE: <http://hdl.handle.net/2060/20070010450>

The primary focus of my presentation is the development of the jet noise prediction code JeNo with most examples coming from the experimental work that drove the theoretical development and validation. JeNo is a statistical jet noise prediction code, based upon the Lilley acoustic analogy. Our approach uses time-average 2-D or 3-D mean and turbulent statistics of the flow as input. The output is source distributions and spectral directivity.

Derived from text

Jet Aircraft Noise; Noise Prediction; Aeroacoustics; Noise Measurement; Computational Fluid Dynamics

20070010579 NASA Langley Research Center, Hampton, VA, USA

Derivation of Formulations 1 and 1A of Farassat

Farassat, F.; March 2007; 25 pp.; In English; Original contains black and white illustrations
Contract(s)/Grant(s): WBS 561581.02.07.07
Report No.(s): NASA/TM-2007-214853; L-19318; No Copyright; Avail.: CASI: [A03](#), Hardcopy
ONLINE: <http://hdl.handle.net/2060/20070010579>

Formulations 1 and 1A are the solutions of the Ffowcs Williams-Hawkings (FW-H) equation with surface sources only when the surface moves at subsonic speed. Both formulations have been successfully used for helicopter rotor and propeller noise prediction for many years although we now recommend using Formulation 1A for this purpose. Formulation 1 has an observer time derivative that is taken numerically, and thus, increasing execution time on a computer and reducing the accuracy of the results. After some discussion of the Green’s function of the wave equation, we derive Formulation 1 which is the basis of deriving Formulation 1A. We will then show how to take this observer time derivative analytically to get

Formulation 1A. We give here the most detailed derivation of these formulations. Once you see the whole derivation, you will ask yourself why you did not do it yourself!

Author

Aerodynamic Noise; Aeroacoustics; Wave Equations; Ffowcs Williams-Hawkings Equation; Aircraft Noise; Derivation; Noise Prediction

20070010603 NASA Glenn Research Center, Cleveland, OH, USA

Low Noise Cruise Efficient Short Take-Off and Landing Transport Vehicle Study

Kim, Hyun D.; Berton, Jeffrey J.; Jones, Scott M.; February 2007; 18 pp.; In English; 6th AIAA Aviation Technology, Integration, and Operations (ATIO) Conference and Exhibit, Sep. 2006, Wichita, KS, USA; Original contains color illustrations
Contract(s)/Grant(s): WBS 561581.02.08.03.07.01

Report No.(s): NASA/TM-2007-214659; E-15790; AIAA Paper 2006-7738; No Copyright; Avail.: CASI: [A03](#), Hardcopy
ONLINE: <http://hdl.handle.net/2060/20070010603>

The saturation of the airspace around current airports combined with increasingly stringent community noise limits represents a serious impediment to growth in world aviation travel. Breakthrough concepts that both increase throughput and reduce noise impacts are required to enable growth in aviation markets. Concepts with a 25 year horizon must facilitate a 4x increase in air travel while simultaneously meeting community noise constraints. Attacking these horizon issues holistically is the concept study of a Cruise Efficient Short Take-Off and Landing (CESTOL) high subsonic transport under the NASA's Revolutionary Systems Concepts for Aeronautics (RSCA) project. The concept is a high-lift capable airframe with a partially embedded distributed propulsion system that takes a synergistic approach in propulsion-airframe-integration (PAI) by fully integrating the airframe and propulsion systems to achieve the benefits of both low-noise short take-off and landing (STOL) operations and efficient high speed cruise. This paper presents a summary of the recent study of a distributed propulsion/airframe configuration that provides low-noise STOL operation to enable 24-hour use of the untapped regional and city center airports to increase the capacity of the overall airspace while still maintaining efficient high subsonic cruise flight capability.

Author

Low Noise; Short Takeoff Aircraft; Transport Vehicles; Vertical Landing; Blended-Wing-Body Configurations; Cruising Flight

20070010927 Naval Postgraduate School, Monterey, CA USA

Sensitivity of Bottom Topography on the Dynamics and Sound Speed Structure in the Northern Canary Current System

Hopkins, Alicia A; Dec 2006; 125 pp.; In English; Original contains color illustrations

Report No.(s): AD-A462597; No Copyright; Avail.: CASI: [A06](#), Hardcopy
ONLINE: <http://hdl.handle.net/100.2/ADA462597>

The knowledge of the ocean environment, especially its littoral/coastal is important for current and future naval operations. In particular, an accurate description of the mesoscale variability of the surface and subsurface currents is essential for optimizing Navy missions. This study determines that different types of topographic smoothing and the addition of a volume constraint to a sigma-coordinate model significantly influences the generation, evolution, and maintenance of not only the surface and subsurface currents, but also other features (upwelling, meanders, eddies, filaments, Mediterranean Outflow, and Meddies) in the Northern Canary Current System (NCCS). The NCCS is chosen for this study for its classical upwelling and equatorward surface current as well as the unique impact of the Mediterranean Outflow. The sound speed structure of these features is examined to establish which regions of the NCCS experience the largest changes in sound speed and the most intense gradients. This study demonstrates that features of classic littoral/coastal eastern boundary current systems, like the NCCS, have an important impact on the sound speed structure which can significantly impact Navy sonar operations.

DTIC

Acoustic Velocity; Ocean Bottom; Sensitivity; Topography

20070010945 Naval Postgraduate School, Monterey, CA USA

Using Acoustic Backscatter to Measure Sediment Flux in the Surf Zone

Roland, Preston J; Dec 2006; 75 pp.; In English; Original contains color illustrations

Report No.(s): AD-A462638; No Copyright; Avail.: CASI: [A04](#), Hardcopy
ONLINE: <http://hdl.handle.net/100.2/ADA462638>

Transport of sediment in coastal regions directly impacts mine countermeasure operations and naval construction efforts.

Wave induced shear stress in the surf zone is responsible for entraining sediment particles into suspension within the combined wave and current boundary layer, where momentum is imparted through highly nonlinear processes. Therefore, a detailed understanding of sediment flux processes in the surf zone is essential to accurately model net sediment transport. This study examines the use of acoustic backscatter inversion as a means of measuring sediment concentration profiles. Measurements of sediment concentration and velocity profiles were made by a high frequency Doppler velocity profiler deployed on Blacks Beach during the Nearshore Canyon Experiment, NCEX. Profiles of sediment flux were compared with hourly mean current measurements from a cross-shore/long-shore array of PUV sensors and two-dimensional planar images of the morphological evolution provided by a three camera Argus video suite. Observations from a seven day period containing the development and evolution of a weak rip channel demonstrated that acoustic backscatter inversion techniques, when calibrated with in situ sediment samples, provide high spatial and temporal resolution estimates of sediment concentration and fluxes into the thin wave boundary layer. These sediment transport measurements were correlated with observed mean currents and rip channel evolution, and show a strong morphological response to the sediment flux.

DTIC

Acoustic Scattering; Backscattering; Sediment Transport; Sediments

20070011145 Massachusetts Inst. of Tech., Lexington, MA USA

Auditory Modeling as a Basis for Spectral Modulation Analysis with Application to Speaker Recognition

Wang, Tianyu T; Quatieri, Thomas F; Jan 31, 2007; 30 pp.; In English

Contract(s)/Grant(s): FA8721-05-C-0002; Proj-1306

Report No.(s): AD-A462760; TR-1119; No Copyright; Avail.: CASI: [A03](#), Hardcopy

This report explores auditory modeling as a basis for robust automatic speaker verification. Specifically, we have developed feature-extraction front-ends that incorporate (1) time-varying, level-dependent filtering, (2) variations in analysis filter-bank size, and (3) nonlinear adaptation. Our methods are motivated both by a desire to better mimic auditory processing relative to traditional front-ends (e.g., the mel-cepstrum) as well as by reported gains in automatic speech recognition robustness exploiting similar principles. Traditional mel-cepstral features in automatic speaker recognition are derived from ~ 20 invariant band-pass filter weights, thereby discarding temporal structure from phase. In contrast, cochlear frequency decomposition can be more precisely modeled as the output of ~ 3500 time-varying, level-dependent filters. Auditory signal processing is therefore more resolved in frequency than mel-cepstral analysis and also derives temporal information. Furthermore, loss of level-dependence has been suggested to reduce human speech reception in adverse acoustic environments. We were thus motivated to employ a recently proposed level-dependent compressed gammachirp filter bank in feature extraction as well as vary the number of filters or filter weights to improve frequency resolution. We are also simulating nonlinear adaptation models of inner hair cell function along the basilar membrane that presumably mimic temporal masking effects. Auditory-based front-ends are being evaluated with the Lincoln Laboratory Gaussian mixture model recognizer on the TIMIT database under clean and noisy (additive Gaussian white noise) conditions. Preliminary results of features derived from our auditory models suggest that they provide complementary information to the mel-cepstrum under clean and noisy conditions, resulting in speaker recognition performance improvements.

DTIC

Modulation; Pattern Recognition; Security; Spectrum Analysis; Speech Recognition

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](#).

20070010772 Naval Research Lab., Washington, DC USA

Gamma-Ray Instrument for Polarimetry, Spectroscopy and Imaging (GIPSI)

Kroeger, R A; Johnson, W N; Kinzer, R L; Kurfess, J D; Inderhees, S E; Philips, B F; Graham, B L; Jan 1996; 13 pp.; In English

Report No.(s): AD-A462290; No Copyright; Avail.: CASI: [A03](#), Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA462290>

We present an instrument concept called GIPSI that uses germanium strip detectors in an imaging system to provide narrow line sensitivity of $8.0 \times 10^{-6} \text{ cm}^{-2} \text{ \%i}$ at 100 keV in a 2 week exposure (3ff), and which has a point spread function (spatial resolution) of approximately 20 arc minutes rms. The germanium strip detectors also make an excellent

polarimeter by capitalizing on the angular dependence of the Compton scattering cross section. Gamma-ray polarimetry in the energy band around 60-300 keV is an interesting area of high energy astrophysics where observations have not been possible with the technologies employed in current and past space missions. We have tested a prototype detector with polarized beams and have measured a modulation factor of approximately 0.8 at 100 keV. A sensitive instrument can be realized on a modest space mission or a long duration balloon flight. Linear polarization can be detected in sources such as the Crab Pulsar, Cen A, Cyg X-1, and solar flares down to less than 5% of the source flux. The proposed instrument would have a collecting area of 400 cm².

DTIC

Gamma Ray Spectrometers; Gamma Rays; Imaging Techniques; Polarimetry; Spectroscopy

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*.

20070010573 Massachusetts Inst. of Tech., Cambridge, MA, USA

Final Report: Modeling and Simulation of Granular Flow in Pebble-Bed Nuclear Reactors

Bazant, M. Z.; January 2006; 28 pp.; In English

Report No.(s): DE2006-882198; No Copyright; Avail.: National Technical Information Service (NTIS)

Pebble-bed nuclear reactor technology, which is currently being revived around the world, raises fundamental questions about dense granular flow in silos. A typical reactor core is composed of graphite fuel pebbles, which drain very slowly in a continuous refueling process. Pebble flow is poorly understood and not easily accessible to experiments, and yet it has a major impact on reactor physics. To address this problem, we perform full-scale, discrete-element simulations in realistic geometries, with up to 440,000 frictional, viscoelastic 6cm-diameter spheres draining in a cylindrical vessel of diameter 3.5m and height 10m with bottom funnels angled at 30 degrees or 60 degrees. We also simulate a bidisperse core with a dynamic central column of smaller graphite moderator pebbles and show that little mixing occurs down to a 1:2 diameter ratio. We analyze the mean velocity, diffusion and mixing, local ordering and porosity (from Voronoi volumes), the residence-time distribution, and the effects of wall friction and discuss implications for reactor design and the basic physics of granular flow.

NTIS

Granular Materials; Nuclear Reactors; Pebble Bed Reactors; Simulation; Mathematical Models

20070010820 Naval Postgraduate School, Monterey, CA USA

Analysis of Coolant Options for Advanced Metal Cooled Nuclear Reactors

Can, Levent; Dec 2006; 89 pp.; In English; Original contains color illustrations

Report No.(s): AD-A462364; No Copyright; Avail.: CASI: [A05](#), Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA462364>

It is well known that any neutron-producing device generates induced radioactivity as a by-product of its operation. In the case of nuclear reactors, the induced radioactivity includes fission and activation products. The overall focus of this study is the build up of induced radioactivity in the coolant of metal cooled reactors as well as the evaluation of other physical and chemical properties of such coolants. The objectives of the thesis are two fold. The first objective is to independently calculate the generation of Polonium-210 in reactors cooled by lead and lead-bismuth eutectic. The motivation for this is to address a noted lack of consensus among the world researchers on the significance of Po-210 build up in lead cooled reactors. The second objective is to evaluate the advantages and disadvantages of selected candidate metal coolants. In addressing both objectives, the computer code ORIGEN was used. To establish the background basis for these assessments, fundamental concepts of reactor physics are reviewed and discussed.

DTIC

Advanced Test Reactors; Chemical Properties; Coolants; Liquid Metals; Nuclear Reactors

20070011118 Naval Postgraduate School, Monterey, CA USA

The Dilemmas of Developing an Indigenous Advanced Arms Industry for Developing Countries: The Case of India and China

Nosek, Paul C; Dec 2006; 97 pp.; In English

Report No.(s): AD-A462722; No Copyright; Avail.: CASI: [A05](#), Hardcopy

This thesis will investigate the feasibility of developing nations ability to create a wholly indigenous advanced arms industry in the 21st century using China and India as case studies. I propose it is not possible for developing nations in the current context of the globalized arms race to build an advanced arms industry because of the high political and economic costs. Diverse competing interests force politicians to make decisions about distribution and usage of resources that will maintain their legitimacy. The hypothesis does not rule out that some domestic advancements may be made in certain sectors, such as nuclear bombs and missiles, because resources may be spent on narrowly defined goals instead of the development of the whole industry. Nor does it rule out that a developing nation cannot have a modern military with advanced weaponry, just that the weapons will not all be wholly domestic. They will obtain advanced weapons through joint development, purchasing, or licensing. Political and economic cost will explain the failure of a wholly indigenous advanced arms industry to fully develop, as well as illustrate the few successes within certain sectors of the industry.

DTIC

China; Developing Nations; India; Industries; Nuclear Weapons

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*.

20070009717 Lawrence Livermore National Lab., Livermore, CA USA

Electrical Transient Sampling System Using a Regenerative Gain-Clamped Fiber Optic Delay Line

Halvorson, C. S.; 31 Jan 05; 8 pp.; In English

Contract(s)/Grant(s): DE-W-7405-ENG-48

Patent Info.: Filed Filed 31 Jan 05; US-Patent-Appl-SN-11-049 556

Report No.(s): PB2007-102948; No Copyright; Avail.: CASI: [A02](#), Hardcopy

Transient signal measurements are bandwidth limited by present digitizer technology. If a transient signal can be stored in a gain-clamped regenerative delay line, such a signal can be regeneratively sampled, resulting in about an order of magnitude increase in measurement bandwidth. The approach involves converting electrical signals to optical signals with high fidelity, injecting such signals into a fiber-optic delay line, and then sampling injected signals repetitively, with signal generation provided by an erbium-doped gain-clamped fiber amplifier. Moreover, signal regeneration can be either steady state (i.e., amplification on each pass) or switched (i.e., amplification after signal levels have dropped significantly).

NTIS

Delay Lines; Fiber Optics; Sampling

20070009887 Army Tank-Automotive and Armaments Command, Warren, MI USA

A Comparison of the Detection Rates for Infrared and Visual Imagery of a Person Holding an RPG

Sohn, Euijung; Meitzler, Tom; Bryk, Darryl; Jozwiak, Rachel; Bednarz, David; Lane, Kim; Bankowski, Elena; Vala, John; Feb 27, 2004; 10 pp.; In English; Original contains color illustrations

Report No.(s): AD-A462229; No Copyright; Avail.: CASI: [A02](#), Hardcopy

Detection of potential threats that are camouflaged or concealed is important not only for military acquisition problems but, also for crowd surveillance as well as tactical use such as on border patrols. Imaging and display technologies that take advantage of photo-simulation and sensor fusion are discussed in this paper. A comparison of the detection rates of visible, infrared (IR) and sensor-fused imagery of scenes that contain a Rocket Propelled Grenade (RPG) were made. Image fusion was achieved using a Gaussian Laplacian pyramidal approach with wavelets for edge enhancement. Three types of images were also compared in terms of better detection of concealed weapons.

DTIC

Infrared Imagery; Grenades; Detection; Weapons

20070010663 Sandia National Labs., Albuquerque, NM USA

Hazard Analysis of Long Term Viewing of Visible Laser Off of Fluorescent Diffuse Reflective Surfaces (Post-It)

Augustoni, A. L.; Oct. 2006; 20 pp.; In English

Report No.(s): DE2006-894322; SAND2006-5844; No Copyright; Avail.: National Technical Information Service (NTIS)

A laser hazard analysis is performed to evaluate if the use of fluorescent diffuse reflectors to view incident laser beams (Coherent Verdi 10W) present a hazard based on the ANSI Standard Z136.1-2000, American National Standard for the Safe

Use of Lasers. The use of fluorescent diffuse reflectors in the alignment process does not pose an increased hazard because of the fluorescence at a different wavelength than that of the incident laser.

NTIS

Fluorescence; Hazards; Laser Beams; Lasers; Viewing

20070010692 California Univ., Lawrence Berkeley National Lab., Berkeley, CA, USA, Brookhaven National Lab., Upton, NY USA

Air Convection Noise of Pencil-Beam Interferometer for Long Trace Profiler

Yashchuk, V. V.; Irick, S. C.; MacDowell, A. A.; McKinney, W. R.; Takacs, P. Z.; Aug. 2006; 14 pp.; In English
Report No.(s): DE2006-894609; BNL-77087-2006-CP; No Copyright; Avail.: Department of Energy Information Bridge

In this work, we investigate the effect of air convection on laser-beam pointing noise essential for the long trace profiler (LTP). We describe this pointing error with noise power density (NPD) frequency distributions. It is shown that the NPD spectra due to air convection have a very characteristic form. In the range of frequencies from (approx.) 0.05 Hz to (approx.) 0.5 Hz, the spectra can be modeled with an inverse-power-law function. Depending on the intensity of air convection that is controlled with a resistive heater of 100 to 150 mW along a one-meter-long optical path, the power index lies between 2 and 3 at an overall rms noise of (approx.) 0.5 to 1 microradian. The efficiency of suppression of the convection noise by blowing air across the beam optical path is also discussed. Air-blowing leads to a white-noise-like spectrum. Air blowing was applied to the reference channel of an LTP allowing demonstration of the contribution of air convection noise to the LTP reference beam. The ability to change (with the blowing technique presented) the spectral characteristics of the beam pointing noise due to air convection allows one to investigate the contribution of the convection effect, and thus make corrections to the power spectral density spectra measured with the LTP.

NTIS

Interferometers; Laser Beams; Pencil Beams; Air Currents; Convection Currents; Density Distribution

20070010696 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Single Crystal Silicon Instrument Mirrors

Bly, Vince; [2007]; 9 pp.; In English; Mirror Technology Days in the Government 2006, 18-20 Sept. 2006, Albuquerque, Mexico; Original contains color and black and white illustrations; No Copyright; Avail.: CASI: A02, Hardcopy
ONLINE: <http://hdl.handle.net/2060/20070010696>

The goals for the fabrication of single crystal silicon instrument mirrors include the following: 1) Develop a process for fabricating lightweight mirrors from single crystal silicon (SCS); 2) Modest lightweighting: 3X to 4X less than equivalent solid mirror; 3) High surface quality, better than $\lambda/40$ RMS @ 633nm; 4) Significantly less expensive than current technology; and 5) Negligible distortion when cooled to cryogenic temperatures.

CASI

Fabrication; Mirrors; Single Crystals; Silicon

20070010726 Jefferson (Thomas) Lab. Computer Center, Newport News, VA, USA

Harmonic Lasing Characterization at Jefferson Lab

Benson, S. V.; Shinn, M. D.; January 2006; 4 pp.; In English
Report No.(s): DE2006-894263; No Copyright; Avail.: National Technical Information Service (NTIS)

Harmonic lasing is normally suppressed because of lasing at the fundamental wavelength. It can, however, be achieved by using any of several methods that suppress fundamental lasing. In this paper we discuss two methods used at Jefferson Lab. The first is to use the characteristics of dielectric coatings to allow harmonic lasing at cavity lengths longer than the synchronous length for the fundamental. The second is to use a dielectric coating that has little reflectivity at the fundamental. This allows us to directly compare fundamental and harmonic lasing with the same optical resonator and electron beam. We present measurement carried out at Jefferson Lab using the IR Upgrade FEL operating at 0.53, 0.94, 1.04, 1.6, and 2.8 microns in which both schemes are used to produce lasing at both the 3rd and 5th harmonic of the fundamental.

NTIS

Characterization; Harmonics; Lasers; Lasing

20070010934 Universal Technology Corp., Dayton, OH USA

Collaborative Research and Development Delivery. Order 0041: Models for the Prediction of Interfacial Properties

Bartha, Bence; Aug 2006; 24 pp.; In English

Contract(s)/Grant(s): F33615-03-D-5801-0041; Proj-4349

Report No.(s): AD-A462607; S-531-0041; No Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA462607>

The research in support of the Air Force Research Laboratory, Materials and Manufacturing Directorate was conducted at Wright-Patterson AFB, Ohio from 25 July 2005 through 4 August 2006. The task developed various experimental and computational tools to determine the material behavior of weld interfaces and local grain behavior of materials. Stereo imaging, optical microscopy and scanning electron microscopy were used to determine the local interfacial characteristics of welds as well as microstructural characteristics of grains at a micro-scale. Computational tools were also developed to analyze and combine the tensile and fatigue data for the various applications. The data shows large strain concentrations develop near the weld interface develop for resistance welds, and near grain boundaries of grain interfaces. The combined data shows the heterogeneous behavior of grains on a micro-scale. Semi-analytical computational tools that determine the stress field of two contacting bodies were also used to analyze and publish data for various contact fatigue applications. The results in the publication show the need for accurate stress based modeling tools to predict the fatigue and crack growth behavior of contracting bodies.

DTIC

Images; Scanning Electron Microscopy

75

PLASMA PHYSICS

Includes magnetohydrodynamics and plasma fusion. For ionospheric plasmas see *46 Geophysics*. For space plasmas see *90 Astrophysics*.

20070010017 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Physics-based Tests to Identify the Accuracy of Solar Wind Ion Measurements: A Case Study with the Wind Faraday Cups

Kasper, J. C.; Lazarus, A. J.; Steinberg, J. T.; Ogilvie, K. W.; Szabo, A.; Journal of Geophysical Research; March 24, 2006; Volume 111, Issue A3; 2 pp.; In English

Contract(s)/Grant(s): NNG05GB44G; Copyright; Avail.: Other Sources

We present techniques for comparing measurements of velocity, temperature, and density with constraints imposed by the plasma physics of magnetized bi-Maxwellian ions. Deviations from these physics-based constraints are interpreted as arising from measurement errors. Two million ion spectra from the Solar Wind Experiment Faraday Cup instruments on the Wind spacecraft are used as a case study. The accuracy of velocity measurements is determined by the fact that differential flow between hydrogen and helium should be aligned with the ambient magnetic field. Modeling the breakdown of field alignment suggests velocity uncertainties are less than 0.16% in magnitude and 3deg in direction. Temperature uncertainty is found by examining the distribution of observed temperature anisotropies in high-beta solar wind intervals where the firehose, mirror, and cyclotron microinstabilities should drive the distribution to isotropy. The presence of a finite anisotropy at high beta suggests overall temperature uncertainties of 8%. Hydrogen and helium number densities are compared with the electron density inferred from observations of the local electron plasma frequency as a function of solar wind speed and year. We find that after accounting for the contribution of minor ions, the results are consistent with a systematic offset between the two instruments of 34%. The temperature and density methods are sensitive to non-Maxwellian features such as heat flux and proton beams and as a result are more suited to slow solar wind where these features are rare. These procedures are of general use in identifying the accuracy of observations from any solar wind ion instrument.

Author

Solar Wind; Ions; Temperature Measurement; Velocity Measurement; Wind Velocity; Accuracy; Cyclotrons; Gas Density; Plasma Physics

20070010498 Lawrence Livermore National Lab., Livermore, CA USA

Confinement Studies in High Temperature Spheromak Plasmas

Hill, D. N.; Mclean, H. S.; Wood, R. D.; Casper, T. A.; Cohen, B. I.; Oct. 25, 2006; 10 pp.; In English

Report No.(s): DE2006-894790; UCRL-CONF-225553; No Copyright; Avail.: National Technical Information Service (NTIS)

Recent results from the SSPX spheromak experiment demonstrate the potential for obtaining good energy confinement ($T_e \approx 350\text{eV}$ and radial electron thermal diffusivity comparable to tokamak L-mode values) in a completely self-organized toroidal plasma. A strong decrease in thermal conductivity with temperature is observed and at the highest temperatures, transport is well below that expected from the Rechester-Rosenbluth model. Addition of a new capacitor bank has produced 60% higher magnetic fields and almost tripled the pulse length to 11ms. For plasmas with $T_e \approx 300\text{eV}$, it becomes feasible to use modest (1.8MW) neutral beam injection (NBI) heating to significantly change the power balance in the core plasma, making it an effective tool for improving transport analysis. We are now developing detailed designs for adding NBI to SSPX and have developed a new module for the CORSICA transport code to compute the correct fast-ion orbits in SSPX so that we can simulate the effect of adding NBI; initial results predict that such heating can raise the electron temperature and total plasma pressure in the core by a factor of two.

NTIS

Confinement; High Temperature Plasmas; Plasma Control; Spheromaks

20070010562 Wisconsin Univ., Madison, WI, USA

Transport Task Force Activities. Final Technical Report. April 1, 2003 - March 31, 2006

Terry, P. W.; January 2006; 19 pp.; In English

Contract(s)/Grant(s): DE-FG02-03ER54707

Report No.(s): DE2006-889841; DOE/ER/54707-1; No Copyright; Avail.: National Technical Information Service (NTIS)

The US Transport Task Force has conducted a comprehensive, year-and-a-half long study of transport science in the US fusion sciences program, assessing progress to date, scientific status, and needs for the future. This study has concluded that the significant and impressive progress realized in understanding and controlling turbulence and transport over the past 15 years has applied primarily to ion thermal transport, and that significant new resources are needed if progress is to be made in areas crucial to the success of fusion where progress has lagged. While major questions in electron thermal transport, H mode/pedestal physics, particle transport, and momentum transport must be answered, the areas of electron thermal transport and H mode/pedestal physics are particularly ripe, in terms of scientific maturity, for a major initiative aimed at answering these questions. These areas are ready because a mature conceptual grasp of the nature and facets of these problems now exists, detailed technical pathways for tackling the problems have been formulated, and the necessary diagnostic, theoretical, and computational tools either exist or the knowledge to build and implement them has been acquired. The US Transport Task Force therefore calls for a new transport initiative, noting that such an effort is scientifically compelling in its own right, and also would contribute in fundamental ways to the success a burning plasma program. A preliminary costing analysis puts the cost at about \$14M/year over a five-year program. Likely deliverables are outlined in an appendix.

NTIS

Momentum Transfer; Transport Theory

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*.

20070009607 Summa, Allan and Addition, P.A., Charlotte, NC, USA

Seeded Single Crystal Silicon Carbide Growth and Resulting Crystals

Jenny, J. R.; Malta, D. P.; Hobgood, H. M.; Mueller, S. G.; Brady, M.; 12 Oct 05; 17 pp.; In English

Contract(s)/Grant(s): N00014-02-C-0306

Patent Info.: Filed 12 Oct 05; US-Patent-Appl-SN-11-248-579

Report No.(s): PB2007-101429; No Copyright; Avail.: CASI: [A03](#), Hardcopy

A method is disclosed for producing a high quality bulk single crystal of silicon carbide in a seeded growth system and in the absence of a solid silicon carbide source, by reducing the separation between a silicon carbide seed crystal and a seed holder until the conductive heat transfer between the seed crystal and the seed holder dominates the radiative heat transfer between the seed crystal and the seed holder over substantially the entire seed crystal surface that is adjacent the seed holder.

NTIS

Crystal Growth; Crystals; Epitaxy; Silicon Carbides; Single Crystals

20070009610 Heslin Rothenberg Faley and Mesiti, PC., Albany, NY, USA

Above Room Temperature Ferromagnetic Silicon

LaBella, V. P.; Bolduc, M.; Abeyandju, C.; Affouda, A.; Huang, M.; 22 Mar 05; 9 pp.; In English

Contract(s)/Grant(s): DMR-0349108

Patent Info.: Filed Filed 22 Mar 05; US-Patent-Appl-SN-11-085-938

Report No.(s): PB2007-101430; No Copyright; Avail.: CASI: [A02](#), Hardcopy

A manganese-implanted silicon substrate exhibits ferromagnetism and a Curie temperature above room temperature when magnetized. The implant is done at a temperature of between about 250 C and about 800 C, while the manganese concentration is between about 0.01 atomic percent and 10 atomic percent. The silicon substrate can be p- or n-type with a doping concentration between 10.sup.15 and 10.sup.21 cm.sup.-3. Annealing may be done to increase the saturation magnetization.

NTIS

Ferromagnetic Materials; Manganese; Room Temperature; Silicon; Substrates

20070009653 California Univ., Lawrence Berkeley National Lab., Berkeley, CA, USA, Stanford Linear Accelerator Center, CA, USA, Fermi National Accelerator Lab., Batavia, IL, USA

Analysis of KEK-ATF Optics and Coupling Using Orbit Response Matrix Analysis

Wolski, A.; Nelson, J.; Ross, M.; Woodley, M.; Mishra, S.; Jan. 12, 2004; 18 pp.; In English

Report No.(s): DE2006-893293; SLAC-PUB-12156; LBNL-59524; No Copyright; Avail.: National Technical Information Service (NTIS)

LOCO is a code for analysis of the linear optics in a storage ring based on the closed orbit response to steering magnets. The analysis provides information on focusing errors, BPM gain and rotation errors, and local coupling. Here, we report the results of an application of LOCO to the KEK-ATF. Although the analysis appears to have provided useful information on the optics of the machine, it appears that one of the main aims of the study--to reduce the vertical emittance by correcting the local coupling--was not successful, and we discuss some possible reasons for this.

NTIS

Matrices (Mathematics); Particle Accelerators; Optics

20070009713 Kopin Corp., Taunton, MA, USA

Bipolar Transistor with Graded Base Layer

Welser, R. E.; Deluca, P. M.; Lutz, C. R.; Stevens, K. S.; Pena, N.; 20 Jan 05; 32 pp.; In English

Contract(s)/Grant(s): USAF-F33615-99-G-1510

Patent Info.: Filed Filed 20 Jan 05; US-Patent-Appl-SN-11-039 299

Report No.(s): PB2007-102806; No Copyright; Avail.: CASI: [A03](#), Hardcopy

A semiconductor material which has a high carbon dopant concentration includes gallium, indium, arsenic and nitrogen. The disclosed semiconductor materials have a low sheet resistivity because of the high carbon dopant concentrations obtained. The material can be the base layer of gallium arsenide-based heterojunction bipolar transistors and can be lattice-matched to gallium arsenide emitter and/or collector layers by controlling concentrations of indium and nitrogen in the base layer. The base layer can have a graded band gap that is formed by changing the flow rates during deposition of III and V additive elements employed to reduce band gap relative to different III-V elements that represent the bulk of the layer. The flow rates of the III and V additive elements maintain an essentially constant doping-mobility product value during deposition and can be regulated to obtain pre-selected base-emitter voltages at junctions within a resulting transistor.

NTIS

Bipolar Transistors; Semiconductors (Materials)

20070009752 American Superconductor Corp., Watertown, MA, USA

Oxide Films with Nanodot Flux Pinning Centers

Rupich, M. W.; Kodenkandath, T.; Zhang, W.; Li, X.; 16 Jan 04; 26 pp.; In English

Contract(s)/Grant(s): USAF-F33615-01-D-5802

Patent Info.: Filed Filed 16 Jan 04; US-Patent-Appl-SN-10-758 710

Report No.(s): PB2007-102807; No Copyright; Avail.: CASI: [A03](#), Hardcopy

A method for producing a thin film includes disposing a precursor solution onto a substrate to form a precursor film. The precursor solution contains precursor components to a rare-earth/alkaline-earth-metal/transition-metal oxide including a salt of a rare earth element, a salt of an alkaline earth metal, and a salt of a transition metal in one or more solvents, wherein at

least one of the salts is a fluoride-containing salt. The precursor solution also contains an additive component comprising one or more metal compounds capable of forming a second phase nanoparticle, either alone or in combination with one or more of the precursor components of the precursor solution or a dopant component comprising one or more metal compounds capable of substituting for an element of the rare-earth/alkaline-earth-metal/transition-metal oxide, and treating the precursor film to form an intermediate metal oxyfluoride including the rare earth, the alkaline earth metal, the transition metal and the additive metal or dopant metal of the precursor solution.

NTIS

Flux Pinning; Oxide Films; Patent Applications; Superconductivity

20070009768 Fermi National Accelerator Lab., Batavia, IL, USA

Tevatron Instrumentation Boosting Collider Performance

Shiltsev, V.; Jansson, A.; Moore, R.; May 01, 2006; 20 pp.; In English

Report No.(s): DE2006-892269; No Copyright; Avail.: National Technical Information Service (NTIS)

The Tevatron in Collider Run II (2001-present) is operating with six times more bunches, many times higher beam intensities and luminosities than in Run I (1992-1995). Beam diagnostics were crucial for the machine start-up and the never-ending luminosity upgrade campaign. We present the overall picture of the Tevatron diagnostics development for Run II, outline machine needs for new instrumentation, present several notable examples that led to Tevatron performance improvements, and discuss the lessons for the next big machines - LHC and ILC.

NTIS

Diagnosis; Particle Accelerators

20070009933 Brookhaven National Lab., Upton, NY, USA

Racetrack Magnet Designs and Technologies

Gupta, R.; Apr. 01, 2006; 11 pp.; In English

Report No.(s): DE2006-892699; BNL-76894-2006-CP; No Copyright; Avail.: Department of Energy Information Bridge

This paper presents a review of racetrack coil magnet designs and technologies for high field magnets that can be used in LHC upgrade. The designs presented here allow both 'Wind & React' and 'React & Wind' technologies as they are based on flat racetrack coils with large bend radii. Test results of the BNL 10.3 T 'React & Wind' common coil magnet are also presented. A possible use of High Temperature Superconductors (HTS) in future high field accelerator magnets is examined.

NTIS

Magnetic Coils; High Field Magnets; High Temperature Superconductors

20070009937 Iowa State Univ. of Science and Technology, Ames, IA USA

Designing of Metallic Photonic Structures and Applications

Kim, Y.; January 2006; 114 pp.; In English

Report No.(s): DE2006-892724; No Copyright; Avail.: Department of Energy Information Bridge

In this thesis our main interest has been to investigate metallic photonic crystal and its applications. We explained how to solve a periodic photonic structure with transfer matrix method and when and how to use modal expansion method. Two different coating methods were introduced, modifying a photonic structure's intrinsic optical properties and rigorous calculation results are presented. Two applications of metallic photonic structures are introduced. For thermal emitter, we showed how to design and find optimal structure. For conversion efficiency increasing filter, we calculated its efficiency and the way to design it. We presented the relation between emitting light spectrum and absorption and showed the material and structural dependency of the absorption spectrum. By choosing a proper base material and structural parameters, we can design a selective emitter at a certain region we are interested in. We have developed a theoretical model to analyze a blackbody filament enclosed by a metallic mesh which can increase the efficiency of converting a blackbody radiation to visible light. With this model we found that a square lattice metallic mesh enclosing a filament might increase the efficiency of incandescent lighting sources. Filling fraction and thickness dependency were examined and presented. Combining these two parameters is essential to achieve the maximum output result.

NTIS

Crystals; Photonics; Metallicity

20070010507 Lawrence Livermore National Lab., Livermore, CA USA

Preliminary Investigations of Eddy Current Effects on a Spinning Disk

Piggott, W. T.; Walston, S.; Mayhall, D.; Sep. 08, 2006; 13 pp.; In English

Report No.(s): DE2006-893982; UCRL-TR-224467; No Copyright; Avail.: National Technical Information Service (NTIS)

The design of the positron source target for the International Linear Collider (ILC) envisions a Ti6Al4V wheel rotating in a large magnetic field (5-10 Tesla) being impacted by a photon beam to produce positrons. One of the many challenges for this system is determining how large a motor will be needed to spin the shaft. The wheel spinning in the magnetic field induces an eddy current in the wheel, which retards the spinning motion of the wheel. Earlier calculations by Mayhall (1) have shown that those eddy forces could be quite large, and resulted in the preliminary design being moved from a solid disk to a rim and spoke design, as shown in Figure 1. A series of experiments with a spinning metal disk were run at the Stanford Linear Accelerator Center (SLAC) to provide experimental validation of the Maxwell 3D simulations. This report will give a brief outline of the experimental setup and results. In addition, earlier work by Smythe (2) will be used to compare with the experimental results.

NTIS

Eddy Currents; Particle Accelerators; Positrons; Targets

20070010513 Lawrence Livermore National Lab., Livermore, CA USA

FRIUMF Nuclear Structure Program and TIGRESS

Garrett, P. E.; Andreyev, A.; Austin, R. A. E.; Ball, G. C.; Bandyopadhyay, D.; Sep. 05, 2006; 15 pp.; In English

Report No.(s): DE2006-894008; UCRL-CONF-224157; No Copyright; Avail.: National Technical Information Service (NTIS)

The Isotope Separator and Accelerator (ISAC) facility located at the TRIUMF laboratory in Vancouver, Canada, is one of the world's most advanced ISOL-type radioactive ion beam facilities. An extensive (gamma)-ray spectroscopy program at ISAC is centered around two major research facilities: (1) the 8(pi) (gamma)-ray spectrometer for (beta)-delayed (gamma)-ray spectroscopy experiments with the low-energy beams from ISAC-I, and (2) the next-generation TRIUMF-ISAC Gamma-Ray Escape Suppressed Spectrometer (TIGRESS) for in-beam experiments with the accelerated radioactive ion beams. An overview of these facilities and recent results from the diverse program of nuclear structure and fundamental interaction studies they support is presented.

NTIS

Ion Beams; Isotope Separation; Nuclear Structure; Particle Accelerators; Radioactivity

20070010557 Smith Hopen, PA, Oldsmar, FL, USA

Method for Etching Microchannel Networks within Liquid Crystal Polymer Substrates

Fries, D. P.; Steimle, G.; Broadbent, H.; 30 Jun 05; 5 pp.; In English

Contract(s)/Grant(s): N00014-98-1-0848

Patent Info.: Filed Filed 30 Jun 05; US-Patent-Appl-SN-11-160 613

Report No.(s): PB2007-101487; No Copyright; Avail.: CASI: A01, Hardcopy

The present invention provides for a method for the fabrication of microchannels, and more particularly to the fabrication of microchannels for use in Microelectromechanical (MEMS) devices and MEMS related devices. In accordance with an embodiment of the present invention, microchannels are formed by a microfabrication method utilizing electronic imaging techniques in combination with chemical etching and subsequent metallization. The method of the present invention is effective in producing networks of channels in liquid crystal polymer (LCP) polymeric substrates which are highly defined in terms of their patterns, and thus are able to encompass a wide variety of end uses.

NTIS

Etching; Liquid Crystals; Microchannels; Microelectromechanical Systems; Patent Applications; Substrates

20070010558 Texas A&M Univ., College Station, TX, USA

New Technology for Future Collider. 2005 Final Technical Report

McIntyre, P.; McInturff, A.; Aug. 01, 2006; 36 pp.; In English

Contract(s)/Grant(s): DE-FG02-04ER41292

Report No.(s): DE2006-889404; No Copyright; Avail.: National Technical Information Service (NTIS)

This document presents an annual report on our long-term R&D grant for development of new technology for future colliders. The organizing theme of our development is to develop a compact high-field collider dipole, utilizing wind-and-react

Nb3Sn coil fabrication, stress management, conductor optimization, bladder preload, and flux plate suppression of magnetization multipoles. The development trail for this new technology began over four years ago with the successful testing of TAMU12, a NbTi model in which we put to a first test many of the construction details of the high-field design. We have built TAMU2, a mirror-geometry dipole containing a single coil module of the 3-module set required for the 14 Tesla design. This first Nb3Sn model was built using ITER conductor which carries much less current than high-performance conductor but enables us to prove in practice our reaction bake and impregnation strategies with free superconductor. TAMU2 has been shipped to LBNL for testing. Work is beginning on the construction of TAMU3, which will contain two coil modules of the 14 Tesla design. TAMU3 has a design field of 13.5 Tesla, and will enable us to fully evaluate the issues of stress management that will be important to the full design. With the completion of TAMU2 and the construction of TAMU3 the Texas A&M group comes of age in the family of superconducting magnet R&D laboratories. We have completed the phase of developing core technologies and fixtures and entered the phase of building and testing a succession of TAMU3 model dipoles that each build incrementally upon a proven core design. TAMU3 provides a testbed in which we can build a succession of model dipoles in which each new model uses one new winding module coupled with one module from the previous model, and uses all of the same structural elements in successive models. This incremental development should enable us to keep to a minimum the time between the completion and testing of successive models. Each new model will incorporate a particular design element that we wish to evaluate: first the basic TAMU3 structure, then substitute one pancake using high-performance superconductor (3,000 A/mm² at 12 T, 4.2 K), then substitute one pancake using mixed-strand cable, then insert a steel nose to reduce the peak field in the end region of a single-pancake coil. While we are building and testing this succession of TAMU3 models we will develop the tooling and evaluate strategies for flaring the ends of the center double-pancake coil needed for TAMU4. TAMU4 is a full implementation of the design, culminating in 14 Tesla performance. Pending the proposed increase of budget from the present 3-year-flat budget and providing that the tests of each model dipole do not lead to substantial modifications of the design, the time to build and test each succeeding model could be about 9 months.

NTIS

Particle Accelerators; Technologies

20070010564 Department of Energy, Washington, DC USA

Mathematical Models of Hysteresis (Dynamic Problems in Hysteresis)

Mayergoyz, I.; Aug. 21, 2006; 7 pp.; In English

Contract(s)/Grant(s): DE-FG02-96ER14614

Report No.(s): DE2006-889747; No Copyright; Avail.: Department of Energy Information Bridge

This research has further advanced the current state of the art in the areas of dynamic aspects of hysteresis and nonlinear large scale magnetization dynamics. The results of this research will find important engineering applications in the areas of magnetic data storage technology and the emerging technology of spintronics. Our research efforts have been focused on the following tasks: Study of fast (pulse) precessional switching of magnetization in magnetic materials. Analysis of critical fields and critical angles for precessional switching of magnetization. Development of inverse problem approach to the design of magnetic field pulses for precessional switching of magnetization. Study of magnetization dynamics induced by spin polarized current injection. Construction of complete stability diagrams for spin polarized current induced magnetization dynamics. Development of the averaging technique for the analysis of the slow time scale magnetization dynamics. Study of thermal effects on magnetization dynamics by using the theory of stochastic processes on graphs.

NTIS

Hysteresis; Mathematical Models

20070010584 California Univ., Lawrence Berkeley National Lab., Berkeley, CA, USA, Argonne National Lab., IL USA, Fermi National Accelerator Lab., Batavia, IL, USA, Illinois Inst. of Tech., Chicago, IL, USA

201 MHz Cavity R&D for MUCOOL and Mice

Li, D.; Virostek, S.; Zisman, M.; Norem, J.; Bross, A.; January 2006; 3 pp.; In English

Report No.(s): DE2006-889262; No Copyright; Avail.: National Technical Information Service (NTIS)

We describe the design, fabrication, analysis and preliminary testing of the prototype 201 MHz copper cavity for a muon ionization cooling channel. Cavity applications include the Muon Ionization Cooling Experiment (MICE) as well as cooling channels for a neutrino factory or a muon collider. This cavity was developed by the US muon cooling (MUCOOL) collaboration and is being tested in the MUCOOL Test Area (MTA) at Fermilab. To achieve a high accelerating gradient, the cavity beam irises are terminated by a pair of curved, thin beryllium windows. Several fabrication methods developed for the cavity and windows are novel and offer significant cost savings as compared to conventional construction methods. The

cavity's thermal and structural performances are simulated with an FEA model. Preliminary high power RF commissioning results will be presented.

NTIS

Cavities; Cooling; Copper; Ionization; Mice; Muons; Particle Accelerators

20070010711 State Univ. of New York, Albany, NY, USA, Oak Ridge National Lab., TN USA

Enhancing YBCO Performance Through Fundamental Process Evaluation and Characterization

Haldar, P.; Daley, J.; Parans, M.; Oct. 11, 2006; 7 pp.; In English

Report No.(s): DE2006-895001; No Copyright; Avail.: National Technical Information Service (NTIS)

The main goal of the program is to develop a fundamental understanding of the mechanisms that result in defects when thick YBCO films are prepared on multi-layered buffered, metal substrates.

NTIS

Characterization; YBCO Superconductors

20070010783 Massachusetts Inst. of Tech., Cambridge, MA USA

The Use of Dipolar Coupled Nuclear Spins for Quantum Information Processing and Quantum Computation

Cory, David G; Ramanathan, Chandrasekhar; Havel, Timothy F; Jun 1, 2004; 15 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W911NF0410211

Report No.(s): AD-A462311; No Copyright; Avail.: CASI: [A03](#), Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA462311>

The goal of this project is to improve our control over nuclear spins in the solid state. We have: 1. Characterized the growth of multi-spin coherences in 1D and 3D spin systems under the dipolar interaction. Measured the decay rates of correlated spin states and characterized the resulting scaling behavior. 2. Studied the transport of polarization in 1D spin chains, both experimentally and in simulations. We have experimentally created states in which polarization is localized to the ends of the chain and studied the ensuing dynamics. 3. Demonstrated the role of nuclear spin dipolar diffusion in dynamic nuclear polarization (DNP) experiments, in dielectric samples with abundant nuclear spins. Achieved a ²⁹Si polarization of 8.3% at 66 GHz and 1.1 K in single-crystal P-doped, the highest ever reported, using DNP. Took delivery of a He-3 cryostat that will allow these experiments to be extended to 94 GHz electron spin frequencies and 300 mK temperatures allowing us to achieve close to unit polarization.

DTIC

Data Processing; Nuclear Spin; Quantum Computation

20070010853 Universal Technology Corp., Dayton, OH USA

Anisotropy of Nonlinear Coupling of Two Counter-Propagating Waves in Photorefractive Fe:KNbO₃ (Postprint)

Cook, G; Carns, J L; Saleh, M A; Evans, D R; May 1, 2006; 10 pp.; In English

Contract(s)/Grant(s): Proj-M08R

Report No.(s): AD-A462416; No Copyright; Avail.: CASI: [A02](#), Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA462416>

The dependence of self-pumped photorefractive two-beam coupling in Fe:KNbO₃ with crystal angle has been measured at 532 nm for the a-c and b-c crystal planes using a combination of oil immersion and relay imaging. A significant deviation between existing theory and experiment is found for large crystal angles. We propose this is due to a highly anisotropic effective charge trap density in Fe:KNbO₃ of almost two orders of magnitude variation with crystal angle in the a-c plane.

DTIC

Anisotropy; Nonlinearity

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*.

20070010677 Stanford Linear Accelerator Center, Stanford, CA, USA, California State Univ., Los Angeles, CA, USA, Saclay Research Centre, Gif-sur-Yvette, France

On-Shell Unitarity Bootstrap for QCD Amplitudes

Berger, C. F.; Bern, Z.; Dixon, L. J.; Forde, D.; Kosower, D. A.; Oct. 2006; 10 pp.; In English

Report No.(s): DE2006-893767; SLAC-PUB-12064; No Copyright; Avail.: National Technical Information Service (NTIS)

Seeking and measuring new physics at the imminent Large Hadron Collider (LHC) will require extensive calculations of high-multiplicity backgrounds in perturbative QCD to next-to-leading order (NLO). The Les Houches 2005 workshop defined a target list, reproduced in table 1, for theorists to attack. In addition to the processes in the table, one would also like to compute processes such as $W, Z + 4$ jets, which are important backgrounds to searches for supersymmetry and other models of new electroweak physics. Such computations require one-loop amplitudes with seven external particles, including the vector boson, as depicted in figure 1. These are challenging calculations and Feynman-diagrammatic computations have only recently reached six-point amplitudes. Some of this progress has been described in this conference.

NTIS

Quantum Chromodynamics; Particle Interactions

20070010678 Grenoble-1 Univ., Annecy, France, Barcelona Univ., Spain, Bari Univ., Italy, Academia Sinica, Beijing, China
Branching Fraction Measurement of B^0 to $D^{(*)}\pi$ and B^- to $D^{(*)}\pi$ and Isospin Analyses of B to $D^{(*)}\pi$ Decays

Aubert, B.; Grauges, E.; Palano, A.; Chen, J. C.; Eigen, G.; Oct. 2006; 8 pp.; In English

Report No.(s): DE2006-893768; BABAR-PUB-06/046; SLAC-PUB-12031; No Copyright; Avail.: National Technical Information Service (NTIS)

Using 65 million $(\Upsilon(4S))$ $B(\bar{B})$ events collected with the BABAR detector at the PEP-II $e^{(+)}e^{(-)}$ storage ring at the Stanford Linear Accelerator Center, they measure the color-favored branching fractions $(\text{Beta})(\bar{B}(\text{sup } 0) \text{ yields } D(\text{sup } +)\pi(\text{sup } -)) = (2.63 (+-) 0.05 (+-) 0.22) \times 10(\text{sup } -3)$, $(\text{Beta})(\bar{B}(\text{sup } 0) \text{ yields } D^{*}(\text{sup } +)\pi(\text{sup } -)) = (2.79 (+-) 0.08 (+-) 0.18) \times 10(\text{sup } -3)$, $(\text{Beta})(B(\text{sup } -) \text{ yields } D(\text{sup } 0)\pi(\text{sup } -)) = (4.90 (+-) 0.07 (+-) 0.23) \times 10(\text{sup } -3)$ and $(\text{Beta})(B(\text{sup } -) \text{ yields } D^{*}(\text{sup } 0)\pi(\text{sup } -)) = (5.52 (+-) 0.17 (+-) 0.43) \times 10(\text{sup } -3)$, where the first error is statistical and the second is systematic. With these results and the current world average for the branching fraction for the color-suppressed decay $(\bar{B}(\text{sup } 0) \text{ yields } D(\text{sup } *)\pi(\text{sup } 0))$, the cosines of the strong phase difference (δ) between the $I = 1/2$ and $I = 3/2$ isospin amplitudes are determined to be $\cos(\delta) = 0.860(\text{sub } -0.006-0.028)(\text{sup } +0.007+0.029)$ for the (\bar{B}) $D(\pi)$ process and $\cos(\delta) = 0.917(\text{sub } -0.016-0.051)(\text{sup } +0.018+0.059)$ for the (\bar{B}) $D^{*}(\pi)$ process. The results for $\cos(\delta)$ suggest that final-state interactions are presented in the $D(\pi)$ system.

NTIS

Isotopic Spin; Mesons; Particle Interactions

20070010717 Istituto Nazionale di Fisica Nucleare, Genoa, Italy, Istituto Nazionale di Fisica Nucleare, Rome, Italy, Academy of Sciences (USSR), Moscow, Russian Federation, Genoa Univ., Genoa, Italy

Neutron Structure Function Moments at Leading Twist

Osipenko, M.; Simula, S.; Kulagin, S.; Ricco, G.; Oct. 15, 2006; 5 pp.; In English

Report No.(s): DE2006-893780; No Copyright; Avail.: Department of Energy Information Bridge

The experimental data on F2 structure functions of the proton and neutron were used to construct their moments. In particular, recent measurements performed with CLAS detector at Jefferson Lab allowed to extend our knowledge of structure functions in the large-x region. The phenomenological analysis of these experimental moments in terms of the Operator Product Expansion permitted to separate the leading and higher twist contributions. Applying nuclear corrections to extracted deuteron moments we obtained the contribution of the neutron. Combining leading twist moments of the neutron and proton we found d/u ratio at $x \rightarrow 1$ approaching 0, although 1/5 value could not be excluded. The twist expansion analysis suggests that the contamination of higher twists influences the extraction of the d/u ratio at $x \rightarrow 1$ even at Q^2 -scale as large as 12 $(\text{GeV}/c)^2$.

NTIS

Neutrons; Atomic Structure

20070010854 Air Force Research Lab., Wright-Patterson AFB, OH USA

Variable-Gravity Effects on A Single-Phase Partially-Confined Spray Cooling System (Postprint)

Yerkes, Kirk L; Michalak, Travis E; Baysinger, Kerri M; Puterbaugh, Rebekah L; Thomas, Scott K; McQuillen, John; Jul 2006; 17 pp.; In English

Contract(s)/Grant(s): Proj-3145

Report No.(s): AD-A462417; AFRL-PR-WP-TP-2006-237; No Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA462417>

This paper discusses the testing of a single-phase spray cooling system that was flown on the NASA KC-135 Reduced-Gravity Research Aircraft. An experimental package, consisting of a spray chamber coupled to a fluid delivery loop system, was fabricated for variable gravity flight tests. The spray chamber contains two opposing nozzles spraying on Indium Tin Oxide (ITO) heaters. These heaters are mounted on glass posts, which are part of a sump system to remove unconstrained liquid from the test chamber. Thermocouples mounted in and around the posts were used to determine both the heat loss through the underside of the ITO heater and the heat extracted by the spray. During flight tests, for Weber numbers of $We = 771$ plus or minus 19 and 757 plus or minus 15, the non-dimensional heat input was varied from G change; = 30 to 110 for the non-dimensional grouping $[Fr(1/2)Ga](1/2) = 20$ to 66. Flight test data and terrestrial data were compared to analytical and numerical solutions in order to evaluate the heat transfer in the heater and support structure. In general, the Nusselt number at the heater surface was found to decrease with increasing $[Fr(1/2)Ga](1/2)$.

DTIC

Confinement; Cooling; Cooling Systems; Gravitation; Sprayers

20070010869 Naval Research Lab., Washington, DC USA

InGaAs Multiple Quantum Well Modulating Retro-reflector for Free Space Optical Communications

Rabinovich, W S; Gilbreath, G C; Goetz, Peter G; Mahon, R; Kazter, D S; Ikossi-Anasatasiou, K; Binari, S; Meehan, T J; Ferraro, M; Sokolsky, I; Vasquez, J A; Vilcheck, M J; Jan 2002; 13 pp.; In English

Report No.(s): AD-A462438; No Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA462438>

Modulating retro-reflectors provide a means for free space optical communication without the need for a laser, telescope or pointer tracker on one end of the link. These systems work by coupling a retro-reflector with an electro-optic shutter. The modulating retro-reflector is then interrogated by a cw laser beam from a conventional optical communications system and returns a modulated signal beam to the interrogator. Over the last few years the Naval Research Laboratory has developed modulating retro-reflector based on corner cubes and large area Transmissive InGaAs multiple quantum well modulators. These devices can allow optical links at speeds up to about 10 Mbps. We will discuss the critical performance characteristics of such systems including modulating rate, power consumption, optical contrast ratio and operating wavelength. In addition a new modulating retro-reflector architecture based upon cat 5 eye retroreflectors will be discussed. This architecture has the possibility for data rates of hundreds of megabits per second at power consumptions below 100 mW.

DTIC

Free-Space Optical Communication; Indium Gallium Arsenides; Modulation; Optical Communication; Quantum Wells; Reflectors; Retroreflectors

20070011107 Clemson Univ., SC USA

Adaptive and Robust Control for Thermal Management Systems

Salah, M H; Mitchell, T H; Wagner, J R; Dawson, D M; Jan 2006; 16 pp.; In English; Original contains color illustrations
Report No.(s): AD-A462591; CU/CRB/10/2/06/ 1; No Copyright; Avail.: CASI: A03, Hardcopy

Advanced thermal management systems for internal combustion engines can improve coolant temperature regulation and servomotor power consumption by better regulating the combustion process with multiple electro-mechanical components. The traditional thermostat valve, coolant pump and clutch-driven radiator fan are upgraded with servomotor actuators. When the system components function harmoniously, desired thermal conditions can be accomplished in a power efficient manner. In this paper, a comprehensive control architecture is proposed for transient temperature tracking. An experimental system has been fabricated and assembled which features a variable position smart thermostat valve, variable speed electric water pump, variable speed electric radiator fan, engine block, and various sensors. In the configured system, the steam-based heat exchanger emulates the heat generated by the engine's combustion process. Representative numerical and experimental results are discussed to demonstrate the functionality of the thermal management system in tracking prescribed temperature profiles.

DTIC

Adaptive Control; Internal Combustion Engines; Temperature Control; Thermodynamic Properties

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*.

20070009619 Office of the Assistant Secretary of Defense, Washington, DC USA
Behind the Wizard's Curtain. An Integration Environment for a System of Systems
 Krygiel, Annette J; Jul 1999; 275 pp.; In English; Original contains color illustrations
 Report No.(s): AD-A461322; No Copyright; Avail.: CASI: [A12](#), Hardcopy
 ONLINE: <http://hdl.handle.net/100.2/ADA461322>

A central premise to future military strategy is the formation of a system of systems (SOS) to attain dominant battlespace knowledge. By coalescing data from collection and processing systems, the resulting information can be integrated with systems of weaponry and warriors for a seamless sensor-to-shooter flow. This work is directed at recovering successful strategies and determining an environment that supports not only the integration of a SOS but its use for operational training. The integration process and its associated environment do not provide an architecture or offer an alternative to a good design. So why emphasize integration? One reason is that it can be used effectively as an adjunct to the requirements and design processes if accomplished early enough in the life cycle. I view the integration phase as the last certain opportunity to deliver an integrated product before its deployment for operations. Frequently it will be necessary to assemble such a capability despite inadequate previous processes and using systems developed and operated for other and different purposes. This book begins with a brief look at a SOS from the viewpoint of the U.S defense strategy. The intent is to provide an impression of SOS scope and the level of expectations for its operational support. Two case studies are the core of the book. Both programs, the DPS and TF XXI, produced an integrated product characterized as a SOS. Conclusions from this examination take the form of nine lessons learned about integration. These provide practical strategies. The lessons learned provide a foundation upon which to build.

DTIC

Curtains; Systems Engineering

20070009668 Office of the Assistant Secretary of Defense, Washington, DC USA
Information Age Anthology: The Information Age Military, Volume 3
 Alberts, David S; Papp, Daniel S; Mar 2001; 862 pp.; In English; Original contains color illustrations
 Report No.(s): AD-A461471; No Copyright; Avail.: CASI: [A99](#), Hardcopy
 ONLINE: <http://hdl.handle.net/100.2/ADA461471>

In what ways will wars and the Military that fight them be different in the Information Age than in earlier ages? What will this mean for the U.S. military? In this third volume of the Information Age Anthology we turn finally to the task of exploring answers to these simply stated but vexing questions that provided the impetus for the first two volumes of the Information Age Anthology. In Volume I we examined some of the broader issues of the Information Age: what the Information Age is; how it affects commerce business and service; what it means for the government and the military; and how it affects international actors and the international system. In Volume II we turned to the impacts and consequences of the Information Age on national security broadly defined: the nature of national security in the Information Age the threats to and opportunities for national security that may emerge in the Information Age and differing interpretations about the degree of change in national security issues that we might expect to actually encounter in the Information Age. Now in Volume III we concentrate on defense conflict and warfare in the Information Age. What characteristics will an Information Age military need to possess to meet current and future challenges? If so how? What is the U.S. military establishment doing to prepare for change? How do military analysts in the USA view those changes? How are those abroad preparing their own military establishments for change? When all is said and done what does all this mean for the defense of the USA and for its ability to deter and failing this to prevail in the Information Age?

DTIC

Command and Control; Data Processing; Warfare

20070009670 Office of the Assistant Secretary of Defense, Washington, DC USA
Information Age Anthology: National Security Implications of the Information Age, Volume 2
 Alberts, David S; Papp, Daniel S; Aug 2000; 555 pp.; In English; Original contains color illustrations
 Report No.(s): AD-A461472; No Copyright; Avail.: CASI: [A24](#), Hardcopy
 ONLINE: <http://hdl.handle.net/100.2/ADA461472>

Few would argue with the premise that new and emerging information and communication technologies are transforming the ways that people around the world work, play, think, and live. Indeed, there is a sense that the transformations underway are so fundamental, so pervasive and all-encompassing, so qualitatively and quantitatively different, that they are ushering in a new era, the so-called Information Age. What does this mean for national security, and how will the concept of national security change because of Information Age technologies? Is the Information Age bringing with it new challenges and threats, and if so, what are they? What sorts of dangers will these challenges and threats present? From where will they-and do they-come? Is Information Warfare a reality? What responses will be required, and by whom, to safeguard national security from a potential adversary's information warriors during the Information Age? And how will national security decision-making be affected? This publication, Volume II of the Information Age Anthology, explores these questions and provides preliminary answers to some of them. This volume follows on the heels of Volume I of the Information Age Anthology, published in 1997 by NDU Press and DoD GGRP Publications, which examined the broader context of the impact of new and emerging information and communication technologies on business, commerce and services; government and the military; and international affairs. It is within this broader context of human activities that questions of national security must be pursued. This publication also precedes Volume III of the Information Age Anthology. Volume III will provide a detailed examination of the potential impacts of new and emerging information and communication technologies on military affairs and operations.

DTIC

Command and Control; Security; Warfare

20070009674 Office of the Assistant Secretary of Defense, Washington, DC USA

The Information Age: An Anthology on Its Impact and Consequences

Alberts, David S; Papp, Daniel S; Jan 1997; 312 pp.; In English

Report No.(s): AD-A461496; No Copyright; Avail.: CASI: A14, Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA461496>

This first of 2 volumes examines some of the broader issues of the Information Age: what the Information Age is; how it affects commerce, business, and service; what it means for the government and the military; and how it affects the international system. Contributions are as follows: 'Welcome to the Revolution,' by Thomas A. Stewart; 'Historical Impacts of Information Technologies: An Overview,' by Daniel S. Papp, et al.; 'The Technologies of the Current Information Revolution,' by David S. Alberts, et al.; 'What Information Society?' by Frank Webster; 'Alone Together: Will Being Wired Set Us Free?' by Andrew Kupfer; 'Reality Check,' by Joel Achenbach; 'The Coming Electronics Commerce (R)evolution,' by Robert Segal; 'Electronic Commerce: Implications of the Internet for Business Practice and Strategy,' by Ajit Kambil; 'Banking and Cyberspace: The New Promised Land,' by Joanna Smith Bers; 'Silicon Summit: Will Technology Affect the News?'; 'Medical Informatics,' by Enrico Coiera; 'School Reform in the Information Age,' by Howard Mehlinger; 'Universities in the Digital Age,' by John Seely Brown, et al.; 'Telecommunications and Democracy'; 'Freedom and Censorship in the Emerging Electronic Environment,' by Martin Fogelman; 'Cyberpower,' by Peter Huber; 'Congress, Information Technology, and the Use of Force,' by Jeffrey Record; 'The Media's Impact on International Affairs, Then and Now,' by Johanna Neuman; 'Warfare in the Information Age,' by Bruce Berkowitz; 'Technology, Change, and the Emerging International Order,' by James Robinson; 'Telecommunications and the Changing Geographics of Knowledge Transmission in the Late 20th Century,' by Barney Warf; 'Connecting Developing Countries to the Information Technology Revolution,' by Jean-Francois Rischarde; 'Little Engines That Could: Computing in Small Energetic Countries,' by J. L. Dedrick, et al.; and 'The Impact of the Information Age on International Actors and the International System,' by Daniel S. Papp, et al.

DTIC

Data Processing; Forecasting; Telecommunication; Trend Analysis

20070009675 Transportation Research Board, Washington, DC, USA

Training Programs, Processes, Policies, and Practices. A Synthesis of Highway Practice

Shiple, M. H.; January 2006; 99 pp.; In English

Report No.(s): PB2007-105113; TRB/NCHRP/SYN-362; Copyright; Avail.: National Technical Information Service (NTIS)

Highway administrators, engineers, and researchers often face problems for which information already exists, either in documented form or as undocumented experience and practice. This information may be fragmented, scattered, and unevaluated. As a consequence, full knowledge of what has been learned about a problem may not be brought to bear on its solution. Costly research findings may go unused, valuable experience may be overlooked, and due consideration may not be given to recommended practices for solving or alleviating the problem. There is information on nearly every subject of concern to highway administrators and engineers. Much of it derives from research or from the work of practitioners faced with problems in their day-to-day work. To provide a systematic means for assembling and evaluating such useful information and

to make it available to the entire highway community, the American Association of State Highway and Transportation Officials through the mechanism of the National Cooperative Highway Research Program authorized the Transportation Research Board to undertake a continuing study. This study, NCHRP Project 20-5, Synthesis of Information Related to Highway Problems, searches out and synthesizes useful knowledge from all available sources and prepares concise, documented reports on specific topics. Reports from this endeavor constitute an NCHRP report series, Synthesis of Highway Practice. This synthesis series reports on current knowledge and practice, in a compact format, without the detailed directions usually found in handbooks or design manuals. Each report in the series provides a compendium of the best knowledge available on those measures found to be the most successful in resolving specific problems.

NTIS

Education; Highways; Policies; Procedures

20070009676 Worcester Polytechnic Inst., MA, USA

Online Access to and Data Analysis Tools for Experiments in Building and Fire Science. Final Report

Woycheese, J. P.; Raghavan, V.; Kim, M.; Geller, F.; May 2006; 90 pp.; In English

Contract(s)/Grant(s): NIST-60NANB3D1112

Report No.(s): PB2007-105092; No Copyright; Avail.: National Technical Information Service (NTIS)

Scientists, engineers, and students have computational tools to aid them in their efforts to model and understand fire events. These users, however, must rely on personal judgment to determine appropriate material properties for theoretical analyses and computer models, given the difficulty in obtaining validated inputs for combustion and material properties. In addition, unavailability of, or lack of confidence in, data ranges for these model inputs precludes sensitivity analyses, which would enable users to generate more complete results and to verify their assumptions. Members of the fire science community would benefit from an on-line compendium, including experimental data and tools, information about various concepts or procedures, and multimedia content like videos, photographs, and reports. The pervasiveness of the Web enables access by people from diverse locales, while allowing similar, but geographically remote, audiences to share their knowledge. There are resources that provide pertinent and useful information but there is no centralized collection of material for the audiences who need these resources.

NTIS

Buildings; Fires; On-Line Systems; Data Processing

20070009679 National Inst. of Standards and Technology, Gaithersburg, MD USA

Building Tactical Information System for Public Safety Officials: Intelligent Building Response (iBR)

Holmberg, D. G.; Davis, W. D.; Treado, S. J.; Reed, K. A.; Jan. 2006; 67 pp.; In English

Report No.(s): PB2007-105077; NISTIR-7314; No Copyright; Avail.: National Technical Information Service (NTIS)

The Building Tactical Information project begins the process of developing technology and standards to realize the vision of making real-time building information accessible to emergency responders to enable safer and more efficient emergency response. This project addresses both the information needs of the fire, police and emergency medical services and the technology needed for moving building data out to emergency responders. A workshop was held to gather information on first responders building information needs, and presentation standards have been examined based on emergency responder needs while enroute to an incident and on-scene. A technology data path is proposed that will allow information collection and transport to the emergency responder. A security analysis addresses the security concerns of the information transfer. A demonstration of the technology, with a decision support system transmitting real-time building information to first responders, was held at NIST and forms the basis for a documentary video.

NTIS

Emergencies; Information Systems; Safety Factors; Systems Engineering; Transponders

20070009696 Air Force Command and Control Training and Innovation Group, Hurlburt Field, FL USA

A Paradigm for Integrated Warfighting: Kinetic and Non-kinetic Solutions

Fawcett, Jr, John M; Jan 2002; 10 pp.; In English

Report No.(s): AD-A461726; No Copyright; Avail.: CASI: [A02](#), Hardcopy

Review of the U.S. Air Force's (USAF) performance during the Gulf War resulted in establishing a requirement for formal training at the operational level of warfare. This requirement was articulated as the interactions of people, process, and technology -- in that order of importance. Concurrent with the emphasis on operational warfighting and the revolution in information technology, the USAF had to adjust to the battlefield imperative of gaining and maintaining information

dominance. Starting in 1994, the USAF was faced with two problems resulting from the Gulf War and subsequent analysis. The first problem was the development of an integrated training program that provided training support to the entire Joint Forces Air Component Commander (JFACC) Team, ranging from the supporting command and control system of systems to the JFACC himself. The second challenge lay in how the arguments concerning the possible Revolution in Military Affairs (RMA) could be incorporated in tactical, theater, and strategic planning and execution. To this end, the USAF Air Combat Command (ACC) initiated a JFACC Team training program. The center of this training is the Air Force Command and Control Training and Innovation Group (AFC2TIG) at Hurlburt Field, Florida. The Air Force has built a substantive program around the BLUE FLAG exercise and a series of training courses. Audiences range from airman to general officer. This paper reviews the training concept involved in this effort, with a focus on how Information Warfare/Information Operations have been integrated into the training and exercise environment. The concept includes the integration of kinetic and non-kinetic solutions to targeting in support of theater goals and objectives. In general, this involves the use of the RAND strategies of task methodology and effects-based targeting.

DTIC

Command and Control; Education; Information Systems; Military Operations

20070009702 Carnegie-Mellon Univ., Pittsburgh, PA USA

Planning in the JAVELIN QA System

Hiyakumoto, Laurie S; May 2004; 52 pp.; In English

Contract(s)/Grant(s): MDA908-02-C-0009; F30602-00-2-0549

Report No.(s): AD-A461009; CMU-CS-04-132; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA461009>

The Planner Module of the JAVELIN Question-Answering system is responsible for sequencing actions in the question-answering process and controlling their execution. This document describes the current implementation of the Planner Module based on the PLEXIS (Planning and Execution for Information Spaces) planner, the protocols it uses to communicate with the rest of JAVELIN, and the model of the question-answering process on which planning and execution is based. Instructions for installing and testing the server are provided, along with a brief discussion of future research directions.

DTIC

Architecture (Computers); Information Retrieval; Quality Control

20070009740 University of Southern California, Marina del Rey, CA USA

A Noisy-Channel Approach to Question Answering

Echihabi, Abdessamad; Marcu, Daniel; Jan 2003; 9 pp.; In English

Contract(s)/Grant(s): MDA908-02-C-0007

Report No.(s): AD-A462242; No Copyright; Avail.: CASI: [A02](#), Hardcopy

We introduce a probabilistic noisy-channel model for question answering and we show how it can be exploited in the context of an end-to-end QA system. Our noisy-channel system outperforms a state-of-the-art rule-based QA system that uses similar resources. We also show that the model we propose is flexible enough to accommodate within one mathematical framework many QA-specific resources and techniques, which range from the exploitation of WordNet, structured, and semi-structured databases to reasoning and paraphrasing.

DTIC

Information Retrieval; Linguistics; Natural Language Processing

20070009757 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

Investigating Barriers to Knowledge Management: A Case Study of the Air Force Center of Excellence for Knowledge Management

Myers, Edgar L; Sep 2006; 124 pp.; In English; Original contains color illustrations

Report No.(s): AD-A462074; AFIT/GIR/ENV/06-01S; No Copyright; Avail.: CASI: [A06](#), Hardcopy

Knowledge is becoming recognized as an organization's most valuable and powerful resource. As a resource, knowledge is used to improve an organization's efficiency and effectiveness, to create innovative solutions, and to enhance decision making capabilities. Being such an important resource, it stands to reason that an organization's knowledge resources must be effectively managed. However, while an organization attempts to manage its knowledge, its efforts are constrained by a variety of influences acting as barriers. Using Holsapple and Joshi's (2000) 'influences on the management of knowledge'

framework, the purpose of this research is to identify those barriers which are acting as barriers to knowledge management (KM) efforts guided by the Air Force Center of Excellence for Knowledge Management. Based on the results of this research, a variety of managerial, resource, and environmental influences acting as barriers were found. It was also determined that the overarching problem of a lack of KM understanding throughout the Air Force serves as the greatest barrier to KM efforts guided by the Air Force Center of Excellence for Knowledge Management.

DTIC

Information Management; Artificial Intelligence; Barriers

20070009759 Library of Congress, Washington, DC USA

The Congressional Research Service and the American Legislative Process

Brudnick, Ida A; Jun 14, 2006; 14 pp.; In English

Report No.(s): AD-A462075; CRS-RL33471; No Copyright; Avail.: CASI: [A03](#), Hardcopy

The Library of Congress, as its name suggests, is a library dedicated to serving the USA Congress and its Members. It serves additionally as an unexcelled national library. The Library was located in the Capitol Building with the House of Representatives and the Senate until 1897, and its collections always have been available for use by Congress. Building upon a concept developed by the New York State Library and then the Wisconsin legislative reference department, Wisconsin Senator Robert LaFollette and Representative John M. Nelson led an effort to direct the establishment of a special reference unit within the Library in 1914. Later known as the Legislative Reference Service, it was charged with responding to congressional requests for information. For more than 50 years, this department assisted Congress primarily by providing facts and publications and by transmitting research and analysis done largely by other government agencies, private organizations, and individual scholars. In 1970, Congress enacted a law transforming the Legislative Reference Service into the Congressional Research Service (CRS) and directing CRS to devote more of its efforts and increased resources to performing research and analysis that assists Congress in direct support of the legislative process. Joined today by two other congressional support agencies, including the Congressional Budget Office and the Government Accountability Office, the Congressional Research Service offers research and analysis to Congress on all current and emerging issues of national policy. CRS analysts work exclusively for Congress, providing assistance in the form of reports, memoranda, customized briefings, seminars, videotaped presentations, information obtained from automated data bases, and consultations in person and by telephone. This work is governed by requirements for confidentiality, timeliness, accuracy, objectivity, balance, and nonpartisanship.

DTIC

Libraries; Congressional Reports; Law (Jurisprudence); Research

20070009767 University of Southern California, Los Angeles, CA USA

Unsupervised Link Discovery in Multi-relational Data via Rarity Analysis

Lin, Shou-de; Chalupsky, Hans; Jan 2003; 9 pp.; In English

Contract(s)/Grant(s): F30602-01-2-0583

Report No.(s): AD-A462272; No Copyright; Avail.: CASI: [A02](#), Hardcopy

A significant portion of knowledge discovery and data mining research focuses on finding patterns of interest in data. Once a pattern is found, it can be used to recognize satisfying instances. The new area of link discovery requires a complementary approach, since patterns of interest might not yet be known or might have too few examples to be learnable. This paper presents an unsupervised link discovery method aimed at discovering unusual, interestingly linked entities in multi-relational data sets. Various notions of rarity are introduced to measure the 'interestingness' of sets of paths and entities. These measurements have been implemented and applied to a real-world bibliographic data set where they give very promising results.

DTIC

Information Retrieval; Data Mining

20070009804 Carnegie-Mellon Univ., Pittsburgh, PA USA

Limited Domain Synthesis

Black, Alan W; Lenzo, Kevin A; Jan 2000; 5 pp.; In English

Contract(s)/Grant(s): N66001-99-1-8905

Report No.(s): AD-A461150; No Copyright; Avail.: CASI: [A01](#), Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA461150>

This work presents a reliable and efficient method for building limited domain speech synthesis voices. By constructing

databases close to the targeted domain of the speech application, unit selection synthesis techniques can be used to reliably give very high quality synthesis within domain. In addition to a high quality result we include the techniques and processes required to build such voices often allowing new voices in limited but quite complex domains such as dialog systems to be created in under a week.

DTIC

Semantics; Speech Recognition

20070009808 Air Force Research Lab., Wright-Patterson AFB, OH USA

Self-Checking Software for Information Assurance

Reinhart, Tod; Boettcher, Carolyn; Gotfried, Roberta; Kuckelman, Mark; Jan 2000; 13 pp.; In English

Report No.(s): AD-A461423; No Copyright; Avail.: CASI: [A03](#), Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA461423>

The key to achieving information dominance by the US armed forces is the transmittal of accurate and timely information to the warfighter when and where it is needed. Information Assurance (IA) is the foundation for ensuring that critical information is both accurate and timely. However, innovative approaches are needed to achieve high levels of information assurance for military applications such as command and control (C2). An adaptation of theoretical checker results derived from the research of Dr. Manuel Blum at the University of California at Berkeley has been applied to several real-life applications at Raytheon with promising results. Under the USAF Self-Checking Embedded Information System Software (SCEISS) program, we have begun studying the feasibility of using checkers to enhance the information assurance of a system. In this paper, various problems in information assurance are presented, along with examples of how checkers might be applied as solutions. The feasibility of using checkers to solve these problems is analyzed and the benefits of using checkers instead of, or in conjunction with, more traditional methods of information assurance are assessed. We conclude with our near term plans to demonstrate and validate the use of checkers for information assurance in a realistic C2 application.

DTIC

Command and Control; Computer Programs; Information Systems

20070009844 Office of the Assistant Secretary of Defense, Washington, DC USA

Information Campaigns for Peace Operations

Avruch, Kevin; Narel, James L; Combelles-Siegel, Pascale; Mar 2000; 224 pp.; In English; Original contains color illustrations

Report No.(s): AD-A461321; No Copyright; Avail.: CASI: [A10](#), Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA461321>

The military's conception of information operations is broad, dividing the domain into three functional areas. The first has to do with how information relates to the overall success of the mission. Information in this sense includes intelligence, logistics, personnel, legal issues, and weather, among other factors. The second functional area has to do with how information is transported to relevant decision makers. This area, encompassing hardware and software, includes communication links, satellites, cables, and procedures, formats, and filters for information transport and retrieval. The third area can be called information operations proper, and includes measures for ensuring the operational security of information, electronic warfare, deception and disinformation, as well as techniques for the physical destruction of the enemy's information systems. Also included in this third area are public affairs, psychological operations (PSYOP), and civil affairs. It is these last three areas that appear most evidently relevant to peace operations. In its broadest sense, this report asks whether the notion of struggles for control over information identifiable in situations of conflict also has relevance for situations of third-party conflict management for peace operations. The question for our purposes is how relevant are conceptions of information warfare for peace operations? The report is organized in four main parts. In the first part we describe and analyze the sorts of activities that comprise information operations, beginning with how the term is used in military and defense contexts. The report studies information activities in Bosnia-Herzegovina and Haiti, paying particular attention to how these activities changed throughout the course of the respective peace operations in both settings. In the last chapter the two cases are compared and contrasted. We conclude with a set of cautions and recommendations for future study and analysis.

DTIC

Information Theory; Electronic Warfare; Intelligence; Peacetime

20070010487 Microsoft Research, USA, Rutgers - The State Univ., New Brunswick, NJ, USA, North Carolina Univ., Chapel Hill, NC, USA

EESS 2006: Proceedings of the ACM SIGIR 2006 Workshop on Evaluating Exploratory Search Systems

White, R. W.; Muresan, G.; Marchionini, G.; January 2006; 56 pp.; In English

Report No.(s): DE2006-894869; No Copyright; Avail.: National Technical Information Service (NTIS)

Research in Question Answering has focused on the quality of information retrieval or extraction using the metrics of precision and recall to judge success; these metrics drive toward finding the specific best answer(s) and are best supportive of a lookup type of search. These do not address the opportunity that users natural language questions present for exploratory interactions. In this paper, we present an integrated Question Answering environment that combines a visual analytics tool for unstructured text and a state-of-the-art query expansion tool designed to compliment the cognitive processes associated with an information analysts work flow. Analysts are seldom looking for factoid answers to simple questions; their information needs are much more complex in that they may be interested in patterns of answers over time, conflicting information, and even related non-answer data may be critical to learning about a problem or reaching prudent conclusions. In our visual analytics tool, questions result in a comprehensive answer space that allows users to explore the variety within the answers and spot related information in the rest of the data. The exploratory nature of the dialog between the user and this system requires tailored evaluation methods that better address the evolving user goals and counter cognitive biases inherent to exploratory search tasks.

NTIS

Conferences; Information Retrieval

20070010540 NASA Glenn Research Center, Cleveland, OH, USA

Paradigm Shift in Data Content and Informatics Infrastructure Required for Generalized Constitutive Modeling of Materials Behavior

Arnold, S. M.; December 2006; 9 pp.; In English

Contract(s)/Grant(s): WBS 645846.02.07.03.03.02; Copyright; Avail.: Other Sources

Materials property information such as composition and thermophysical/mechanical properties abound in the literature. Oftentimes, however, the corresponding response curves from which these data are determined are missing or at the very least difficult to retrieve. Further, the paradigm for collecting materials property information has historically centered on (1) properties for materials comparison/selection purposes and (2) input requirements for conventional design/analysis methods. However, just as not all materials are alike or equal, neither are all constitutive models (and thus design/ analysis methods) equal; each model typically has its own specific and often unique required materials parameters, some directly measurable and others indirectly measurable. Therefore, the type and extent of materials information routinely collected is not always sufficient to meet the current, much less future, needs of the materials modeling community. Informatics has been defined as the science concerned with gathering, manipulating, storing, retrieving, and classifying recorded information. A key aspect of informatics is its focus on understanding problems and applying information technology as needed to address those problems. The primary objective of this article is to highlight the need for a paradigm shift in materials data collection, analysis, and dissemination so as to maximize the impact on both practitioners and researchers. Our hope is to identify and articulate what constitutes 'sufficient' data content (i.e., quality and quantity) for developing, characterizing, and validating sophisticated nonlinear time- and history-dependent (hereditary) constitutive models. Likewise, the informatics infrastructure required for handling the potentially massive amounts of materials data will be discussed.

Author

Information Systems; Data Acquisition; Materials Selection; Mechanical Properties; Thermophysical Properties; Design Analysis

20070010773 Bolt, Beranek, and Newman, Inc., Arlington, VA USA

Agent-Based Computing Integration and Testing

Dean, Michael; Dec 2006; 25 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): F30602-00-C-0178; Proj-DAML

Report No.(s): AD-A462293; No Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA462293>

The DARPA Agent Markup Language (DAML) program developed technology to enable the vision of a Semantic Web, where computers and software agents can discover, understand and exploit disparate data across the World Wide Web in response to a human query. DARPA has provided the leadership and the first crucial steps toward this vision as evidenced by the emerging international standards and technology transition examples initiated under this program. The facilitation,

collaboration and sharing of technology across an international research community was critical to the success of DAML, and its successor, the Ontology Web Language (OWL). Like the Semantic Web vision, the work described in this report involved leveraging data physically positioned throughout cyberspace via the World Wide Web (WWW). A very significant portion of the DAML program was conducted on the WWW. Accordingly, the thousands of artifacts evidencing progress and transition are also accessible via the web. This report documents activities and accomplishments under the primary integration and testing contract of the DAML program, along with many live links to underlying standards, documents, tools, tutorials, applications and data artifacts which comprise the bulk of the program legacy and the seeds for future growth of the Semantic Web.

DTIC

Document Markup Languages; Internets

20070010776 Space and Naval Warfare Systems Command, Charleston, SC USA

Are Service Oriented Architectures the Only Valid Architectural Approach for the Transformation to Network Centric Warfare? (Briefing Charts)

Lenahan, Jack; Jun 2004; 13 pp.; In English; Original contains color illustrations

Report No.(s): AD-A462299; No Copyright; Avail.: CASI: [A03](#), Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA462299>

The use of a Service Oriented Architecture (SOA) as the dominant single architectural design paradigm of Network Centric Warfare (NCW) introduces architectural infrastructure stability risk levels which may be unacceptable in C4ISR mission frameworks.

DTIC

Charts; Command and Control; Warfare

20070010778 Naval Research Lab., Washington, DC USA

A Bayesian Network Schema for Lessening Database Inference

Chang, LiWu; Moskowitz, Ira S; Jan 2001; 8 pp.; In English

Report No.(s): AD-A462301; No Copyright; Avail.: CASI: [A02](#), Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA462301>

'Database inference' occurs when unauthorized users infer sensitive information from publicly released data. To protect against such 'inference attacks,' information that is probabilistically related to sensitive information must be examined and perhaps modified. The authors introduce a formal schema for database inference analysis, based upon a Bayesian network structure, which identifies critical parameters involved in the inference problem and represents them in a coherent framework.

DTIC

Bayes Theorem; Data Bases; Inference; Information Systems; Protection; Relational Data Bases; Security

20070010827 Space and Naval Warfare Systems Command, Charleston, SC USA

Are DOD Network Centric Policies, Processes and Edge Organizations Sufficiently Adaptable to Adequately Respond to The Impact of Globalization? (Briefing Charts)

Lenahan, Jack; Jun 2004; 20 pp.; In English; Original contains color illustrations

Report No.(s): AD-A462376; No Copyright; Avail.: CASI: [A03](#), Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA462376>

No abstract available

Charts; Command and Control; Military Operations; Organizations; Policies; Security; Warfare

20070010829 Library of Congress, Washington, DC USA

Navy Network-Centric Warfare Concept: Key Programs and Issues for Congress

O'Rourke, Ronald; May 31, 2005; 7 pp.; In English

Report No.(s): AD-A462379; CRS-RS20557; No Copyright; Avail.: CASI: [A02](#), Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA462379>

The concept of network-centric warfare (NCW) is a key element of the Department of Defense's (DoD's) transformation effort. NCW focuses on using computers, high-speed data links, and networking software to link military personnel, platforms, and formations into highly integrated local and wide-area networks. Within these networks, personnel will share large amounts of critical information on a rapid and continuous basis. DoD believes that NCW will dramatically improve combat capability

and efficiency. Key programs for implementing NCW in the Navy include the Cooperative Engagement Capability (CEC), the Joint Fires Network (JFN), the IT-21 program, and ForceNet. A related program is the Navy-Marine Corps Intranet (NMCI). Congress has closely followed and expressed concern for some of these programs, particularly NMCI. This report may be updated if developments warrant.

DTIC

Communication Networks; Computer Networks; Interoperability; Navy; Procurement; Warfare

20070010836 Space and Naval Warfare Systems Center, San Diego, CA USA

Composeable FORCENet Command and Control: The Key to Energizing the Global Information Grid to Enable Superior Decision Making

Galdorisi, George; Grossman, Jeff; Reilley, Mike; Clarkson, Jeff; Priebe, Chris; Jan 2004; 29 pp.; In English; Original contains color illustrations

Report No.(s): AD-A462394; No Copyright; Avail.: CASI: [A03](#), Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA462394>

This paper will examine one of the most critical aspects of transforming information age concepts and technologies how do we think about the problem of Joint command and control. Our research has shown that warfighters operating in a Global Information Grid (GIG) and FORCENet-enabled environment must be able to compose the command and control elements at their disposal to ensure superior decision-making to enable the Joint Force Commander to achieve the Joint Vision 2020 goal of Full Spectrum Dominance. The key word in this construct is composeable and our thesis is that commanders must have the ability to compose a command and control architecture that meets their warfighting requirements from a broad array of multi-tiered networked sensors, dynamic bandwidth capabilities and tailorable visualization. This paper will show that in the naval context, this requires that we engineer FORCENet, from the keel up, not as a set-piece bundle of fixed capabilities, but as a fungible toolbox of capabilities that the commander selects based on the operational mission he must accomplish as well as a set of capabilities that fits seamlessly into the GIG. Composeable FORCENet enables warfighters to make the superior decisions necessary to win in battle. We will describe how Composeable FORCENet unlocks the power of the GIG to fundamentally alter the way in which military decision makers view, manage and understand the information environment in a Joint and combined warfighting context. We will show how Composeable FORCENet supports shared situational awareness across strategic, operational and tactical levels to enable superior decision-making.

DTIC

Command and Control; Decision Making; Navy

20070010842 Library of Congress, Washington, DC USA

High Performance Computers and Export Control Policy: Issues for Congress

McLoughlin, Glenn J; Fergusson, Ian F; May 5, 2005; 27 pp.; In English

Report No.(s): AD-A462401; No Copyright; Avail.: CASI: [A03](#), Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA462401>

Congress has a strong interest in export control policy with regard to technologies that may have both commercial and military applications outside of the USA. Through its constitutionally delegated authority to regulate foreign commerce, Congress has the authority to control exports for national security or foreign policy purposes. The 109th Congress may examine issues of national export control policy, including reauthorization of the Export Administration Act (EAA), and control policies concerning key technologies. Among these technologies are High Performance Computers HPCs. HPCs are either single computing machines (usually called supercomputers) or a cluster of easily available, high-end workstations or personal computers. Congressional interest in HPCs has primarily, but not exclusively, been focused on the dual-use applications of HPCs. That is, commercial HPCs that may also be used to simulate nuclear weapon tests, chemical and biological weapons production, and for military command, control, and communications. The 109th Congress likely will again consider the reauthorization of the EAA. Both chambers last considered EAA legislation in the 107th Congress. Legislation may also be introduced to repeal specific controls on HPCs enacted as part of the National Defense Authorization Act of 1998.

DTIC

Computers; Foreign Policy; International Trade; Law (Jurisprudence); Technology Transfer

20070010867 Texas Univ., Dallas, TX USA

Tuberous Sclerosis Complex National Database

Sparagana, Steven P; Oct 2006; 191 pp.; In English

Contract(s)/Grant(s): W81XWH-04-1-0896

Report No.(s): AD-A462436; No Copyright; Avail.: CASI: [A09](#), Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA462436>

A Consortium was formed in July 2002 by the Tuberous Sclerosis Alliance (TSA) and tuberous sclerosis (TS) clinic personnel nationwide to begin discussions of natural history studies and the development of a comprehensive clinical database (DB) to be used for both research and clinical purposes. The Consortium proposed to characterize the natural history of tuberous sclerosis complex (TSC) through the development of an internet-based DB to collect comprehensive data on individuals with TSC. The DB was developed through the collaborative efforts of clinicians and scientists from all major TSC clinics in the USA and the TSA. In July of 2005, TSA assumed control of the development process and contracted with a computer software designer, Tesuji, Inc., to begin development of the DB. Working Groups, a Steering Committee, and an Advisory Panel worked diligently to develop data collection points that were used by Tesuji, Inc. in the development phase. The scope of this award allowed the authors to establish the administrative framework for the development of the DB and to bring development to its final stages. DB development is complete and is now being overseen by the TSA. Once the DB is fully online, subjects will be recruited on a voluntary basis from multiple tuberous sclerosis clinics throughout the USA, possibly from select international sites, as well as the TSA. A trial of the DB is scheduled to begin in Fall 2006 at two pilot sites. Data is to be collected both retrospectively and prospectively, with the intent to capture data longitudinally.

DTIC

Clinical Medicine; Data Acquisition; Data Bases; Internets; Patients

20070010901 Naval Research Lab., Washington, DC USA

A Multilevel Secure Workflow Management System

Kang, Myong H; Froscher, Judith N; Sheth, Amit P; Kochut, Krys J; Miller, John A; Jan 1999; 16 pp.; In English

Report No.(s): AD-A462527; No Copyright; Avail.: CASI: [A03](#), Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA462527>

The Department of Defense (DoD) needs multilevel secure (MLS) workflow management systems to enable globally distributed users and applications to cooperate across classification levels to achieve mission critical goals. An MLS workflow management system that allows a user to program multilevel mission logic, to securely coordinate widely distributed tasks, and to monitor the progress of the workflow across classification levels is required. In this paper, we present a roadmap for implementing MLS workflows and focus on a workflow builder that is a graphical design tool for specifying such workflows.

DTIC

Information Retrieval; Management Information Systems; Management Systems

20070010940 Naval Research Lab., Washington, DC USA

A Single-Level Scheduler for the Replicated Architecture for Multilevel-Secure Databases

McDermott, John P; Jajodia, Sushil; Sandhu, Ravi S; Jan 1991; 11 pp.; In English

Report No.(s): AD-A462621; No Copyright; Avail.: CASI: [A03](#), Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA462621>

The replicated architecture for multilevel secure database systems provides security by replicating data into separate untrusted single-level database systems. To be successful, a system using the replicated architecture must have a concurrency and replica control algorithm that does not introduce any covert channels. Jajodia and Kogan have developed one such algorithm that uses update projections and a write-all replica control algorithm. Here we describe an alternative algorithm. The new algorithm uses replicated transactions and a set of queues organized according to security class. A new definition of correctness is required for this approach, so we present one and use it to show that our algorithm is correct. The existence of this new algorithm increases the viability of the replicated architecture as an alternative to kernelized approaches.

DTIC

Algorithms; Data Bases; Scheduling; Security

20070010948 Eotvos Lorand Univ., Budapest, Hungary

Adaptive Associative Scale-Free Maps for Fusing Human and Robotic Intelligences

Lorincz, Andras; Jun 2006; 66 pp.; In English

Contract(s)/Grant(s): FA8655-03-1-3036

Report No.(s): AD-A462665; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA462665>

This report results from a contract tasking Eotvos Lorand University as follows: The Grantee will perform research in high level Information Fusion focused on real-time management and cooperative planning in supervised autonomous systems. The research will be guided by two principal considerations: A) human knowledge should influence and guide information gathering and B) collected machine-processed information should reflect human intelligence and be readily comprehensible to the user. The domain is web-based knowledge extraction using crawlers word-maps and scale-free network models. Complete details of expected results and technical contributions are provided in the technical proposal.

DTIC

Man Machine Systems; Multisensor Fusion; Robotics

20070011091 Carnegie-Mellon Univ., Pittsburgh, PA USA

Instance-Based Question Answering

Lita, Lucian V; Dec 2006; 232 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): MDA908-02-C-0009

Report No.(s): AD-A462538; CMU-CS-06-179; No Copyright; Avail.: CASI: [A11](#), Hardcopy

During recent years, question answering (QA) has grown from simple passage retrieval and information extraction to very complex approaches that incorporate deep question and document analysis, reasoning, planning, and sophisticated uses of knowledge resources. Most existing QA systems combine rule-based, knowledge-based and statistical components, and are highly optimized for a particular style of questions in a given language. Typical question answering approaches depend on specific ontologies, resources, processing tools, document sources, and very often rely on expert knowledge and rule-based components. Furthermore, such systems are very difficult to re-train and optimize for different domains and languages, requiring considerable time and human effort. We present a fully statistical, data-driven, instance-based approach to question answering (IBQA) that learns how to answer new questions from similar training questions and their known correct answers. We represent training questions as points in a multi-dimensional space and cluster them according to different granularity, scatter, and similarity metrics. From each individual cluster we automatically learn an answering strategy for finding answers to questions. When answering a new question that is covered by several clusters, multiple answering strategies are simultaneously employed. The resulting answer confidence combines elements such as each strategy's estimated probability of success, cluster similarity to the new question, cluster size, and cluster granularity. The IBQA approach obtains good performance on factoid and definitional questions, comparable to the performance of top systems participating in official question answering evaluations.

DTIC

Information Retrieval; Knowledge Based Systems

20070011092 Naval Research Lab., Washington, DC USA

Tradeoffs in Secure System Development: An Outline

Meadows, Catherine; Jan 1994; 12 pp.; In English

Report No.(s): AD-A462539; No Copyright; Avail.: CASI: [A03](#), Hardcopy

In this paper we identify several areas in which the satisfaction of security requirements can affect the cost and performance of a system, and describe what is known about tradeoffs in these areas. We also show where these tradeoffs appear in the life cycle of a system, and show how they are affected by different kinds of security requirements.

DTIC

Information Systems; Security; Tradeoffs

20070011130 University of Southern California, Los Angeles, CA USA

Next-Generation Image and Sound Processing Strategies: Exploiting the Biological Model

Bartlett, Mel W; Grzywacz, Norberto M; Itti, Laurent; Narayanan, Shri; Feb 1, 2007; 9 pp.; In English

Contract(s)/Grant(s): N00014-06-1-0746

Report No.(s): AD-A462740; PR-95-164-2394; No Copyright; Avail.: CASI: [A02](#), Hardcopy

The main objective of this project is to extend the technical state-of-the-art in mid-level visual and auditory signal processing using an integrative biologically inspired approach. Though our research and development efforts are focused on different levels of sensory information processing, from low-level sensory adaptation to object selection and recognition, all of our efforts described in this progress report intersect at the level of features: what low level sensory features to extract, what methods used to extract them, and how to adapt feature detector parameters, such as their gains, in order to perform optimally in changing environments. In this progress report, we detail developments in each of these areas.

DTIC

Bionics; Data Processing; Image Processing; Pattern Recognition; Signal Processing

20070011131 Navy Personnel Research Studies and Technology, Millington, TN USA

A Brief Review of Biodata History, Research, and Applications

Farmer, William L.; Jan 2007; 58 pp.; In English

Report No.(s): AD-A462741; NPRST-TN-07-3; No Copyright; Avail.: CASI: [A04](#), Hardcopy

The assertion is often made that individuals are the sum total of their behavior and experience. This notion, along with the widely held belief that the best predictor of future behavior is past behavior, is at the core of the keen interest in biographical life history information. Information on life history can be obtained in many ways, including narrative biographies, interviews, cumulative observational records, and biographical data questionnaires. The latter, referred to as biodata, have been a preferred method for gathering life history information in applied psychology for over one hundred years. A number of studies, have documented biodata-type research programs that have led to the development and operational usage in practical settings. In military settings, studies conducted by the Army, Navy, and the Air Force have documented successes (and failures) of these efforts in the prediction of first term attrition. A comprehensive review and efforts aimed at laying out a program of assessing military service adaptability via biographical inventories is presented in Trent and Laurence. A collection of biodata items that can be used as a starting point for the construction of the biographical component of an adaptability screen is presented in the Appendix of this report. It is proposed that these items be utilized in the initial data collection and keying efforts.

DTIC

Biography; Psychology

83

ECONOMICS AND COST ANALYSIS

Includes cost effectiveness studies.

20070010547 Government Accountability Office, Washington, DC, USA

Use of Award Fees for Achieving Program Outcomes Should be Improved

January 2007; 34 pp.; In English

Report No.(s): GAO-07-58; No Copyright; Avail.: CASI: [A03](#), Hardcopy

Our objectives were to determine (1) the extent the National Aeronautics and Space Administration's (NASA) guidance addresses the problems previously identified with the use of award-fee contracts and (2) whether NASA follows its guidance in using award fees to achieve desired outcomes. We selected 10 NASA cost-plus-award-fee (CPAF) contracts to review. Our selection was based on contract data from the Federal Procurement Data System. We extracted information on all NASA contracts active between fiscal years 2002 and 2004 that were coded as CPAF. To ensure the validity of the database from which we drew our contracts, we confirmed the contract type of each of the 10 contracts we selected through NASA contracting officers and contract documentation. The contracts we selected were the top 10 dollar value contracts active from fiscal years 2002 through 2004.

Derived from text

Costs; NASA Programs; Finance; Contract Management

88

SPACE SCIENCES (GENERAL)

Includes general research topics related to the natural space sciences. For specific topics in space sciences see *categories 89 through 193*.

20070009868 NASA Johnson Space Center, Houston, TX, USA

Effect of Thermospheric Neutral Density upon Inner Trapped-belt Proton Flux

Wilson, Thomas L.; Lodhi, M. A. K.; Diaz, Abel B.; [2007]; 23 pp.; In English; Copyright; Avail.: CASI: [A03](#), Hardcopy

We wish to point out that a secular change in the Earth's atmospheric neutral density alters charged-particle lifetime in the inner trapped radiation belts, in addition to the changes recently reported as produced by greenhouse gases. Heretofore, changes in neutral density have been of interest primarily because of their effect on the orbital drag of satellites. We extend this to include the orbital lifetime of charged particles in the lower radiation belts. It is known that the charged-belt population is coupled to the neutral density of the atmosphere through changes induced by solar activity, an effect produced by multiple scattering off neutral and ionized atoms along with ionization loss in the thermosphere where charged and neutral populations interact. It will be shown here that trapped-belt flux J is bivariate in energy E and thermospheric neutral density ρ , as $J(E, \rho)$. One can conclude that proton lifetimes in these belts are also directly affected by secular changes in the neutral species populating the Earth's thermosphere. This result is a consequence of an intrinsic property of charged-particle flux, that flux is not merely a function of E but is dependent upon density ρ when a background of neutrals is present.

Author

Atmospheric Density; Radiation Belts; Charged Particles; Neutral Atmospheres; Solar Activity Effects

20070009921 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

Using SCIAMACHY and Ground-based FTS Measurements to Test the OCO X(sub CO₂) Retrieval and Validation Approach

Boesch, Hartmut; Toon, G.; Sen, B.; Li, Q. B.; Salawitch, R.; Miller, C.; Crisp, D.; Washenfelder, R.; Wennberg, P.; Natraj, V.; Yung, Y.; Buchwitz, M.; Burrows, J.; DeBeek, R.; Connor, B.; Christi, M.; Spurr, R.; May 30, 2006; 16 pp.; In English; 3rd IWGGMS Workshop, 30 May - 1 Jun. 2006, Tsukuba, Japan; Original contains color illustrations; Copyright; Avail.:

Other Sources

ONLINE: <http://hdl.handle.net/2014/39959>

Global, space-based observations of atmospheric CO₂ with precision, resolution, and coverage needed to monitor sources and sinks: a) Spectra of reflected/scattered sunlight in NIR CO₂ and O₂ bands used to estimate X(sub CO₂) with large sensitivity to surface; b) A-train orbit (1:15 PM polar sun sync); c) 16 day repeat cycle samples seasonal cycle on semi-monthly intervals; and d) NASA ESSP (Earth Space System Pathfinder) scheduled for Sept 2008 launch; 2 yrs lifetime. Initial comparison of SCIAMACHY and FTS retrievals for Park Falls: a) Positive bias in X(sub CO₂) of approx. 10 ppm; and b) Negative bias in surface pressure After correction of spectral artifacts in O₂A band: a) Largely improved agreement between SCIAMACHY and FTS X(sub CO₂) (without clear bias) and in surface pressure; and b) Standard deviation of SCIAMACHY X(sub CO₂) approx. 6 ppm. Good qualitative agreement with GEOS-CHEM, with GEOS-CHEM underestimating seasonal cycle. OCO is a dedicated CO₂ instrument and will achieve much higher accuracy and precision: a) much higher spectral resolution (by factor of 20); and b) smaller ground pixels (by factor of 600).

Derived from text

Atmospheric Composition; Carbon Dioxide Concentration; Carbon Dioxide; Standard Deviation; Spectral Resolution

20070009990 NASA Johnson Space Center, Houston, TX, USA

Space Plasma Ion Processing of Ilmenite in the Lunar Soil: Insights from In-Situ TEM Ion Irradiation Experiments

Christoffersen, R.; Keller, L. P.; [2007]; 2 pp.; In English; Lunar and Planetary Science Conference, 12-16 Mar. 2007, Houston, TX, USA; Copyright; Avail.: CASI: [A01](#), Hardcopy

Space weathering on the moon and asteroids results largely from the alteration of the outer surfaces of regolith grains by the combined effects of solar ion irradiation and other processes that include deposition of impact or sputter-derived vapors. Although no longer considered the sole driver of space weathering, solar ion irradiation remains a key part of the space weathering puzzle, and quantitative data on its effects on regolith minerals are still in short supply. For the lunar regolith, previous transmission electron microscope (TEM) studies performed by ourselves and others have uncovered altered rims on ilmenite (FeTiO₃) grains that point to this phase as a unique 'witness plate' for unraveling nanoscale space weathering processes. Most notably, the radiation processed portions of these ilmenite rims consistently have a crystalline structure, in contrast to radiation damaged rims on regolith silicates that are characteristically amorphous. While this has tended to support informal designation of ilmenite as a 'radiation resistant' regolith mineral, there are to date no experimental data that directly and quantitatively compare ilmenite's response to ion radiation relative to lunar silicates. Such data are needed because the radiation processed rims on ilmenite grains, although crystalline, are microstructurally and chemically complex, and exhibit changes linked to the formation of nanophase Fe metal, a key space weathering process. We report here the first ion radiation processing study of ilmenite performed by in-situ means using the Intermediate Voltage Electron Microscope-Tandem Irradiation facility (IVEM-Tandem) at Argonne National Laboratory. The capability of this facility for performing real time

TEM observations of samples concurrent with ion irradiation makes it uniquely suited for studying the dose-dependence of amorphization and other changes in irradiated samples.

Derived from text

Lunar Rocks; Ilmenite; Amorphous Materials; Space Weathering; Regolith; Ion Irradiation; Crystallinity; Space Plasmas

20070010481 NASA Goddard Space Flight Center, Greenbelt, MD, USA

The Origin of Planetary Nitrogen

Owen, T.; Niemann, H.; Mahaffy, P.; Atreya, S.; [2006]; 1 pp.; In English; European Planetary Science Congress 2006, 16-23 Sep. 2006, Berlin, Germany; Copyright; Avail.: Other Sources; Abstract Only

The nitrogen found today in planetary atmospheres appears to come from two sources: N₂ and condensed, nitrogen-containing compounds. On Jupiter and thus presumably on the other giant planets, the nitrogen is present mainly as ammonia but was apparently delivered primarily in the form of N₂, whereas on the inner planets and Titan, the nitrogen is present as N₂ but was delivered as condensed compounds, dominated by ammonia. This analysis is consistent with abundance data from the Interstellar Medium and models for the solar nebula. For Jupiter and the inner planets, it is substantiated by measurements of N-15/N-14 and is supported by investigations of comets and meteorites, soon to be supplemented by solar wind data from the Genesis Mission. The Cassini-Huygens Mission may be able to constrain models for Saturn's ammonia abundance that could test the proportion of N₂ captured by the planet. The Titan story is less direct, depending on studies of noble gases. These studies in turn suggest an evolutionary stage of the early Earth's atmosphere that included the ammonia and methane postulated by S. L. Miller (1953) in his classical experiments on the production of biogenic compounds.

Author

Nitrogen; Planetary Atmospheres; Gas Giant Planets; Genesis Mission; Cassini Mission; Nitrogen Compounds; Interstellar Matter

20070010651 NASA Stennis Space Center, Stennis Space Center, MS, USA, Science Systems and Applications, Inc., Bay Saint Louis, MS, USA

Radiometric Calibration of the AWiFS Using Vicarious Calibration Techniques

Pagnutti, Mary; Holekamp, Kara; [2007]; 27 pp.; In English; JACIE Civil Commercial Imagery Evaluation Workshop, 20-22 Mar. 2007, Fairfax, VA, USA

Contract(s)/Grant(s): NNS04AB54T

Report No.(s): SSTI-2220-0099; No Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: <http://hdl.handle.net/2060/20070010651>

A radiometric calibration assessment of the AWiFS (Advanced Wide Field Sensor) on the Indian Remote Sensing Resourcesat-1 satellite was performed by the NASA Applied Research & Technology Project Office (formerly the Applied Sciences Directorate) at the John C. Stennis Space Center. A reflectance-based vicarious calibration approach, requiring ground-based measurements coincident with satellite acquisitions and radiative transfer calculations, was used to estimate at-sensor radiance. The AWiFS is a 4-band, multispectral, moderate-resolution (60 m) imaging sensor that operates in the visible through short-wave infrared spectrum and is currently being considered as a Landsat-like alternative. Several study sites near the Stennis Space Center that attempted to span the dynamic range of the sensor were employed. Satellite at-sensor radiance values were compared to those estimated to determine the sensor's radiometric accuracy. The results of this evaluation provide the user community with an independent assessment of the radiometric accuracy of AWiFS image products, which are commercially available through GeoEye. These results are an extension of an independent assessment made by the University of Arizona Remote Sensing Group, the South Dakota State University Satellite Calibration Group & Image Processing Lab, and the NASA Applied Sciences Directorate at the John C. Stennis Space Center the previous year.

Author

Radiometric Resolution; Landsat Satellites; Radiative Transfer; Remote Sensing; Satellite Imagery; Infrared Spectra; Image Processing

20070010657 NASA Stennis Space Center, Stennis Space Center, MS, USA, Science Systems and Applications, Inc., Bay Saint Louis, MS, USA

A Non-Radiative Transfer Approach to Radiometric Vicarious Calibration

Ryan, Robert; Holekamp, Kara; Pagnutti, Mary; Stanley, Thomas; [2007]; 1 pp.; In English; JACIE 2007 Civil Commercial Imagery Evaluation Workshop, 20-22 Mar. 2007, Fairfax, VA, USA

Contract(s)/Grant(s): NNS04AB54T

Report No.(s): SSTI-2220-0101; Copyright; Avail.: Other Sources; Abstract Only

TOA (top-of-atmosphere) radiance from high-spatial-resolution satellite imagery systems is important for a wide variety of research and applications. Many research initiatives require data with absolute radiometric accuracy better than a few percent. The conversion of satellite digital numbers to radiance depends on accurate radiometric calibration. A common method for determining and validating radiometric calibrations is to rely upon vicarious calibration approaches. Historically, vicarious calibration methods use radiative transfer codes with ground-based atmosphere and surface reflectance or radiance inputs for estimating TOA radiance values. These TOA radiance values are compared against the satellite digital numbers to determine the radiometric calibration. However, the radiative transfer codes used depend on many assumptions about the aerosol properties and the atmospheric point spread function. A measurement-based atmospheric radiance estimation approach for high-spatial-resolution, multispectral, visible/near-infrared sensors is presented that eliminates the use of radiative transfer codes and many of the underlying assumptions. A comparison between the radiative transfer and non-radiative transfer approaches is made.

Author

Calibrating; Radiometers; Accuracy; High Resolution; Aerosols; Spectral Reflectance; Radiometric Resolution; Radiative Transfer

20070011402 NASA Johnson Space Center, Houston, TX, USA

Evaluation of Hands-Free Devices for Space Habitat Maintenance Procedures

Hoffman, R. B.; Twyford, E.; Conlee, C. S.; Litaker, H. L.; Solemn, J. A.; Holden; [2007]; 3 pp.; In English; Copyright; Avail.: CASI: [A01](#), Hardcopy

Currently, International Space Station (ISS) crews use a laptop computer to display procedures for performing onboard maintenance tasks. This approach has been determined to be suboptimal. A heuristic evaluation and two studies have been completed to test commercial off-the-shelf (COTS) 'near-eye' heads up displays (HUDs) for support of these types of maintenance tasks. In both studies, subjects worked through electronic procedures to perform simple maintenance tasks. As a result of the Phase I study, three HUDs were down-selected to one. In the Phase II study, the HUD was compared against two other electronic display devices - a laptop computer and an e-book reader. Results suggested that adjustability and stability of the HUD display were the most significant acceptability factors to consider for near-eye displays. The Phase II study uncovered a number of advantages and disadvantages of the HUD relative to the laptop and e-book reader for interacting with electronic procedures.

Author

Display Devices; Habitats; Space Maintenance; International Space Station; Commercial Off-the-Shelf Products; Head-Up Displays; Heuristic Methods

89

ASTRONOMY

Includes observations of celestial bodies; astronomical instruments and techniques; radio, gamma-ray, x-ray, ultraviolet, and infrared astronomy; and astrometry.

20070009652 Naval Research Lab., Washington, DC USA

Infrared 3-4 um Spectroscopic Investigation of a Large Sample of Nearby Ultraluminous Infrared Galaxies

Imanishi, Masatoshi; Dodley, C C; Maloney, Philip R; Sep 27, 2005; 25 pp.; In English

Report No.(s): AD-A461566; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA461566>

We present infrared L-band (3-4 μ m) nuclear spectra of a large sample of nearby ultraluminous infrared galaxies (ULIRGs). ULIRGs classified optically as non-Seyfert galaxies (LINERs, Hii regions, and unclassified) are our main targets. Using the 3.3 μ m polycyclic aromatic hydrocarbon (PAH) emission and absorption features at 3.1 μ m due to ice-covered dust and at 3.4 μ m produced by bare carbonaceous dust, we search for signatures of powerful AGNs deeply buried along virtually all lines of sight. The 3.3 μ m PAH emission, the signatures of starbursts, is detected in all but two non-Seyfert ULIRGs, but the estimated starburst magnitudes can account for only a small fraction of the infrared luminosities. Three LINER ULIRGs show spectra typical of almost pure buried AGNs, namely, strong absorption features with very small equivalent width PAH emission. Besides these three sources, 14 LINER and three H ii ULIRGs nuclei show strong absorption features whose absolute optical depths suggest an energy source more centrally concentrated than the surrounding dust, such as a buried AGN. In total, 17 out of 27 (63%) LINER and 3 out of 13 (23%) H ii ULIRGs nuclei show some degree of evidence for powerful buried AGNs, suggesting that powerful buried AGNs may be more common in LINER ULIRGs than in H ii ULIRGs. The evidence of AGNs

is found in non- Seyfert ULIRGs with both warm and cool far-infrared colors. These spectra are compared with those of 15 ULIRGs nuclei with optical Seyfert signatures taken for comparison. The overall spectral properties suggest that the total amount of dust around buried AGNs in non-Seyfert ULIRGs is systematically larger than that around AGNs in Seyfert 2 ULIRGs. We argue that the optical (non)detectability of Seyfert signatures in ULIRGs is highly dependent on how deeply buried the AGNs are, and that it is essential to properly evaluate the energetic importance of buried AGNs in non-Seyfert ULIRGs.

DTIC

Far Infrared Radiation; Galaxies; Infrared Radiation; Luminosity; Optical Properties; Spectroscopy

20070009840 Northwestern Univ., Evanston, IL USA

OSSE Observations of the Crab Pulsar

Ulmer, M P; Matz, S M; Cameron, R A; Grabelsky, D A; Grove, J E; Johnson, W N; Jung, G V; Kinzer, R L; Kurfess, J D; Leising, M D; Purcell, W R; Strickman, M S; Jan 1991; 10 pp.; In English

Report No.(s): AD-A461745; No Copyright; Avail.: CASI: [A02](#), Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA461745>

We present preliminary results of the Compton Gamma Ray Observatory OSSE observations of the Crab pulsar. The pulsar energy spectra and light curves are in general agreement with previous observations, validating the OSSE pulsar data acquisition modes and data analysis algorithms. The data suggest that the spectrum of the pulsar varies throughout the light curve. The 'interpulse' region has a slightly flatter spectrum in the ~ 60 -250 keV region and a slightly steeper spectrum at higher energies than the two main pulses. We find no evidence for any lines in the spectra with a typical sensitivity of about 10^{-4} photons $\text{cm}^{-2} \text{s}^{-1}$.

DTIC

Pulsars; Gamma Ray Observatory; Spectrometers; Scintillation

20070010000 Colorado Univ., Boulder, CO, USA

X-ray Observations of Binary and Single Wolf-Rayet Stars with XMM-Newton and Chandra

Skinner, Stephen; Gudel, Manuel; Schmutz, Werner; Zhekov, Svetozar; Astrophysics and Space Science; 2006; Volume 304, pp. 97-99; In English

Contract(s)/Grant(s): NNG05GA10G; NNG05GB48G; GO-5003-X; Copyright; Avail.: Other Sources

We present an overview of recent X-ray observations of Wolf-Rayet (WR) stars with XMM-Newton and Chandra. These observations are aimed at determining the differences in X-ray properties between massive WR + OB binary systems and putatively single WR stars. A new XMM spectrum of the nearby WN8 + OB binary WR 147 shows hard absorbed X-ray emission (including the Fe K α line complex), characteristic of colliding wind shock sources. In contrast, sensitive observations of four of the closest known single WC (carbon-rich) WR stars have yielded only nondetections. These results tentatively suggest that single WC stars are X-ray quiet. The presence of a companion may thus be an essential factor in elevating the X-ray emission of WC + OB stars to detectable levels.

Author

Wolf-Rayet Stars; X Ray Binaries; Binary Stars; O Stars; Carbon Stars

20070010574 NASA Goddard Space Flight Center, Greenbelt, MD, USA

The Jet/Disk Connection in AGN: Chandra and XMM-Newton Observations of Three Powerful Radio-Loud Quasars

Sambruna, Rita; Gliozzi, Mario; Tavecchio, F.; Maraschi, L.; Foschini, Luigi; [2007]; 39 pp.; In English; Original contains black and white illustrations

Contract(s)/Grant(s): NAG-30240; HST-GO4-5111A; NAG5-10708; COFIN-MIUR 2004023189-005; Copyright; Avail.:

CASI: [A03](#), Hardcopy

The connection between the accretion process that powers AGN and the formation of jets is still poorly understood. Here we tackle this issue using new, deep Chandra and XMM-Newton observations of the cores of three powerful radio loud quasars: 1136-135, 1150+497 (Chandra), and 0723+679 (XMM-Newton), in the redshift range $z=0.3$ -0.8. These sources are known from our previous Chandra sipislot survey to have kpc-scale X-ray jets. In 1136-135 and 1150-1+497; evidence is found for the presence of diffuse thermal X-ray emission around the cores; on scales of 40-50 kpc and with luminosity $L(\text{sub } 0.3\text{-}2 \text{ keV approx. } 10^{43} \text{ erg per second}$, suggesting thermal emission from the host galaxy or a galaxy group. The X-ray continua of the cores in the three sources are described by an upward-curved (concave) broken power law, with photon indices GAMMA (sub soft) approx. 1.8 - 2.1 and GAMMA (sub hard) approx. 1.7 below and above approx. equal to 2 keV,

respectively. There is evidence for an unresolved Fe K alpha line with EW approx. 70 eV in the three quasars. The Spectral Energy Distributions of the sources can be well described by a mix of jet and disk emission, with the jet dominating the radio and hard X-rays (via synchrotron and external Compton) and the disk dominating the optical/UV through soft X-rays. The ratio of the jet-to-disk powers is approx. 1, consistent with those derived for a number of gamma ray emitting blazars. This indicates that near equality of accretion and jet power may be common in powerful radio-loud AGN.

Author

Quasars; XMM-Newton Telescope; Active Galactic Nuclei; Radio Astronomy; X Ray Astronomy; Accretion Disks

20070010582 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Gamma Ray Burst Discoveries by the Swift Mission

Gehrels, Neil; [2006]; 1 pp.; In English; High Energy Astrophysics Division (HEAD) conference, 1-7 Oct. 2006, San Francisco, CA, USA; Copyright; Avail.: Other Sources; Abstract Only

The NASA Swift mission is an innovative new multiwavelength observatory designed to determine the origin of gamma-ray bursts and use them to probe the early Universe. Swift is now in orbit since November 20, 2004 and all hardware is performing well. A new-technology wide-field gamma-ray camera is detecting a hundred bursts per year. Sensitive narrow-field X-ray and UV/optical telescopes, built in collaboration with UK and Italian partners, are pointed at the burst location in 50-100 sec by an autonomously controlled 'swift' spacecraft. For each burst, arcsec positions are determined and optical/UV/X-ray/gamma-ray spectrophotometry performed. Information is also rapidly sent to the ground to a team of more than 50 observers at telescopes around the world. The first year and a half of findings from the mission will be presented. There has been a break-through in the long-standing mystery of short GRBs; they appear to be caused by merging neutron stars. High redshift bursts have been detected leading to a better understanding of star formation rates and distant galaxy environments. A fascinating nearby burst triggered Swift and enabled the best early-time observations of an emerging coincident Type Ib/c supernova. GRBs have been found with giant X-ray flares occurring in their afterglow.

Author

Gamma Ray Bursts; X Ray Telescopes; Gamma Rays; Star Formation Rate; Neutron Stars

90

ASTROPHYSICS

Includes cosmology; celestial mechanics; space plasmas; and interstellar and interplanetary gases and dust.

20070009863 NASA Johnson Space Center, Houston, TX, USA

The Abundance and Distribution of Presolar Materials in Cluster IDPS

Messenger, Scott; Keller, Lindsay; Nakamura-Messenger, Keiko; Ito, Motoo; [2007]; 2 pp.; In English; Lunar and Planetary Science Conference, 12-16 Mar. 2007, Houston, TX, USA; No Copyright; Avail.: CASI: A01, Hardcopy

ONLINE: <http://hdl.handle.net/2060/20070009863>

Presolar grains and remnants of interstellar organic compounds occur in a wide range of primitive solar system materials, including meteorites, interplanetary dust particles (IDPs), and comet Wild-2 samples. Among the most abundant presolar phases are silicate stardust grains and molecular cloud material. However, these materials have also been susceptible to destruction and alteration during parent body and nebular processing. In addition to their importance as direct samples of remote and ancient astrophysical environments, presolar materials thus provide a measure of how well different primitive bodies have preserved the original solar system starting materials.

Derived from text

Meteorites; Organic Compounds; Interplanetary Dust; Wild 2 Comet; Stardust Mission; Silicates

20070009874 NASA Johnson Space Center, Houston, TX, USA

Challenges in 21st Century Physics

Wilson, Thomas L.; [2007]; 1 pp.; In English; AAAS-SWARM 82nd Annual Meeting, 18-21 Apr. 2007, Houston, TX, USA; No Copyright; Avail.: Other Sources; Abstract Only

We are truly fortunate to live in one of the great epochs of human discovery, a time when science is providing new visions and understanding about ourselves and the world in which we live. At last, we are beginning to explore the Universe itself. One particularly exciting area of advancement is high-energy physics where several existing concepts will be put to the test. A brief survey will be given of accomplishments in 20th Century physics. These include relativity and quantum physics which have produced breakthroughs in cosmology, astrophysics, and high-energy particle physics. The current situation is then

assessed, combining the last 100 years of progress with new 21st Century challenges about unification and where to go next. Finally, the future is upon us. The next frontier in experimental high-energy physics, the Large Hadron Collider (LHC) at CERN in Geneva, is scheduled to begin coming online this year (2007). The potential for the LHC to address several of the significant problems in physics today will be discussed, as this great accelerator examines the predictions of the Standard Model of particle physics and even cosmology. New physics and new science will surely emerge and a better vision of the world will unfold.

Author

Quantum Mechanics; Standard Model (Particle Physics); Time Measurement; Relativity; Hadrons; Astrophysics; Cosmology

20070009890 George Mason Univ., Fairfax, VA USA

OSSE Observations of the 4 June 1991 Solar Flare

Murphy, R J; Share, G H; Forrest, D J; Grabelsky, D A; Grove, J E; Jensen, C M; Johnson, W N; Jung, G V; Kinzer, R L; Kroeger, R A; Kurfess, J D; Matz, S M; Purcell, W R; Strickman, M S; Ulmer, M P; Vestrand, W T; Jan 1993; 5 pp.; In English

Report No.(s): AD-A461926; No Copyright; Avail.: CASI: [A01](#), Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA461926>

We present time profiles of the 2.223 MeV neutron-capture line and the 4.44 MeV ^{12}C nuclear-deexcitation line derived from observations of the 4 June 1991 X12+ solar flare obtained by the Oriented Scintillation Spectrometer Experiment (OSSE) on board the Compton Gamma-Ray Observatory (CGRO). We discuss the OSSE instrument, the solar observation mode used during the June period, the data analysis technique employed, and derive an estimate of the accelerated-particle spectrum and a lower limit to the number of interacting particles.

DTIC

Solar Flares; Scintillation; Spectrometers

20070009947 Stanford Linear Accelerator Center, CA, USA

Gamma-Ray Burst Physics with GLAST

Omodei, N.; Oct. 01, 2006; 8 pp.; In English

Report No.(s): DE2006-892972; SLAC-PUB-12140; No Copyright; Avail.: National Technical Information Service (NTIS)

The Gamma-ray Large Area Space Telescope (GLAST) is an international space mission that will study the cosmos in the energy range 10 keV-300 GeV, the upper end of which is one of the last poorly observed region of the celestial electromagnetic spectrum. The ancestor of the GLAST/LAT was the Energetic Gamma Ray Experiment Telescope (EGRET) detector, which flew onboard the Compton Gamma Ray Observatory (CGRO). The amount of information and the step forward that the high energy astrophysics made thanks to its 9 years of observations are impressive. Nevertheless, EGRET uncovered the tip of the iceberg, raising many questions, and it is in the light of EGRET's results that the great potential of the next generation gamma-ray telescope can be appreciated. GLAST will have an imaging gamma-ray telescope, the Large Area Telescope (LAT) vastly more capable than instruments own previously, as well as a secondary instrument, the GLAST Bursts Monitor, or GBM, to augment the study of gamma-ray bursts. Gamma-Ray Bursts (GRBs) science is one of the most exciting challenges for the GLAST mission, exploring the high energy emission of one of the most intense phenomena in the sky, shading light on various problems: from the acceleration of particles to the emission processes, to more exotic physics like Quantum Gravity effect. In this paper we report the work done so far in the simulation development as well as the study of the LAT sensitivity to GRB.

NTIS

Gamma Ray Bursts; Telescopes; Particle Acceleration; Astrophysics

20070009959 Fermilab Particel Astrophysics Center, Batavia, IL, USA, Paris XI Univ., Orsay, France

Measuring Velocities Using the SMB and LSS

Stebbins, A.; Jul. 01, 2006; 12 pp.; In English

Report No.(s): DE2006-892365; FERMILAB-CONF-06-218-T; No Copyright; Avail.: National Technical Information Service (NTIS)

Here is discussed various ways by which the cosmic microwave background (CMB) radiation can be use to measure the velocities of matter in the universe. We include some new statistical techniques for using the kinetic Sunyaev-Zeldovich (kSZ)

effect and integrated Sachs-Wolfe (ISW) effect to determine velocities by correlating wide area CMB maps with overlapping large-scale structure (LSS) surveys.

NTIS

Cosmic Microwave Background Radiation; Surveys; Astrophysics

20070010515 Stanford Linear Accelerator Center, Stanford, CA, USA

Prospects of High Energy Laboratory Astrophysics

Ng, J. S. T.; Chen, F.; Sep. 2006; 7 pp.; In English

Report No.(s): DE2006-891833; SLAC-PUB-12119; No Copyright; Avail.: Department of Energy Information Bridge

Ultra high energy cosmic rays (UHECR) have been observed but their sources and production mechanisms are yet to be understood. We envision a laboratory astrophysics program that will contribute to the understanding of cosmic accelerators with efforts to: (1) test and calibrate UHECR observational techniques, and (2) elucidate the underlying physics of cosmic acceleration through laboratory experiments and computer simulations. Innovative experiments belonging to the first category have already been done at the SLAC FFTB. Results on air fluorescence yields from the FLASH experiment are reviewed. Proposed future accelerator facilities can provide unprecedented high-energy-densities in a regime relevant to cosmic acceleration studies and accessible in a terrestrial environment for the first time. We review recent simulation studies of nonlinear plasma dynamics that could give rise to cosmic acceleration, and discuss prospects for experimental investigation of the underlying mechanisms.

NTIS

Astrophysics; Laboratory Astrophysics

20070010520 Stanford Linear Accelerator Center, Stanford, CA, USA

Status of Identification of VHE Gamma-Ray Sources

Funk, S.; Sep. 2006; 6 pp.; In English

Report No.(s): DE2006-892599; SLAC-PUB-12139; No Copyright; Avail.: National Technical Information Service (NTIS)

With the recent advances made by Cherenkov telescopes such as H.E.S.S. the field of very high-energy (VHE) (gamma)-ray astronomy has recently entered a new era in which for the first time populations of Galactic sources such as e.g. Pulsar wind nebulae (PWNe) or Supernova remnants (SNRs) can be studied. However, while some of the new sources can be associated by positional coincidence as well as by consistent multi-wavelength data to a known counterpart at other wavelengths, most of the sources remain not finally identified. In the following, the population of Galactic H.E.S.S. sources will be used to demonstrate the status of the identifications, to classify them into categories according to this status and to point out outstanding problems.

NTIS

Gamma Rays; Energy Sources

20070010530 Stanford Linear Accelerator Center, Stanford, CA, USA

GLAST. Physics Goals and Instrument Status

Carson, J.; Nov. 01, 2006; 4 pp.; In English

Report No.(s): DE2006-894932; SLAC-PUB-12184; No Copyright; Avail.: Department of Energy Information Bridge

The Gamma-ray Large Area Space Telescope (GLAST) is a space-based observatory scheduled to launch in October 2007 with two instruments: (1) the GLAST Burst Monitor (GBM), sensitive to photon energies between 8 keV and 25 MeV and optimized to detect gamma-ray bursts, and (2) the Large Area Telescope (LAT), sensitive to gamma rays between 20 MeV and 300 GeV and designed to survey the gamma-ray sky with unprecedented sensitivity. We describe the LAT and the GBM. We then focus on the LAT's capabilities for studying active galactic nuclei.

NTIS

Gamma Ray Observatory; Gamma Ray Telescopes; Hubble Space Telescope; Imaging Techniques

20070010531 Stanford Linear Accelerator Center, Stanford, CA, USA

Phenomenology of Extra Dimensions

Hewett, J. L.; Nov. 07, 2006; 35 pp.; In English

Report No.(s): DE2006-894933; No Copyright; Avail.: National Technical Information Service (NTIS)

If the structure of spacetime is different than that readily observed, gravitational physics, particle physics and cosmology are all immediately affected. The physics of extra dimensions offers new insights and solutions to fundamental questions

arising in these fields. Novel ideas and frameworks are continuously born and evolved. They make use of string theoretical features and tools and they may reveal if and how the 11-dimensional string theory is relevant to our four-dimensional world. We have outlined some of the experimental observations in particle and gravitational physics as well as astrophysical and cosmological considerations that can constrain or confirm these scenarios. These developing ideas and the wide interdisciplinary experimental program that is charted out to investigate them mark a renewed effort to describe the dynamics behind spacetime. We look forward to the discovery of a higher dimensional spacetime.

NTIS

Cosmology; Phenomenology; Space-Time Functions

20070010532 Stanford Linear Accelerator Center, Stanford, CA, USA, Stanford Univ., Stanford, CA USA

Normal Modes of Black Hole Accretion Disks

Rodriguez, M. O.; Silbergleit, A. S.; Wagoner, R. V.; Nov. 01, 2006; 56 pp.; In English

Report No.(s): DE2006-894930; SLAC-PUB-12186; No Copyright; Avail.: Department of Energy Information Bridge

This paper studies the hydrodynamical problem of normal modes of small adiabatic oscillations of relativistic barotropic thin accretion disks around black holes (and compact weakly magnetic neutron stars). Employing WKB techniques, we obtain the eigen frequencies and eigenfunctions of the modes for different values of the mass and angular momentum of the central black hole. We discuss the properties of the various types of modes and examine the role of viscosity, as it appears to render some of the modes unstable to rapid growth.

NTIS

Accretion Disks; Black Holes (Astronomy)

20070010581 NASA Johnson Space Center, Houston, TX, USA

TOF-SIMS Analysis of Crater Residues from Wild 2 Cometary on Stardust Aluminum Foil

Leutner, Jan; Stephan, Thomas; Kearsley, T.; Horz, Friedrich; Flynn, George J.; Sandford, Scott A.; [2007]; 24 pp.; In English; Original contains color and black and white illustrations

Contract(s)/Grant(s): STE-576/17-1; Copyright; Avail.: CASI: [A03](#), Hardcopy

Impact residues of cometary particles on aluminum foils from the Stardust mission were investigated with TOF-SIMS for their elemental and organic composition. The residual matter from comet 81P/Wild 2 shows a wide compositional range, from nearly monomineralic grains to polymict aggregates. Despite the comparably small analyzed sample volume, the average element composition of the investigated residues is similar to bulk CI chondritic values. Analysis of organic components in impact residues is complicated, due to fragmentation and alteration of the compounds during the impact process and by the presence of contaminants on the aluminum foils. Nevertheless, polycyclic aromatic hydrocarbons (PAHs) that are unambiguously associated with the impact residues were observed, and thus are most likely of cometary origin.

Author

Craters; Residues; Wild 2 Comet; Chemical Composition; Chondrites; Stardust Mission; Polycyclic Aromatic Hydrocarbons

20070010607 Lawrence Livermore National Lab., Livermore, CA USA

Evolutionary Processes in Multiple Systems

Eggleton, P. P.; Kisseleva-Eggleton, L.; Feb. 14, 2006; 12 pp.; In English

Report No.(s): DE2006-895077; UCRL-CONF-218977; No Copyright; Avail.: Department of Energy Information Bridge

There are several ways in which triple stars can evolve in somewhat unusual ways. They discuss two situations where Case A Roche-lobe overflow, followed by a merger, can produce anomalous wide binaries such as (gamma) Per; and Kozai cycles in triples with non-parallel orbits, which can produce merged rapidly-rotating stars like AB Dor, and which can also lead to the delayed ejection of one component of a multiple, as may have been observed in T Tau in 1998.

NTIS

Stellar Evolution; Stellar Systems

20070010897 Washington Univ., Saint Louis, MO USA

Thermal and Non-Thermal Plasmas in the Galaxy Cluster 3C 129

Krawczynski, H; Harris, D E; Grossman, R; Lane, W; Kassim, N; Willis, A G; Jan 2003; 12 pp.; In English

Report No.(s): AD-A462509; No Copyright; Avail.: CASI: [A03](#), Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA462509>

We describe new Chandra spectroscopy data of the cluster which harbors the prototypical head tail radio galaxy 3C 129

and the weaker radio galaxy 3C 129.1. We combined the Chandra data with Very Large Array (VLA) radio data taken at 0.33.5 and 8 GHz (archival data) and 1.4 GHz (new data). We also obtained new H I observations at the Dominion Radio Astrophysical Observatory (DRAO) to measure the neutral hydrogen column density in the direction of the cluster with arcmin angular resolution. The Chandra observation reveals extended X-ray emission from the radio galaxy 3C 129.1 with a total luminosity of $1.5 \times 10^{41} \text{ erg s}^{-1}$. The X-ray excess is resolved into an extended central source of approximately 2 arcsec (1 kpc) diameter and several point sources with individual luminosities up to $2.1 \times 10^{40} \text{ erg s}^{-1}$. There is no evidence for a correlation between the 3C 129.1 X-ray and radio morphology. In the case of the radio galaxy 3C 129, the Chandra observation shows, in addition to core and jet X-ray emission reported in an earlier paper, some evidence for extended, diffuse X-ray emission from a region east of the radio core. The 12.36 arcsec squared (6 kpc \times 17 kpc) region lies in front of the radio core, in the same direction into which the radio galaxy is moving. We use the radio and X-ray data to study in detail the pressure balance between the non-thermal radio plasma and the thermal intracluster medium (ICM) along the tail of 3C 129 which extends over 15 arcmin (427 kpc). Depending on the assumed lower energy cut-off of the electron energy spectrum, the minimum pressure of the radio plasma lies a factor of between 10 and 40 below the ICM pressure for a large part of the tail. We discuss several possibilities to explain the apparent pressure mismatch.

DTIC

Galactic Clusters; Galaxies; Plasmas (Physics); Radio Galaxies; Spectroscopy; Thermal Plasmas

20070010899 Naval Postgraduate School, Monterey, CA USA

Implementation of a Fault Tolerant Control Unit within an FPGA for Space Applications

Perez Casanova, Gaspar M; Dec 2006; 105 pp.; In English; Original contains color illustrations

Report No.(s): AD-A462520; No Copyright; Avail.: CASI: [A06](#), Hardcopy

ONLINE: <http://hdl.handle.net/100.2/ADA462520>

The space environment implies a challenge for the development and utilization of electronics. Field Programmable Gate Arrays (FPGAs) represent a possible solution to that challenge. An FPGA itself is not a Fault Tolerant component, but with the correct configuration it can emulate and behave as one. The Configurable Fault Tolerant Processor (CFTP) developed at the Naval Postgraduate School (NPS) was intended to work as a platform for the implementation and testing of designs and experiments for space applications. The major components of the CFTP are two FPGAs, one configured as the control FPGA (X1) and the other as the experiment FPGA (X2). The configuration of the experiment FPGA already includes fault tolerant properties against radiation and its effects over FPGAs. The control experiment did not have any fault tolerance built-in. This thesis investigates the design, considerations, implementation, performance and resource utilization of a Fault Tolerant Control Unit based on FPGA technology using a Triple Modular Redundancy (TMR) approach.

DTIC

Aerospace Environments; Control Equipment; Electronic Equipment; Fault Tolerance; Field-Programmable Gate Arrays; Technology Utilization

20070011399 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Solar Wind Helium Abundance as a Function of Speed and Heliographic Latitude: Variation through a Solar Cycle

Kasper, J. C.; Stenens, M. L.; Stevens, M. L.; Lazarus, A. J.; Steinberg, J. T.; Ogilvie, Keith W.; [2006]; 2 pp.; In English Contract(s)/Grant(s): NNG05GB44G; Copyright; Avail.: Other Sources; Abstract Only

We present a study of the variation of the relative abundance of helium to hydrogen in the solar wind as a function of solar wind speed and heliographic latitude over the previous solar cycle. The average values of $A(\text{sub He})$, the ratio of helium to hydrogen number densities, are calculated in 25 speed intervals over 27-day Carrington rotations using Faraday Cup observations from the Wind spacecraft between 1995 and 2005. The higher speed and time resolution of this study compared to an earlier work with the Wind observations has led to the discovery of three new aspects of $A(\text{sub He})$, modulation during solar minimum from mid-1995 to mid-1997. First, we find that for solar wind speeds between 350 and 415 km/s, $A(\text{sub He})$, varies with a clear six-month periodicity, with a minimum value at the heliographic equatorial plane and a typical gradient of 0.01 per degree in latitude. For the slow wind this is a 30% effect. We suggest that the latitudinal gradient may be due to an additional dependence of coronal proton flux on coronal field strength or the stability of coronal loops. Second, once the gradient is subtracted, we find that $A(\text{sub He})$, is a remarkably linear function of solar wind speed. Finally, we identify a vanishing speed, at which $A(\text{sub He})$, is zero, is 259 km/s and note that this speed corresponds to the minimum solar wind speed observed at one AU. The vanishing speed may be related to previous theoretical work in which enhancements of coronal helium lead to stagnation of the escaping proton flux. During solar maximum the $A(\text{sub He})$, dependences on speed and latitude disappear, and we interpret this as evidence of two source regions for slow solar wind in the ecliptic plane, one being

the solar minimum streamer belt and the other likely being active regions.

Author

Helium; Abundance; Solar Cycles; Wind Velocity; Hydrogen; Solar Activity Effects; Gas Density; Coronal Loops

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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*.

20070009853 NASA Johnson Space Center, Houston, TX, USA

Accretion, Differentiation, and Impact Processes on the Ureilite Parent Body

Downes, Hilary; Herrin, J. S.; Hudon, P.; [2007]; 2 pp.; In English; Lunar and Planetary Science Conference, 12-16 Mar. 2007, Houston, TX, USA; Original contains black and white illustrations; Copyright; Avail.: CASI: [A01](#), Hardcopy

Ureilites are primitive ultramafic achondrites composed largely of olivine and pigeonite, with minor augite, orthopyroxene, carbon, sulphide and metal. They represent very early material in the history of the Solar System and (in common with lodranites and acapulcoites) form a bridge between undifferentiated chondrites and fully differentiated asteroidal bodies. They show an intriguing mixture of chemical characteristics, some of which are considered to be nebula-derived (e.g. variations in $\Delta^{17}\text{O}$ and mg#) whereas others have been imposed by asteroidal differentiation (e.g. core formation, silicate partial melting, removal of basalt).

Derived from text

Ureilites; Deposition; Achondrites; Olivine; Carbon; Sulfides; Meteoritic Composition; Nebulae

20070009865 NASA Johnson Space Center, Houston, TX, USA

A Zircon U-Pb Study of the Evolution of Lunar KREEP

Meyer, Charles; Nemchin, A.; Pidgeon, R.; Whitehouse, M.; Vaughan, J.; [2007]; 31 pp.; In English; No Copyright; Avail.: CASI: [A03](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20070009865>

SIMS U-Pb analyses show that zircons from breccias from Apollo 14 and Apollo 17 have essentially identical age distributions in the range 4350 to 4200 Ma but, whereas Apollo 14 zircons additionally show ages from 4200 to 3900 Ma, the Apollo 17 samples have no zircons with ages ≤ 4200 Ma. The zircon results also show an uneven distribution with distinct peaks of magmatic activity. In explaining these observations we propose that periodic episodes of KREEP magmatism were generated from a primary reservoir of KREEP magma, which contracted over time towards the centre of Procellarum KREEP terrane.

Author

KREEP; Igneous Rocks; Lunar Maria; Breccia; Minerals

20070009920 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

Unusual Radar Backscatter Properties Along the Northern Rim of Imbrium Basin

Thompson, Thomas W.; Campbell, Bruce A.; March 14, 2005; 16 pp.; In English; Lunar and Planetary Science Conference, 14-18 Mar. 2005, Houston, TX, USA; Original contains black and white illustrations; Copyright; Avail.: Other Sources

ONLINE: <http://hdl.handle.net/2014/39697>

Earth-based radar backscatter from the lunar terrae is 2-4 times that of the maria. The largest (most conspicuous) exception is the terra along the northern rim of Imbrium Basin, where highlands that surround Sinus Iridium and crater Pluto have long wavelength (70-cm) radar backscatter that is comparable to (and sometimes weaker) the mare.

Derived from text

Backscattering; Lunar Maria; Iridium; Craters

20070009925 NASA Johnson Space Center, Houston, TX, USA

Temperature and Oxygen Fugacity Constraints on CK and R Chondrites and Implications for Water and Oxidation in the Early Solar System

Righter, K.; Neff, K. E.; [2007]; 60 pp.; In English; Copyright; Avail.: CASI: [A04](#), Hardcopy

Recent chondritic meteorite finds in Antarctica have included CB, CH, CK and R chondrites, the latter two of which are among the most oxidized materials found in meteorite collections. In this study we present petrographic and mineralogic data

for a suite of CK and R chondrites, and compare to previous studies of CK and R, as well as some CV chondrites. In particular we focus on the opaque minerals magnetite, chromite, sulfides, and metal as well as unusual silicates hornblende, biotite, and plagioclase. Several mineral thermometers and oxy-barometers are utilized to calculate temperatures and oxygen fugacities for these unusual meteorites compared to other more common chondrite groups. R and CK chondrites show lower equilibrium temperatures than ordinary chondrites, even though they are at similar petrologic grades (e.g., thermal type 6). Oxygen fugacity calculated for CV and R chondrites ranges from values near the iron-wustite (IW) oxygen buffer to near the fayalite-magnetite-quartz (FMQ) buffer. In comparison, the fO_2 recorded by ilmenite-magnetite pairs from CK chondrites are much higher, from FMQ+3.1 to FMQ+5.2. The latter values are the highest recorded for materials in meteorites, and place some constraints on the formation conditions of these magnetite-bearing chondrites. Differences between mineralogic and O isotopic compositions of CK and R chondrites suggest two different oxidation mechanisms, which may be due to high and low water: rock ratios during metamorphism, or to different fluid compositions, or both.

Author

Oxidation; Oxygen; Solar System; Water; Carbonaceous Chondrites; Mineralogy; Petrography; Temperature

20070009926 NASA Johnson Space Center, Houston, TX, USA

Beagle to the Moon: An Experiment Package to Measure Polar Ice and Volatiles in Permanently Shadowed Areas or Beneath the Lunar Surface

Gibson, E. K.; McKay, D. S.; Pillinger, C. T.; Wright, I. P.; Sims, M. R.; Richter, L.; [2007]; 2 pp.; In English; Lunar and Planetary Science Conference, 12-16 Mar. 2007, Houston, TX, USA; Original contains color illustrations; Copyright; Avail.: CASI: [A01](#), Hardcopy

Near the beginning of the next decade we will see the launch of scientific payloads to the lunar surface to begin laying the foundations for the return to the moon in the Vision for Space Exploration. Shortly thereafter, astronauts will return to the lunar surface and have the ability to place scientific packages on the surface that will provide information about lunar resources and compositions of materials in permanently shadowed regions of the moon (1). One of the important questions which must be answered early in the program is whether there are lunar resources which would facilitate 'living off the land' and not require the transport of resources and consumables from Earth (2). The Beagle science package is the ideal payload (3) to use on the lunar surface for determining the nature of hydrogen, water and lunar volatiles found in the polar regions which could support the Vision for Space Exploration

Derived from text

Lunar Surface; Lunar Resources; Space Exploration; Polar Regions

20070009927 NASA Johnson Space Center, Houston, TX, USA

Crew/Robot Coordinated Planetary EVA Operations at a Lunar Base Analog Site

Diftler, M. A.; Ambrose, R. O.; Bluethmann, W. J.; Delgado, F. J.; Herrera, E.; Kosmo, J. J.; Janoiko, B. A.; Wilcox, B. H.; Townsend, J. A.; Matthews, J. B.; Fong, T. W.; Bualat, M. G.; Lee, S. Y.; Dorsey, J. T.; Doggett, W. R.; [2007]; 2 pp.; In English; Lunar and Planetary Science Conference, 12-16 Mar. 2007, League City, TX, USA; Original contains color illustrations; No Copyright; Avail.: CASI: [A01](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20070009927>

Under the direction of NASA's Exploration Technology Development Program, robots and space suited subjects from several NASA centers recently completed a very successful demonstration of coordinated activities indicative of base camp operations on the lunar surface. For these activities, NASA chose a site near Meteor Crater, Arizona close to where Apollo Astronauts previously trained. The main scenario demonstrated crew returning from a planetary EVA (extra-vehicular activity) to a temporary base camp and entering a pressurized rover compartment while robots performed tasks in preparation for the next EVA. Scenario tasks included: rover operations under direct human control and autonomous modes, crew ingress and egress activities, autonomous robotic payload removal and stowage operations under both local control and remote control from Houston, and autonomous robotic navigation and inspection. In addition to the main scenario, participants had an opportunity to explore additional robotic operations: hill climbing, maneuvering heaving loads, gathering geo-logical samples, drilling, and tether operations. In this analog environment, the suited subjects and robots experienced high levels of dust, rough terrain, and harsh lighting.

Author

Extravehicular Activity; Lunar Bases; Robotics; Spacecrews; Analogs; Space Exploration

20070009930 NASA Johnson Space Center, Houston, TX, USA

Quantum Effects in Cosmochemistry: Complexation Energy and Van Der Waals Radii

Mittlefehldt, D. W.; Wilson, T. L.; [2007]; 2 pp.; In English; Lunar and Planetary Science Conference, 12-16 Mar. 2007, Houston, TX, USA; Original contains color and black and white illustrations; No Copyright; Avail.: CASI: [A01](#), Hardcopy ONLINE: <http://hdl.handle.net/2060/20070009930>

The subject of quantum effects in cosmochemistry was recently addressed with the goal of understanding how they contribute to Q-phase noble gas abundances found in meteorites. It was the pursuit of the Q-phase carrier of noble gases and their anomalous abundances that ultimately led to the identification, isolation, and discovery of presolar grains. In spite of its importance, Q-phase investigations have led a number of authors to reach conclusions that do not seem to be supported by quantum chemistry. In view of the subject's fundamental significance, additional study is called for. Two quantum properties of Q-phase candidates known as endohedral carbon-cage clathrates such as fullerenes will be addressed here. These are complexation energy and instability induced by Pauli blocking (exclusion principle).

Derived from text

Cosmochemistry; Quantum Chemistry; Radii; Van Der Waals Forces; Energy Distribution

20070009931 NASA Johnson Space Center, Houston, TX, USA

A New Method for Evaluating the Carbon Isotope Characteristics of Carbonate Formed Under Cryogenic Conditions Analogous to Mars

Niles, P. B.; Socki, R. A.; Hredzak, P. L.; [2007]; 2 pp.; In English; Lunar and Planetary Science Conference, 12-16 Mar. 2007, Houston, TX, USA; Original contains color and black and white illustrations; Copyright; Avail.: CASI: [A01](#), Hardcopy

The two upcoming robotic missions to Mars, Phoenix and MSL, will both have the capability of measuring the carbon isotopic composition of CO₂ in the martian atmosphere, as well as possible CO₂ trapped in carbonate minerals in the Martian soil. Results from orbital and landed missions now clearly indicate that no large scale deposits of carbonate materials exist at the surface. However, some results from orbital remote sensing have been interpreted to indicate that carbonate minerals are present as fine particles interspersed at low concentrations (approx. 2%) in the martian dust. One likely mechanism for the production of these carbonates is during the freezing of transient water near the surface. Large deposits of near surface ice and photographic evidence for flowing water on the surface suggest that transient melting and refreezing of H₂O is an active process on Mars. Any exposure of these fluids to the CO₂ rich atmosphere should allow the production of HCO₃⁻ solutions. Carbonates are likely precipitates from these solutions during freezing as extensive CO₂ degassing, driven by the fluid's decreasing volume, drives CO₂ out. This rapid CO₂ degassing increases the pH of the solution and drives carbonate precipitation. It has been shown in previous studies that this rapid CO₂ degassing also results in a kinetic isotopic fractionation where the CO₂ gas has a much lighter isotopic composition causing a large isotope enrichment of C-13 in the precipitated carbonate. This kinetic isotope enrichment may be very common in the current martian environment, and may be a very important factor in understanding the very high deltaC-13 values of carbonates found in the martian meteorites. However, while previous studies have succeeded in generally quantifying the magnitude of this effect, detailed studies of the consistency of this effect, and the freezing rates needed to produce it are needed to understand any carbon isotope analyses from carbonate minerals in the martian soil or dust. This study demonstrates an innovative new method for measuring the isotopic composition of gas evolved from the freezing of carbonate solutions in real time, which allows for a much clearer view of the chemical processes involved. This method now sets the stage for detailed analysis of the chemical and isotopic mechanisms that produce cryogenic carbonates.

Derived from text

Carbon 13; Carbon Isotopes; Carbonates; Cryogenics; Mars Missions; Mars Surface

20070009966 Stanford Univ., Stanford, CA USA, Stanford Linear Accelerator Center, CA, USA, California Univ., Santa Cruz, CA, USA, Max-Planck-Inst. fuer Extraterrestrische Physik, Garching, Germany

Understanding Limitations in the Determination of the Diffuse Galactic Gamma-ray Emission

Moskalenko, I. V.; Digel, S. W.; Porter, T. A.; Reimer, O.; Strong, A. W.; Oct. 01, 2006; 4 pp.; In English Report No.(s): DE2006-892989; SLAC-PUB-12142; No Copyright; Avail.: Department of Energy Information Bridge

We discuss uncertainties and possible sources of errors associated with the determination of the diffuse Galactic (gamma)-ray emission using the EGRET data. Most of the issues will be relevant also in the GLAST era. The focus here is on issues that impact evaluation of dark matter annihilation signals against the diffuse (gamma)-ray emission of the Milky Way.

NTIS

Dark Matter; Galaxies; Gamma Rays

20070009991 NASA Johnson Space Center, Houston, TX, USA

Isotopic Measurements in CAIs with the Nanosims: Implications to the understanding of the Formation process of Ca, Al-Rich Inclusions

Ito, M.; Messenger, S.; Walker, Robert M.; [2007]; 2 pp.; In English; Lunar and Planetary Science Conference, 12-16 Mar. 2007, Houston, TX, USA; Original contains color illustrations; No Copyright; Avail.: CASI: [A01](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20070009991>

Ca, Al-rich Inclusions (CAIs) preserve evidence of thermal events that they experienced during their formation in the early solar system. Most CAIs from CV and CO chondrites are characterized by large variations in O-isotopic compositions of primary minerals, with spinel, hibonite, and pyroxene being more O-16-rich than melilite and anorthite, with $\delta^{17}\text{O}$, $\delta^{18}\text{O}$ = approx. -40‰ (DELTA O-17 = $\delta^{17}\text{O} - 0.52 \times \delta^{18}\text{O}$ = approx. -20‰). These anomalous compositions cannot be accounted for by standard mass dependent fractionation and diffusive process of those minerals. It requires the presence of an anomalous oxygen reservoir of nucleosynthetic origin or mass independent fractionations before the formation of CAIs in the early solar system. The CAMECA NanoSIMS is a new generation ion microprobe that offers high sensitivity isotopic measurements with sub 100 nm spatial resolution. The NanoSIMS has significantly improved abilities in the study of presolar grains in various kind of meteorites and the decay products of extinct nuclides in ancient solar system matter. This instrument promises significant improvements over other conventional ion probes in the precision isotopic characterization of sub-micron scales. We report the results of our first O isotopic measurements of various CAI minerals from EK1-6-3 and 7R19-1(a) utilizing the JSC NanoSIMS 50L ion microprobe. We evaluate the measurement conditions, the instrumental mass fractionation factor (IMF) for O isotopic measurement and the accuracy of the isotopic ratio through the analysis of a San Carlos olivine standard and CAI sample of 7R19-1(a).

Derived from text

Calcium; Aluminum; Inclusions; Meteoritic Composition; Mineralogy; Ion Probes

20070009996 NASA Johnson Space Center, Houston, TX, USA

Coupled Nd-142, Nd-143 and Hf-176 Isotopic Data from 3.6-3.9 Ga Rocks: New Constraints on the Timing of Early Terrestrial Chemical Reservoirs

Bennett, Vickie C.; Brandon, alan D.; Hiess, Joe; Nutman, Allen P.; [2007]; 2 pp.; In English; Lunar and Planetary Science Conference, 12-16 Mar. 2007, Houston, TX, USA; Copyright; Avail.: CASI: [A01](#), Hardcopy

Increasingly precise data from a range of isotopic decay schemes, including now extinct parent isotopes, from samples of the Earth, Mars, Moon and meteorites are rapidly revising our views of early planetary differentiation. Recognising Nd-142 isotopic variations in terrestrial rocks (which can only arise from events occurring during the lifetime of now extinct Sm-146 [$t_{1/2}=103$ myr]) has been an on-going quest starting with Harper and Jacobsen. The significance of Nd-142 variations is that they unequivocally reflect early silicate differentiation processes operating in the first 500 myr of Earth history, the key time period between accretion and the beginning of the rock record. The recent establishment of the existence of Nd-142 variations in ancient Earth materials has opened a new range of questions including, how widespread is the evidence of early differentiation, how do Nd-142 compositions vary with time, rock type and geographic setting, and, combined with other types of isotopic and geochemical data, what can Nd-142 isotopic variations reveal about the timing and mechanisms of early terrestrial differentiation? To explore these questions we are determining high precision Nd-142, Nd-143 and Hf-176 isotopic compositions from the oldest well preserved (3.63- 3.87 Ga), rock suites from the extensive early Archean terranes of southwest Greenland and western Australia.

Derived from text

Geochemistry; Hafnium Isotopes; Neodymium Isotopes; Precambrian Period; Reservoirs; Rocks

20070009997 NASA Johnson Space Center, Houston, TX, USA

Highly Siderophile Element Abundance Constraints on the Nature of the Late Accretionary Histories of Earth, Moon and Mars

Walker, R. J.; Puchtel, I. S.; Brandon, A. D.; Horan, M. F.; James, O. B.; [2007]; 2 pp.; In English; Lunar and Planetary Science Conference, 12-16 Mar. 2007, Houston, TX, USA

Contract(s)/Grant(s): NNG04GJ49A; NNG04GK52G; NSF EAR-02-07107; Copyright; Avail.: CASI: [A01](#), Hardcopy

The highly siderophile elements (HSE) include Re, Os, Ir, Ru, Pt and Pd. These elements are initially nearly-quantitatively stripped from planetary silicate mantles during core segregation. They then may be re-enriched in mantles via continued accretion sans continued core segregation. This suite of elements and its included long-lived radiogenic isotopes systems (Re-187 (right arrow) Os-187; Pt-190 (right arrow) Os-186) can potentially be used to fingerprint the characteristics of late accreted materials. The fingerprints may ultimately be useful to constrain the prior nebular history of the dominant late

accreted materials, and to compare the proportion and genesis of late accretionary materials added to the inner planets. The past ten years have seen considerable accumulation of isotopic and compositional data for HSE present in the Earth's mantle, lunar mantle and impact melt breccias, and Martian meteorites. Here we review some of these data and consider the broader implications of the compiled data.

Derived from text

Abundance; Siderophile Elements; Constraints; Planetary Geology; Moon; Geochronology; Mars Surface; Earth Mantle

20070010020 NASA Johnson Space Center, Houston, TX, USA

Overview of the Results of the Organics PET Study of the Cometary Samples from Comet Wild 2 by the Stardust Mission

Sandford, S. A.; Aleon, J.; Alexander, C. M. O'D.; Araki, T.; Bajt, S.; Baratta, G. A.; Borg, J.; Bradley, J. P.; Brownlee, D. E.; Brucato, J. R.; Burchell, M. J.; Busemann, H.; Butterworth, A.; Clemett, S. J.; Cody, G.; Colangeli, L.; Cooper, G., et al.; [2007]; 2 pp.; In English; Lunar and Planetary Science Conference, 12-16 Mar. 2007, Houston, TX, USA

Contract(s)/Grant(s): W-7405-eng-48; Copyright; Avail.: CASI: [A01](#), Hardcopy

STARDUST is the first mission designed to bring samples back to Earth from a known comet. The captured samples were successfully returned to Earth on 15 Jan 2006, after which they were subjected to a preliminary examination by a number of teams of scientists from around the world. This abstract describes the efforts of the Organics Preliminary Examination Team (PET). More detailed discussions of specific analyses of the samples can be found in other papers presented at this meeting by individual members of the Organics PET (see the author list above for team members). The studied Wild 2 gas and dust samples were collected by impact onto aerogel tiles and Al foils when the spacecraft flew through the coma of 81P/Wild 2 on 2 Jan 2004 at a relative velocity of approx. 6.1 kilometers per second. After recovery of the Sample Return Capsule (SRC) on 15 Jan 2006, the aerogel collector trays were removed in a clean room at JSC. After documentation of the collection, selected aerogel tiles and aluminum foils were removed and aerogel and cometary samples extracted for study.

Derived from text

General Overviews; Wild 2 Comet; Stardust Mission; Organic Materials; Sample Return Missions; Chemical Analysis; Comets

20070010021 NASA Johnson Space Center, Houston, TX, USA

Geomorphic and Aqueous Chemistry of a Portion of the Upper Rio Tinto System, Spain

Osburn, M. R.; Fernandez-Remolar, D. C.; Arvidson, R. E.; Morris, R. V.; Ming, D.; Prieto-Ballesteros, O.; Amils, R.; Stein, T. C.; Heil-Chapdelaine, V.; Friedlander, L. R.; Herndon, B.; Marlow, J.; Rosenberg, S.; Scherpker, K.; Steiner, A.; [2007]; 2 pp.; In English; Lunar and Planetary Science Conference, 12-16 Mar. 2007, Houston, TX, USA; Copyright; Avail.:

CASI: [A01](#), Hardcopy

Observations from the two Mars rovers, Spirit and Opportunity, combined with discoveries of extensive hydrated sulfate deposits from OMEGA and CRISM show that aqueous deposition and alteration involving acidic systems and sulfate deposition has been a key contributor to the martian geologic record. Rio Tinto, Spain, provides a process model for formation of sulfates on Mars by evaporation of acidic waters within shallow fluvial pools, particularly during dry seasons. We present results from a detailed investigation of an upper portion of the Rio Tinto, focusing on geomorphology, clastic sediment transport, and acidic aqueous processes. We also lay out lessons-learned for understanding sulfate formation and alteration on Mars.

Derived from text

Geomorphology; Planetary Geology; Spain; Aqueous Solutions; Rivers; Mineralogy

20070010022 NASA Johnson Space Center, Houston, TX, USA

Scientific Exploration of Near-Earth Objects via the Crew Exploration Vehicle

Abell, P. A.; Korsmeyer, D. J.; Landis, R. R.; Lu, E.; Adamo, D.; Jones, T.; Lemke, L.; Gonzales, A.; Gershman, B.; Morrison, D.; Sweetser, T.; Johnson, L.; [2007]; 1 pp.; In English; Workshop on Science Associated with the Lunar Exploration Architecture, 27 Feb. - 2 Mar. 2007, Tempe, AZ, USA; Copyright; Avail.: CASI: [A01](#), Hardcopy

The concept of a crewed mission to a near-Earth object (NEO) has been previously analyzed several times in the past. A more in depth feasibility study has been sponsored by the Advanced Projects Office within NASA's Constellation Program to examine the ability of a Crew Exploration Vehicle (CEV) to support a mission to a NEO. The national mission profile would

involve a crew of 2 or 3 astronauts on a 90 to 120 day mission, which would include a 7 to 14 day stay for proximity operations at the target NEO.

Derived from text

Near Earth Objects; Crew Exploration Vehicle; Space Missions; NASA Space Programs; Space Exploration

20070010024 NASA Johnson Space Center, Houston, TX, USA

GCR-induced Photon Luminescence of the Moon: The Moon as a CR Detector

Wilson, Thomas L.; Lee, Kerry; Andersen, Vic; February 24, 2007; 2 pp.; In English; 30th International Cosmic Ray Conference, 3-8 Jul. 2007, Merida, Yucatan, Mexico; Copyright; Avail.: Other Sources; Abstract Only

We report on the results of a preliminary study of the GCR-induced photon luminescence of the Moon using the Monte Carlo program FLUKA. The model of the lunar surface is taken to be the chemical composition of soils found at various landing sites during the Apollo and Luna programs, averaged over all such sites to define a generic regolith for the present analysis. This then becomes the target that is bombarded by Galactic Cosmic Rays (GCRs) in FLUKA to determine the photon fluence when there is no sunshine or Earthshine. From the photon fluence we derive the energy spectrum which can be utilized to design an orbiting optical instrument for measuring the GCR-induced luminescence. This is to be distinguished from the gamma-ray spectrum produced by the radioactive decay of its radiogenic constituents lying in the surface and interior. Also, we investigate transient optical flashes from high-energy CRs impacting the lunar surface (boulders and regolith). The goal is to determine to what extent the Moon could be used as a rudimentary CR detector. Meteor impacts on the Moon have been observed for centuries to generate such flashes, so why not CRs?

Author

Galactic Cosmic Rays; Moon; Photons; Detectors; Lunar Luminescence

20070010025 NASA Johnson Space Center, Houston, TX, USA

Cosmic Ray Flux in the Presence of a Neutral Background

Wilson, Thomas L.; Lodhi, Arfin; Diaz, Abel; February 24, 2007; 2 pp.; In English; 30th International Cosmic Ray Conference, 3-11 Jul. 2007, Merida, Yucatan, Mexico; Copyright; Avail.: Other Sources; Abstract Only

The study of cosmic rays (CRs) is a very mature subject developed around the concept of radiative particle flux ϕ as a mono-variant function of energy E , that is $\phi = \phi(E)$. This is based on the notion of the cosmos as being filled with cosmic radiation in the form of a collisionless exosphere of plasma. Neutrals, however, are likewise ubiquitous in space and planetary trapped-radiation belts. It will be shown that in the presence of a neutral background of density ρ , flux ϕ is actually bivariate in energy E and ρ , creating a surface $\phi(E, \rho)$. This is an intrinsic property of charged-particle flux, that flux is not merely a function of E but is dependent upon density ρ when a background of neutrals is present. The effect is produced by multiple scattering of charged particles off neutral and ionized atoms along with ionization loss where charged and neutral populations interact. For the harder portion of CR spectra, flux is mono-variant but at nonrelativistic energies (below approx, 350 MeV) it becomes sensitive to the presence of neutral backgrounds. The dependence of $\phi(E, \rho)$ upon background neutrals is helpful in discussing the anomalous CR (ACR) flux made up of ionized components of the heliospheric neutral atmosphere.

Author

Cosmic Rays; Neutral Atmospheres; Exosphere; Heliosphere

20070010026 NASA Johnson Space Center, Houston, TX, USA

The Ultimate Monte Carlo: Studying Cross-Sections With Cosmic Rays

Wilson, Thomas L.; February 24, 2007; 2 pp.; In English; 30th International Cosmic Ray Conference, 3-11 Jul. 2007, Merida, Yucatan, Mexico; No Copyright; Avail.: Other Sources; Abstract Only

The high-energy physics community has been discussing for years the need to bring together the three principal disciplines that study hadron cross-section physics - ground-based accelerators, cosmic-ray experiments in space, and air shower research. Only recently have NASA investigators begun discussing the use of space-borne cosmic-ray payloads to bridge the gap between accelerator physics and air shower work using cosmic-ray measurements. The common tool used in these three realms of high-energy hadron physics is the Monte Carlo (MC). Yet the obvious has not been considered - using a single MC for simulating the entire relativistic energy range (GeV to EeV). The task is daunting due to large uncertainties in accelerator, space, and atmospheric cascade measurements. These include inclusive versus exclusive cross-section measurements, primary composition, interaction dynamics, and possible new physics beyond the standard model. However, the discussion of a common tool or ultimate MC might be the very thing that could begin to unify these independent groups

into a common purpose. The Offline ALICE concept of a Virtual MC at CERN's Large Hadron Collider (LHC) will be discussed as a rudimentary beginning of this idea, and as a possible forum for carrying it forward in the future as LHC data emerges.

Author

Cosmic Ray Showers; Monte Carlo Method; Cross Sections; Hadrons

20070010457 NASA Glenn Research Center, Cleveland, OH, USA

Survey of Dust Issues for Lunar Seals and the RESOLVE Project

Proctor, Margaret P.; Dempsey, Paula; [2006]; 19 pp.; In English; 2006 NASA Seal/Secondary Air System Workshop, 14-15 Nov. 2006, Cleveland, OH, USA

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Lunar dust poses a technical challenge for sealing applications on the moon. A survey of seals used in Apollo lunar missions is presented as well as lunar soil characteristics and a description of the lunar environment. Seal requirements and technical challenges for the volatiles characterization oven and hydrogen reduction reaction chamber of the RESOLVE project are discussed. The purpose of the RESOLVE project is to find water or ice in lunar soil and demonstrate the ability to produce water, and hence oxygen and hydrogen, from lunar regolith for life support and propellants.

Author

Lunar Dust; Regolith; Lunar Soil; Hydrogen; Propellants; Water; Life Support Systems

20070010698 NASA Johnson Space Center, Houston, TX, USA

Thank You for Flying the Vomit Comet

Dempsey, Robert; DiLisi, Gregory A.; DiLisi, Lori A.; Santo, Gretchen; [2007]; 19 pp.; In English; Original contains color illustrations; Copyright; Avail.: CASI: [A03](#), Hardcopy

This paper describes our flight aboard NASA's C9 Weightless Wonder, more affectionately known as The Vomit Comet. The C9 is NASA's aircraft that creates multiple periods of microgravity by conducting a series of parabolic maneuvers over the Gulf of Mexico.

Derived from text

Comets; Microgravity; NASA Space Programs; C-9 Aircraft; Manned Space Flight

20070010740 NASA Johnson Space Center, Houston, TX, USA

Crystal Field Effects and Siderophile Element Partitioning: Implications for Mars HSE Geochemistry

Jones, John H.; Malavergne, V.; Neal, C. R.; [2007]; 2 pp.; In English; Lunar and Planetary Science Conference, 12-16 Mar. 2007, Houston, TX, USA; Copyright; Avail.: CASI: [A01](#), Hardcopy

Analyses of martian (SNC) meteorites indicate that Pt abundances do not vary much compared to other highly siderophile elements (HSE). Therefore, Jones et al. [1] inferred that $D(\text{Pt})$ during basalt petrogenesis was of order unity. This inference was at odds with previously published experiments that gave a $D(\text{sub ol/liq})$ for Pt of approx. 0.01 [2]. Because olivine is likely to be an important constituent of any reasonable martian mantle, the implication of these findings is that minor minerals must have $D(\text{Pt})$ much greater than 1, which seemed improbable. However, not only did the SNC evidence point to a $D(\text{sub ol/liq})$ approx. equal to 1, but so did plots of $D(\text{sub ol/liq})$ vs. ionic radius (Onuma diagram). The ionic radius of $\text{Pt}(2+)$ suggested that $D(\text{sub ol/liq})$ for Pt was of order unity, in agreement with the inferences from SNC meteorites. New experiments have failed to detect measurable Pt in olivine, even at high oxygen fugacities [3]. Therefore, some other parameter, other than ionic charge and radius, must hold sway during olivine liquid partitioning of Pt.

Author

Crystal Field Theory; Geochemistry; Siderophile Elements; Mars Surface; Petrogenesis

20070010742 NASA Glenn Research Center, Cleveland, OH, USA

The Solar System: Recent Exploration Results

Landis, Geoffrey A.; [2006]; 62 pp.; In English; Confluence, 29 Jul. 2006, Pittsburgh, PA, USA; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 361426.07.03; No Copyright; Avail.: CASI: [A04](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20070010742>

The solar system has been visited by space probes, ranging from the Mariner Mercury-Venus mission exploring inward

toward the sun, and continuing through the Voyager probes out into interstellar space and (on its way now) the New Horizons probe to Pluto and the Kuiper belt. This talk examines what we know of the planets of the solar system from probes, and talks about where we will go from here.

Author

Solar System; Space Exploration; Space Probes

20070010746 NASA Langley Research Center, Hampton, VA, USA

POST2 End-To-End Descent and Landing Simulation for the Autonomous Landing and Hazard Avoidance Technology Project

Fisher, Jody I.; Striepe, Scott A.; [2007]; 15 pp.; In English; 17th AAS/AIAA Space Flight Mechanics Meeting, 28 Jan. - Feb. 2007, Sedona, AZ, USA; Original contains color illustrations

Contract(s)/Grant(s): WBS 419680.04.07.01.02

Report No.(s): AAS-07-119; No Copyright; Avail.: CASI: [A03](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20070010746>

The Program to Optimize Simulated Trajectories II (POST2) is used as a basis for an end-to-end descent and landing trajectory simulation that is essential in determining the design and performance capability of lunar descent and landing system models and lunar environment models for the Autonomous Landing and Hazard Avoidance Technology (ALHAT) project. This POST2-based ALHAT simulation provides descent and landing simulation capability by integrating lunar environment and lander system models (including terrain, sensor, guidance, navigation, and control models), along with the data necessary to design and operate a landing system for robotic, human, and cargo lunar-landing success. This paper presents the current and planned development and model validation of the POST2-based end-to-end trajectory simulation used for the testing, performance and evaluation of ALHAT project system and models.

Author

Optimization; Autonomy; Hazards; Technology Utilization; Lunar Landing; Avoidance; Landing Simulation

20070010747 NASA Langley Research Center, Hampton, VA, USA

Huygens Titan Probe Trajectory Reconstruction Using Traditional Methods and the Program to Optimize Simulated Trajectories II

Striepe, Scott A.; Blanchard, Robert C.; Kirsch, Michael F.; Fowler, Wallace T.; [2007]; 28 pp.; In English; 17th AAS/AIAA Space Flight Mechanics Meeting, 28 Jan. - 1 Feb. 2007, Sedona, AZ, USA

Contract(s)/Grant(s): WBS 843515.02.01.07.05.06.01

Report No.(s): AAS-07-226; Copyright; Avail.: CASI: [A03](#), Hardcopy

On January 14, 2005, ESA's Huygens probe separated from NASA's Cassini spacecraft, entered the Titan atmosphere and landed on its surface. As part of NASA Engineering Safety Center Independent Technical Assessment of the Huygens entry, descent, and landing, and an agreement with ESA, NASA provided results of all EDL analyses and associated findings to the Huygens project team prior to probe entry. In return, NASA was provided the flight data from the probe so that trajectory reconstruction could be done and simulation models assessed. Trajectory reconstruction of the Huygens entry probe at Titan was accomplished using two independent approaches: a traditional method and a POST2-based method. Results from both approaches are discussed in this paper.

Author

Huygens Probe; Simulation; Trajectory Optimization; Titan Atmosphere

20070010748 NASA Goddard Space Flight Center, Greenbelt, MD, USA

The Space Infrared Interferometric Telescope (SPIRIT): High-resolution Imaging and Spectroscopy in the Far-infrared

Leisawitz, D.; Baker, G.; Barger, A.; Benford, D.; Blain, A.; Boyle, R.; Broderick, R.; Budinoff, J.; Carpenter, J.; Caverly, R.; Chen, P.; Cooley, S.; Cottingham, C.; Crooke, J.; DiPietro, D.; Femiano, M.; Ferrer, A.; Fischer, J.; Gardner, J.; Hallock, L.; Harris, K.; Hartman, K.; Harwit, M.; Hillenbrand, L.; Hyde, T.; [2007]; 1 pp.; In English; Committee on Space Research Conference 'Advances in Far Infrared and Submillimeter Astrophysics', 17-19 Jul, 2006, Beijing, China; Copyright;

Avail.: Other Sources; Abstract Only

We report results of a recently-completed study of SPIRIT, a candidate NASA Origins Probe. SPIRIT is a spatial and spectral interferometer with an operating wavelength range 25 - 400 microns. SPIRIT will provide sub-arcsecond resolution images and spectra with resolution $R = 3000$ in a 1 arcmin field of view to accomplish three primary scientific objectives: (1)

Learn how planetary systems form from protostellar disks, and how they acquire their chemical organization; (2) Characterize the family of extrasolar planetary systems by imaging the structure in debris disks to understand how and where planets form, and why some planets are ice giants and others are rocky; and (3) Learn how high-redshift galaxies formed and merged to form the present-day population of galaxies. Observations with SPIRIT will be complementary to those of the James Webb Space Telescope and the ground-based Atacama Large Millimeter Array. All three observatories could be operational contemporaneously. SPIRIT will pave the way to the 1 km maximum baseline interferometer known as the Submillimeter Probe of the Evolution of Cosmic Structure (SPECS). In addition to the SPIRIT mission concept, this talk will emphasize the importance of dense u-v plane coverage and describe some of the practical considerations associated with alternative interferometric baseline sampling schemes.

Author

High Resolution; Imaging Techniques; Infrared Telescopes; Interferometers; Spectroscopy; Far Infrared Radiation

20070010749 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Origin and Evolution of Nitrogen on Titan, Enceladus, Triton, and Pluto

Atreya, S. K.; Niemann, H. B.; Mahaffy, P. R.; Owen, T. C.; [2007]; 1 pp.; In English; European Planetary Science Congress 2006, 16-23 Sept. 2006, Berlin, Germany; Copyright; Avail.: Other Sources; Abstract Only

Nitrogen, together with carbon, hydrogen, oxygen, phosphorus and sulfur (CHNOPS), plays a central role in life as we know it. Indeed, molecular nitrogen is the most abundant component of the terrestrial atmosphere, and second only to carbon dioxide on Mars and Venus. The Voyager and Cassini-Huygens observations show that copious nitrogen is present on Titan also, comprising some 95% by volume of this moon's 1500 millibar atmosphere. After water vapor, it may be the most abundant (4%) of the gases around tiny Enceladus, as revealed by the recent Cassini observations. A thin nitrogen atmosphere is found even on the coldest of the solar system bodies, Triton and Pluto. The available evidence on nitrogen isotopes and the heavy noble gases suggests that Titan acquired its nitrogen largely in the form of ammonia. Subsequent chemical evolution, beginning with the photolysis of NH₃ on primordial Titan, led to the nitrogen atmosphere we see on Titan today. This is also the scenario for the origin of nitrogen on the terrestrial planets. Contrary to Titan, the colder outer solar system objects, Triton and Pluto, neither had the luxury of receiving much ammonia in the first place, nor of photolyzing whatever little ammonia they did receive in the planetesimals that formed them. On the other hand, it is plausible the planetesimals were capable of trapping and delivering molecular nitrogen directly to Triton and Pluto, unlike Titan. The origin of nitrogen on Enceladus is somewhat enigmatic. A scenario similar to Titan's, but with a role for the interior processes, may be at work. In this paper, we will discuss the source and loss of nitrogen for the above objects, and why Ganymede, the largest moon in the solar system, is nitrogen starved.

Author

Enceladus; Ganymede; Nitrogen; Titan; Pluto Atmosphere; Satellite Atmospheres; Atmospheric Chemistry; Atmospheric Composition

20070010753 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Lunar Dust Characterization for Exploration Life Support Systems

Agui, Juan H.; [2007]; 10 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): WBS 516572.04.02.01.02; No Copyright; Avail.: CASI: A02, Hardcopy

ONLINE: <http://hdl.handle.net/2060/20070010753>

Lunar dust effects can have a significant impact on the performance and maintenance of future exploration life support systems. Filtration systems will be challenged by the additional loading from lunar dust, and mitigation technology and strategies have to be adapted to protect sensitive equipment. An initial characterization of lunar dust and simulants was undertaken. The data emphasize the irregular morphology of the dust particles and the frequency dependence of lunar dust layer detachment from shaken surfaces.

Author

Life Support Systems; Lunar Dust; Filtration; Morphology; Characterization

92
SOLAR PHYSICS

Includes solar activity, solar flares, solar radiation and sunspots. For related information see *93 Space Radiation*.

20070009843 NASA Marshall Space Flight Center, Huntsville, AL, USA

An Examination of Sunspot Number Rates of Growth and Decay in Relation to the Sunspot Cycle

Wilson, Robert M.; Hathaway, David H.; June 2006; 36 pp.; In English; Original contains black and white illustrations

Report No.(s): NASA/TP-2006-214433; M-1165; No Copyright; Avail.: CASI: [A03](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20070009843>

On the basis of annual sunspot number averages, sunspot number rates of growth and decay are examined relative to both minimum and maximum amplitudes and the time of their occurrences using cycles 12 through present, the most reliably determined sunspot cycles. Indeed, strong correlations are found for predicting the minimum and maximum amplitudes and the time of their occurrences years in advance. As applied to predicting sunspot minimum for cycle 24, the next cycle, its minimum appears likely to occur in 2006, especially if it is a robust cycle similar in nature to cycles 17-23.

Author

Sunspot Cycle; Sunspots; Sun; Decay Rates

20070009876 NASA Johnson Space Center, Houston, TX, USA

Badhwar-O'Neil 2007 Galactic Cosmic Ray (GCR) Model Using Advanced Composition Explorer (ACE) Measurements for Solar Cycle 23

O'Neill, P. M.; [2007]; 5 pp.; In English; IEEE Nuclear and Space Radiation Effects Conference, 23-27 Jul. 2007, Honolulu, HI, USA

Contract(s)/Grant(s): 401769.06.01.01.01; No Copyright; Avail.: CASI: [A01](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20070009876>

Advanced Composition Explorer (ACE) satellite measurements of the galactic cosmic ray flux and correlation with the Climax Neutron Monitor count over Solar Cycle 23 are used to update the Badhwar O'Neil Galactic Cosmic Ray (GCR) model.

Author

Advanced Composition Explorer; Galactic Cosmic Rays; Satellite Observation; Solar Cycles; Mathematical Models

20070010586 NASA Goddard Space Flight Center, Greenbelt, MD, USA

First Results from EUNIS-06

Rabin, Douglas M.; Thomas, R. J.; Davila, J. M.; April 17, 2006; 2 pp.; In English; Solar Physics Division Meeting, 25-30 Jun. 2006, Durham, NH, USA; No Copyright; Avail.: Other Sources; Abstract Only

The Extreme Ultraviolet Normal-Incidence Spectrograph (EUNIS) sounding rocket experiment successfully completed its first flight on 12 April 2006 from White Sands Missile Range, obtaining 145 science images in each of two wavelength channels. EUNIS is designed to investigate the energetics of the solar corona and hotter transition region through high-resolution imaging spectroscopy with a rapid (2-3 second) cadence. The two independent optical systems of EUNIS simultaneously record spectra over two passbands (170-205 Angstroms and 300-370 Angstroms), each spatially resolved along slit lengths of about 660 arcsec. The longwave channel includes He II 304 Angstroms and strong lines from Fe XI-XVI. The shortwave passband has a sequence of very strong Fe IX-XIII lines. Together, the EUNIS telescopes furnish a wide range of temperature and density diagnostics and enables underflight calibration of instrumental passbands on the SOHO, TRACE, Solar-B and STEREO missions. We present an overview of the science images from the first flight with emphasis on transient phenomena. The target was active region NOAA 10871 and adjacent quiet areas. Spectra were recorded with exposure times as short as 0.1 s, demonstrating that EUNIS is the most sensitive solar EUV spectrograph in operation, with over 100 times the throughput of its predecessor, the Solar Extreme ultraviolet Research Telescope and Spectrograph (SERTS). EUNIS is supported by the NASA Heliophysics Division's Solar & Heliospheric Physics Supporting Research and Technology and Low Cost Access to Space Program.

Author

Extreme Ultraviolet Radiation; Spectrographs; Incidence; Sounding Rockets; Solar Physics; Ultraviolet Telescopes

20070010724 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Multispacecraft Observations of Solar Flare Particles in the Inner Heliosphere

Wibberenz, G.; Cane, H. V.; [2007]; 27 pp.; In English; To appear in *The Astrophysical Journal*; Original contains black and white illustrations

Contract(s)/Grant(s): NCC5-637; Copyright; Avail.: CASI: [A03](#), Hardcopy

For a number of impulsive solar particle events we examine variations of maximum intensities and times to maximum intensity as a function of longitude, using observations from the two Helios spacecraft and near the Earth. We find that electrons in the MeV range can be detected more than 80 deg. from the flare longitude, corresponding to a considerably wider 'well connected' region than that (approx. 20 deg. half width) reported for He-3-rich impulsive solar events. This wide range and the decrease of peak intensities with increasing connection angle revive the concept of some propagation process in the low corona that has a diffusive nature. Delays to the intensity maximum are not systematically correlated with connection angles. We argue that interplanetary scattering parallel to the average interplanetary magnetic field, that varies with position in space, plays an important role in flare particle events. In a specific case variations of the time profiles with radial distance and with particle rigidity are used to quantitatively confirm spatial diffusion. For a few cases near the edges of the well connected region the very long times to maximum intensity might result from interplanetary lateral transport.

Author

Heliosphere; Solar Corpuscular Radiation; Solar Flares; Helios 1; Helios 2; Explorer 50 Satellite

20070010752 NASA Glenn Research Center, Cleveland, OH, USA

The Solar Spectrum on the Martian Surface and its Effect on Photovoltaic Performance

Landis, Geoffrey A.; Hyatt, Daniel; [2007]; 4 pp.; In English; 4th World Conference on Photovoltaic Energy Conversion, 7-12 May 2006, Waikoloa, HI, USA; Original contains color illustrations

Contract(s)/Grant(s): WBS 22-390-30-20; Copyright; Avail.: CASI: [A01](#), Hardcopy

Solar cells operating on the surface of Mars receive a spectrum of illumination different from the AM0 spectrum, since the sunlight is filtered by dust suspended in the atmosphere. This spectrum changes with the amount of dust in the atmosphere, as well as with air mass change due to time of day and season. This spectral variation affects the performance of solar cells. We used data from Mars Exploration Rovers to measure this spectrum. By comparing the measured intensity with the known reflectance of the pancam calibration target on the rovers Spirit and Opportunity, we measure the solar spectrum reaching the surface. The effect of this spectrum on the performance of solar cells is then calculated based on the spectral response of several different solar cell types.

Author

Solar Cells; Mars Surface; Photovoltaic Conversion; Solar Spectra; Dust; Calibrating; Spectral Sensitivity

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*.

20070009850 NASA Langley Research Center, Hampton, VA, USA

The Exploration Atmospheres Working Group's Report on Space Radiation Shielding Materials

Barghouty, A. F.; Thibeault, S. A.; September 2006; 32 pp.; In English; Original contains color and black and white illustrations

Report No.(s): NASA/TM-2006-214604; M-1173; No Copyright; Avail.: CASI: [A03](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20070009850>

This part of Exploration Atmospheres Working Group analyses focuses on the potential use of nonmetallic composites as the interior walls and structural elements exposed to the atmosphere of the spacecraft or habitat. The primary drive to consider nonmetallic, polymer-based composites as an alternative to aluminum structure is due to their superior radiation shielding properties. But as is shown in this analysis, these composites can also be made to combine superior mechanical properties with superior shielding properties. In addition, these composites can be made safe; i.e., with regard to flammability and toxicity, as well as 'smart' i.e., embedded with sensors for the continuous monitoring of material health and conditions. The analysis main conclusions are that (1) smart polymer-based composites are an enabling technology for safe and reliable exploration missions, and (2) an adaptive, synergetic systems approach is required to meet the missions

requirements from structure, properties, and processes to crew health and protection for exploration missions.

Author

Radiation Shielding; Extraterrestrial Radiation; Flammability; Toxicity; Spacecrews; Aerospace Medicine

20070010704 NASA Johnson Space Center, Houston, TX, USA

Space Radiation Organ Doses for Astronauts on Past and Future Missions

Cucinotta, Francis A.; [2007]; 32 pp.; In English; Original contains color illustrations; No Copyright; Avail.: CASI: [A03](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20070010704>

We review methods and data used for determining astronaut organ dose equivalents on past space missions including Apollo, Skylab, Space Shuttle, NASA-Mir, and International Space Station (ISS). Expectations for future lunar missions are also described. Physical measurements of space radiation include the absorbed dose, dose equivalent, and linear energy transfer (LET) spectra, or a related quantity, the lineal energy (y) spectra that is measured by a tissue equivalent proportional counter (TEPC). These data are used in conjunction with space radiation transport models to project organ specific doses used in cancer and other risk projection models. Biodosimetry data from Mir, STS, and ISS missions provide an alternative estimate of organ dose equivalents based on chromosome aberrations. The physical environments inside spacecraft are currently well understood with errors in organ dose projections estimated as less than plus or minus 15%, however understanding the biological risks from space radiation remains a difficult problem because of the many radiation types including protons, heavy ions, and secondary neutrons for which there are no human data to estimate risks. The accuracy of projections of organ dose equivalents described here must be supplemented with research on the health risks of space exposure to properly assess crew safety for exploration missions.

Author

Organs; Extraterrestrial Radiation; Space Missions; Radiation Dosage; Astronauts; NASA Space Programs

99

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.

20070009762 British National Space Centre, London, UK

space:uk, January 2007, Issue 21

Bibi, Azara, Editor; January 2007; 28 pp.; In English; Original contains color illustrations; Copyright; Avail.: Other Sources

The cover article in this issue is about Asteroid impact, and preparing for the worst. The other articles in this issue are: UK in Moon talks with NASA, monitoring drug crops and the 'face on Mars' proof at last. Fifty years and counting: The early years: inside the UK's rocket programme. Where are our Spacecraft? Catching up with Europe's space science missions. The Name Game How do planets get their names? Ask The Experts Our: panel answers questions on satellites, stars and space elevators. Have you got the right stuff to work in the space industry?

CASI

Space Missions; Periodicals; Asteroid Collisions; European Space Programs; UK Space Program

20070010478 University of Central Florida, Orlando, FL, USA

2001 Research Reports NASA/ASEE Summer Faculty Fellowship Program

October 2001; 205 pp.; In English; Original contains black and white illustrations

Contract(s)/Grant(s): NAG10-299

Report No.(s): NASA/CR-2001-210265; No Copyright; Avail.: CASI: [A10](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20070010478>

This document is a collection of technical reports on research conducted by the participants in the 2001 NASMASEE Summer Faculty Fellowship Program at the Kennedy Space Center (KSC). This was the 17th year that a NASMASEE program has been conducted at KSC. The 2001 program was administered by the University of Central Florida (UCF) in cooperation with KSC. The program was operated under the auspices of the American Society for Engineering Education (ASEE) with sponsorship and funding from the Education Division, NASA Headquarters, Washington, D.C., and KSC. The KSC Program

was one of nine such Aeronautics and Space Research Programs funded by NASA in 2001. The KSC Faculty Fellows spent ten weeks working with NASA scientists and engineers on research of mutual interest to the university faculty member and the NASA colleague. The editors of this document were responsible for selecting appropriately qualified faculty to address some of the many research areas of current interest to NASA/KSC. The NASMASEE program is intended to be a two-year program to allow in-depth research by the university faculty member.

Author

Space Programs; Education; Engineers; Scientists; Research and Development

20070010578 NASA Langley Research Center, Hampton, VA, USA

A Longitudinal Analysis of the Causal Factors in Major Maritime Accidents in the USA and Canada (1996-2006)

Johnson, C. W.; Holloway, C. M.; [2007]; 20 pp.; In English; Safety-Critical Systems Symposium 2007, 13-15 Feb. 2007, Bristol, UK; Original contains color illustrations

Contract(s)/Grant(s): WBS 23-090-21-TF; Copyright; Avail.: CASI: [A03](#), Hardcopy

Accident reports provide important insights into the causes and contributory factors leading to particular adverse events. In contrast, this paper provides an analysis that extends across the findings presented over ten years investigations into maritime accidents by both the US National Transportation Safety Board (NTSB) and Canadian Transportation Safety Board (TSB). The purpose of the study was to assess the comparative frequency of a range of causal factors in the reporting of adverse events. In order to communicate our findings, we introduce J-H graphs as a means of representing the proportion of causes and contributory factors associated with human error, equipment failure and other high level classifications in longitudinal studies of accident reports. Our results suggest the proportion of causal and contributory factors attributable to direct human error may be very much smaller than has been suggested elsewhere in the human factors literature. In contrast, more attention should be paid to wider systemic issues, including the managerial and regulatory context of maritime operations.

Author

Human Factors Engineering; Human Performance; Transportation; Safety Management

20070010694 Lumein Intellectual Property Services, Inc., Palo Alto, CA, USA

GPS INS Vehicle Attitude System

Alban, S.; Rock, S. M.; Powell, J. D.; 17 Sep 04; 32 pp.; In English

Patent Info.: Filed Filed 17 Sep 04; US-Patent-Appl-SN-10-944 458

Report No.(s): PB2007-103150; No Copyright; Avail.: CASI: [A03](#), Hardcopy

Systems are provided to increase the robustness of a low-cost GPS system by coupling it with an INS system, and by using one-satellite attitude determination in conjunction with the traditional multiple-satellite method. The system has demonstrated accuracy and robustness approaching needed standards for automobile control systems. The applications of this system are abundant, including real-time vehicle system ID, slip angle estimation, position estimation by GPS and dead reckoning, as well as sophisticated control systems.

NTIS

Attitude Control; Global Positioning System; Patent Applications

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