



**National Aeronautics and
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Langley Research Center**

**Scientific and Technical
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Scientific and Technical Aerospace Reports

STAIR

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NASA STI Program ... in Profile

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

The NASA STI Program

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

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

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

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NASA Center for AeroSpace Information (CASI)

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

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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>.

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

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

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[Subject Term Index](#)

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SCIENTIFIC AND TECHNICAL AEROSPACE REPORTS

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01

AERONAUTICS (GENERAL)

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

20070035108 American Inst. of Aeronautics and Astronautics, Reston, VA, USA

Better Vibrations for Turboprop Technology

Butterworth-Hayes, Philip; Aerospace America; July 2007; Volume 45, No. 7, pp. 4-6; In English; Original contains black and white illustrations; Copyright; Avail.: Other Sources

This article reviews the unducted fan (or 'open rotor') engine as a possible replacement technology for the CFM-56 range of engines. One company's solution is the LEAP56, or Leading Edge Aviation Propulsion next-generation engine. The program's goals, in terms of improvements over current CFM-56 engines, are 10-15% lower specific fuel consumption, 15-25% lower maintenance costs, 25% longer initial on-wing life, 15- EPNdB lower noise levels, and 50% fewer noxious emissions. Another company has chosen a slightly more radical design route in a geared turbofan, and reportedly has already demonstrated 10% operating cost improvements, 9% reductions in fuel burn, and lower noise and emission levels. And eliminating more than half the airfoils in the compressor and turbine sections should make maintenance costs substantially lower, too. Another company is returning to the concept of open rotors. By eliminating the nacelle, open rotors reduce drag and weight, and open-rotor engines can be developed with bypass ratios of, potentially, 35:1 and more. They should have 10% better fuel efficiency than the proposed LEAP56, according to the company. However, the problem with open rotors is that compared with more conventional jet engines, they vibrate more and are very noisy.

CASI

Rotors; Replacing; Aircraft Engines; Turboprop Engines; Turbofan Engines

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.

20070035069 NASA Langley Research Center, Hampton, VA, USA

Effective Inflow Conditions for Turbulence Models in Aerodynamic Calculations

Spalart, Philippe R.; Rumsey, Christopher L.; [2007]; 14 pp.; In English; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 561581.02.08; Copyright; Avail.: CASI: [A03](#), Hardcopy

The selection of inflow values at boundaries far upstream of an aircraft is considered, for one- and two-equation turbulence models. Inflow values are distinguished from the ambient values near the aircraft, which may be much smaller. Ambient values should be selected first, and inflow values that will lead to them after the decay second; this is not always possible, especially for the time scale. The two-equation decay during the approach to the aircraft is shown; often, the time scale has been set too short for this decay to be calculated accurately on typical grids. A simple remedy for both issues is to impose floor values for the turbulence variables, outside the viscous sublayer, and it is argued that overriding the equations in this manner is physically justified. Selecting laminar ambient values is easy, if the boundary layers are to be tripped, but a more common practice is to seek ambient values that will cause immediate transition in boundary layers. This opens up a

wide range of values, and selection criteria are discussed. The turbulent Reynolds number, or ratio of eddy viscosity to laminar viscosity has a huge dynamic range that makes it unwieldy; it has been widely mis-used, particularly by codes that set upper limits on it. The value of turbulent kinetic energy in a wind tunnel or the atmosphere is also of dubious value as an input to the model. Concretely, the ambient eddy viscosity must be small enough to preserve potential cores in small geometry features, such as flap gaps. The ambient frequency scale should also be small enough, compared with shear rates in the boundary layer. Specific values are recommended and demonstrated for airfoil flows

Author

Upstream; Boundary Layers; Turbulence Models; Mathematical Models; Dynamic Range

20070035084 NASA Langley Research Center, Hampton, VA, USA

Unsteady Flowfield around Tandem Cylinders as Prototype for Component Interaction in Airframe Noise

Khorrami, Mehdi R.; Choudhari, Meelan M.; Lockhard, David P.; Jenkins, Luther N.; McGinley, Catherine B.; [2007]; 30 pp.; In English; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 561581.02.08; No Copyright; Avail.: Other Sources

The current effort is aimed at characterizing the details of the flow interaction and wake interference effects between two cylinders in a tandem configuration. This setup is viewed to be representative of several component-level flow interactions that occur when air flows over the main landing gear of large civil transports. Interactions of this type are likely to have a significant impact on the noise radiation associated with the aircraft undercarriage. The paper is focused on two-dimensional, time-accurate flow simulations of tandem cylinder configurations. Results of the unsteady Reynolds Averaged Navier-Stokes (URANS) computations with a two-equation turbulence model run at a Reynolds number of 1.66×10^5 and a Mach number of 0.166 are presented. Two distinct flow regimes of interest, associated with short and intermediate separation distances between the two cylinders, are considered. Emphasis is placed on understanding both the time-averaged and unsteady flow features between the two cylinders and in the wake of the rear cylinder. Predicted mean flow quantities and vortex shedding frequencies show reasonable agreement with measured data for both cylinder spacings. Computations for the short separation distance exhibit a non physical decay of flow unsteadiness with time; however, the predicted sensitivity of the mean lift coefficient to small variations in the upstream flow angularity explains the asymmetric flowfield observed in the present measurements and by previous investigators.

Author

Aerodynamic Interference; Air Flow; Flow Characteristics; Flow Distribution; Undercarriages; Unsteady Flow; Reynolds Averaging; Two Dimensional Flow; Turbulence Models

20070035175 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

Performing Particle Image Velocimetry in a Supersonic Wind Tunnel Using Carbon Dioxide as the Seed Material

Peltier, III, Donald W; Jun 2007; 230 pp.; In English; Original contains color illustrations

Report No.(s): AD-A470088; AFIT/GAE/ENY/07-J17; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470088>

Particle image velocimetry (PIV) was performed utilizing clean seed particles generated by injecting liquid carbon dioxide (CO₂) directly into an open-circuit blowdown Mach 2.9 supersonic wind tunnel. Rapid atomization and cooling of the liquid CO₂ created a preponderance of nearly uniform and well dispersed microscopic dry ice particles which were illuminated using a frequency double Nd:YAG laser. Ample light was scattered from the flow tracers, which provided a strong signal to noise ratio. The particles completely sublimed into an innocuous gas downstream of the test section causing no side effects or problems with wind tunnel operation. A variety of geometries were inspected using PIV. In addition to empty test section characterization, flow aft of a cone and transverse injection through a long shallow cavity was visualized and adaptive cross-correlation vector maps were computed. These vector maps revealed many relevant flow structures pertinent to each test setup. Measured velocities followed the trends expected for each test setup but the vector magnitudes were shifted 3-9% below those predicted by theory. Procedures and information pertinent to liquid CO₂ injection are provided to help researchers implement this process in similarly scaled supersonic wind tunnels.

DTIC

Carbon Dioxide; Particle Image Velocimetry; Seeds; Supersonic Wind Tunnels

20070035177 Teledyne Scientific and Imaging, LLC, Thousand Oaks, CA USA

High Fidelity Multidisciplinary Tool Development for Helicopter Quieting

Chen, Chung-Lung; Chen, Ya-Chi; Chen, Bing; Jain, Rohit; Lund, Tom; Zhao, Hongwu; Wang, Z -J; Sun, Yuzhi; Saberi, Hossein; Shih, T -H; May 18, 2007; 22 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W911NF-04-C-0102

Report No.(s): AD-A470091; 71250; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470091>

Flows over helicopter blades are very complex turbulent flows. The blades experience dramatically different flow field at various azimuthal angles. Also, a rotor normally consists of many elastic blades, with a strong coupling between aerodynamics and structure. The problem is indeed multidisciplinary. Current helicopter blade designers use computational models, which depend heavily on experimental data and cannot be used to predict any novel design, which is a significant departure from existing designs. To simulate this multiscale and multidisciplinary physics with confidence, we have developed a robust multidisciplinary computational tool called WINDUS-HELI based on the WIND-US code by coupling CFD with CSD, adopting state-of-the-art numerical approaches, and applying high fidelity physics models. Very reasonable results have been obtained for both the aerodynamic loads/performance and acoustics predictions for all the validation cases studied. In summary, the WIND-US based helicopter rotor code coupled with RCAS and WOPWOP-PSU has been developed. The UH60A calculations are in good agreement with experimental data. The high-order spectral difference code demonstrates its potential for capturing the rotor wake. Additional validation of codes for dynamic stall and blade-vortex interaction are still required.

DTIC

Acoustics; Computational Fluid Dynamics; Dynamic Response; Dynamic Structural Analysis; Helicopters; Mathematical Models

20070035514 Micro Analysis and Design, Inc., Boulder, CO USA

Multisensory Integration for Pilot Spatial Orientation

Small, Ronald L; Keller, John W; Wickens, Christopher D; Socash, Connie M; Ronan, Ann M; Fisher, Alia M; Sep 2006; 162 pp.; In English

Contract(s)/Grant(s): FA8650-04-C-6457; Proj-3005

Report No.(s): AD-A470352; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This program modeled pilot spatial disorientation illusions as part of a real-time illusion detection and aiding system. The models and detection algorithms focus on human vestibular responses to aircraft motion. The aiding portion of the product was part of a comprehensive approach to combating the adverse effects of SD on military and civilian pilots. Four experiments supported the detection and aiding calculations. Two focused on creating vestibular illusions and quantifying pilot perception of those illusions for the models. The other two experiments focused on the aiding portion of the system and tested an innovative visual cue as well as the efficacy of voice and tactile commands for recovering for unusual attitudes. The vestibular models formed the foundation of a tool for post hoc flight data analysis from SD mishaps. Twelve total data sets were analyzed to help fine-tune the tool. The program was very successful.

DTIC

Aircraft Safety; Attitude (Inclination); Disorientation; Flight; Flight Safety; Hearing; Pilots

20070035805 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

Process Improvements for the AH-64 Tail Rotor Vibration Analysis

Newkirk, Mark C; Jun 2007; 97 pp.; In English; Original contains color illustrations

Report No.(s): AD-A470136; AFIT/GAE/ENY/07-J15; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470136>

The Apache was the first helicopter of its kind to fly with the tail rotor blade offset by 55 degrees as opposed to the traditional 90 degrees. Current balancing methods approximate the rotor system as a traditional 4 bladed, same plane system with different weight sensitivity coefficients for each set of blades. The Apache tail rotor computer model was built using the Rotorcraft Comprehensive Analysis System (RCAS) program. The objective was not to develop solutions for the sensitivity coefficients, but to identify predictive trends that result from the tail rotor blade location. Currently, sensitivity coefficients applied to the adjustment algorithms of the Aviation Vibration Analyzer (AVA) processor are broken down into an outer blade coefficient and an inner blade coefficient. Evidence from the computer simulation results computed in this research showed that the sensitivities depended on the quadrant the phase fell into, not the relationship between the inner and outer blades. That

would mean every blade would have two sensitivity coefficients, one for the adjacent 55 degree quadrant and one for the adjacent 125 degree quadrant. Information collected from RCAS provides enough validation that changes should be made in the process and the next steps should be taken to determining more accurate sensitivity coefficients for the Apache tail rotor balancing procedures.

DTIC

AH-64 Helicopter; Dynamic Structural Analysis; Mathematical Models; Rotary Wings; Tail Rotors

20070035807 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

The Aerodynamic Performance of the Houck Configuration Flow Guides

Killian, Dermot N; Jun 2007; 184 pp.; In English; Original contains color illustrations

Report No.(s): AD-A470086; AFIT/GAE/ENY/07-J09; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470086>

In an effort to explore efficient wing designs for UAV's, the Air Force is investigating the patented Houck Aircraft Configuration, which is a joined-wing aircraft with curved flow guides of varying camber connecting the upper and lower wingtips. Models were drawn in three-dimensions using Solidworks(registered) with upper and lower wings drawn as identical NACA 2412 airfoil sections for all models. A variety of airfoil sections between the upper and lower wingtips were drawn and rotated to achieve a combination of cant and angle of attack variation. Subsequently, a solid part was lofted through these sections and merged with the upper and lower wings. Each model was built by a rapid prototype machine. A six-component balance in the AFIT low-speed wind tunnel provided measurements yielding the aerodynamic data of each model. Comparisons are made to the same basic planform area without flow guides and to a case where the wingtips are joined with a flat plate. At a Reynolds number of 38K, the increase in skin friction drag outweighed any possible reduction of induced drag. However for Reynolds numbers in the 57K to 120K range, improvements in L/Dmax of about 2-5% over the no flow guide case were measured.

DTIC

Aerodynamic Characteristics; Aerodynamics; Wings

20070035811 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

Structural Stability of a Joined-Wing Sensorcraft

Adams, Brandon J; Jun 2007; 129 pp.; In English; Original contains color illustrations

Report No.(s): AD-A470037; AFIT/GAE/ENY/07-J01; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470037>

This thesis employed a multi-disciplinary design approach to determine the structural stability of the Boeing Joined-Wing SensorCraft. Specifically, this thesis sought to characterize the free vibration modes, ensure a buckling safe design and determine the influence of the geometric and aeroelastic nonlinearities associated with this joined-wing design. The clamped free vibration modes were developed for a wind tunnel model and were compared to the free-free vibration modes, several differences were found. Linear static analyses were performed on numerous maneuver loads and gust conditions to determine the critical loading condition. The SensorCraft was then redesigned for the critical load case to be both panel and global buckling safe. The multi-disciplinary design process which incorporated both geometric nonlinearities and aeroelastic follower-force effects was then performed for the pre-gust trim and critical gust conditions. The resulting analysis showed that the deformations that resulted from the aerodynamic forces were not substantial enough to fully characterize the follower force effect. Furthermore this thesis demonstrates that the geometric and aeroelastic nonlinearities are not significant. However, for a fully optimized design incorporation of these coupled nonlinearities is critical.

DTIC

Aerodynamic Forces; Body-Wing Configurations; Structural Analysis; Structural Stability; Wings

20070035822 Air Force Flight Test Center, Edwards AFB, CA USA

USAF TPS L-23 Shear Wind Observed Optimized Path Investigation for NASA (SENIOR ShWOOPIN)

Gordon, Randy; Fails, Robert; Baase, Solomon; Eckberg, Jason; Ryan, Charles; Smith, Chris; Jun 2006; 78 pp.; In English Report No.(s): AD-A470169; AFFTC-TIM-06-02; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470169>

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

viability of aircraft endurance enhancement through the extraction of energy from horizontal wind gradients. Eighty-eight test sorties were performed from 15 March -3 May 2006 under Job Order Number (JON) M06C0100. The six member SENIOR ShWOOPIN test team from TPS Class OSE performed the testing at the North Base facilities of Edwards AFB. Flight testing gathered sailplane flight state and energy height data during the course of several Dynamic Soaring maneuvers through horizontal wind shears as well as calm winds. Data were recorded and reduced post flight.

DTIC

Wind Shear; Flight Tests; Aerodynamic Drag; Lift Drag Ratio

20070035887 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

Structural Optimization of a Distributed Actuation System in a Flexible In-Plane Morphing Wing

Westfall, James T; Jun 2007; 111 pp.; In English; Original contains color illustrations

Report No.(s): AD-A470137; AFIT/GAE/ENY/07-M22; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470137>

Structural weight and efficiency are hurdles for morphing aircraft being realizable on the full-scale level. The optimal distribution and orientation of actuators throughout an in-plane flexible morphing wing structure is investigated. The drive to minimize structural weight causes a wing to be more flexible and the location and orientation of the actuators become more critical as the structure becomes more flexible. NextGen's N-MAS morphing wing is used as a case study. The wing is modeled as a number of unit cells assembled in a scissor-like structure, each comprised of four linkages pinned together and an actuator. The flexible skin of the wing is modeled with a nonlinear material stretched between two opposing vertices. It will be shown that the optimal orientation of the actuators will vary depending on the loading conditions and initial configuration of the wing. Sequential quadratic programming (SQP) optimization techniques are utilized to orient those actuators and effectively size the members of the structure. The goal is to minimize weight while maximizing the geometric advantage and efficiency. The constraints are member stresses and the force transferred to the actuators is not to be greater than the force the actuator is able to produce. Matlab(R) code is developed to do the SQP optimization while NASTRAN(TM) is utilized to do the nonlinear finite element analysis required to evaluate the objective function and constraints. The single-cell results are compared to experimental data to validate the finite element model (FEM) and optimization routine. A three-cell experiment is designed by utilizing aeroelastic scaling techniques. Matlab is used to develop the scaling problem while the actual scaling is done as an optimization in NASTRAN. The objective for scaling the wing is to minimize the differences in the non-dimensional displacements and strain energies between the two models, using the element cross-sectional dimensions as design variables.

DTIC

Wings; Flexible Wings; Structural Engineering; Structural Weight; Aircraft Design

20070035924 NASA, Washington, DC, USA

Facing the Heat Barrier: A History of Hypersonics

Heppenheimer, Thomas A.; November 2007; 194 pp.; In English; Original contains color and black and white illustrations

Report No.(s): NASA/SP-2007-4232; No Copyright; Avail.: CASI: [EA4](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20070035924>

Hypersonics is the study of flight at speeds where aerodynamic heating dominates the physics of the problem. Typically this is Mach 5 and higher. Hypersonics is an engineering science with close links to supersonics and engine design. Within this field, many of the most important results have been experimental. The principal facilities have been wind tunnels and related devices, which have produced flows with speeds up to orbital velocity. Why is it important? Hypersonics has had two major applications. The first has been to provide thermal protection during atmospheric entry. Success in this enterprise has supported ballistic-missile nose cones, has returned strategic reconnaissance photos from orbit and astronauts from the Moon, and has even dropped an instrument package into the atmosphere of Jupiter. The last of these approached Jupiter at four times the speed of a lunar mission returning to Earth. Work with re-entry has advanced rapidly because of its obvious importance. The second application has involved high-speed propulsion and has sought to develop the scramjet as an advanced airbreathing ramjet. Scramjets are built to run cool and thereby to achieve near-orbital speeds. They were important during the Strategic Defense Initiative, when a set of these engines was to power the experimental X-30 as a major new launch vehicle. This effort fell short, but the X-43A, carrying a scramjet, has recently flown at Mach 9.65 by using a rocket. Atmospheric entry today is fully mature as an engineering discipline. Still, the Jupiter experience shows that work with its applications continues to reach for new achievements. Studies of scramjets, by contrast, still seek full success, in which such engines can accelerate a

vehicle without the use of rockets. Hence, there is much to do in this area as well. For instance, work with computers may soon show just how good scramjets can become.

Derived from text

Hypersonics; Hypersonic Speed; Atmospheric Entry; Ablation; Hypersonic Vehicles; Aerodynamic Heating

20070036055 Virginia Polytechnic Inst. and State Univ., Blacksburg, VA USA

Airfoil Design by an All-At-Once Method

Shenoy, Ajit; Heinkenschloss, Matthias; Cliff, Eugene M; Nov 5, 1997; 35 pp.; In English

Contract(s)/Grant(s): F49620-93-1-0280; F49620-96-1-0329

Report No.(s): AD-A470562; CRPC-TR99703-S; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470562>

The all-at-once approach is implemented to solve an optimum airfoil design problem. The airfoil design problem is formulated as a constrained optimization problem in which flow variables and design variables are viewed as independent and the coupling steady state Euler equation is included as a constraint, along with geometry and other constraints. In this formulation, the optimizer computes a sequence of points which tend toward feasibility and optimality at the same time (all-at-once). This decoupling of variables typically makes the problem less nonlinear and can lead to more efficient solutions. In this paper an existing optimization algorithm is combined with an existing flow code. The problem formulation, its discretization, and the underlying solvers are described. Implementation issues are presented and numerical results are given which indicate that the cost of solving the design problem is approximately six times the cost of solving a single analysis problem.

DTIC

Airfoils; Computational Fluid Dynamics

20070036169 NASA Dryden Flight Research Center, Edwards, CA, USA

Aerodynamics and Autonomous Soaring

Cumming, Stephen; Allen, Michael; [2005]; 38 pp.; In English; Aerodynamics and Autonomous Soaring, 16 Dec. 2005, Lancaster, PA, USA; Original contains color illustrations; No Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: <http://hdl.handle.net/2060/20070036169>

This viewgraph presentation reviews NASA's basics of flight, controlling flight, and flight systems.

CASI

Aerodynamics; Autonomy; Soaring; Jet Aircraft; Helicopters

20070036382 Lehigh Univ., Bethlehem, PA USA

Theoretical Analysis of Control Mechanisms for Boundary-Layer Separation on Rotorcraft Blades

Blythe, Philip A; Jun 1, 2007; 69 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAAD19-03-1-0127

Report No.(s): AD-A470926; No Copyright; Avail.: Defense Technical Information Center (DTIC)

High maneuverability is one of the major goals in rotorcraft design. In practice, this goal is limited by unsteady (dynamic) stall near blade leading edges. Studies of three-dimensional boundary layer separation on a rotating blade are made. For hovering flight, the blade twist and downwash are included in the effective angle of attack. For forward flight, high angles of attack are used to simulate the most severe situation at the retreating blade. Because of the disparate scales of the leading edge radius and the blade span, separation is found to be quasi two-dimensional, and local singular behaviors at separation are very similar to the two-dimensional cases. Most of the results are obtained using an Eulerian approach, but a Lagrangian formulation is used to study the behavior near the separation singularity. Control mechanisms based on suction and blade oscillations are examined. It is found that oscillations, with a tuned frequency and amplitude, can delay separation. Leading edge suction/injection is also effective in delaying separation for particular (optimized) slot locations.

DTIC

Aerodynamics; Boundary Layer Separation; Boundary Layers; Control Surfaces; Controllers; Oscillations; Rotary Wing Aircraft; Separated Flow

20070036463 Innovative Scientific Solutions, Inc., Dayton, OH USA

Multi-Aspect Solutions for Moving Vehicle Testing

Fonov, S; Crafton, J; Goss, L; Jones, G; Fonov, V; Tyler, C; Apr 1, 2005; 33 pp.; In English; Original contains color illustrations

Report No.(s): AD-A471056; No Copyright; Avail.: Defense Technical Information Center (DTIC)

No abstract available

Aerodynamic Characteristics; Fluid Dynamics; Hydrodynamics

20070036733 NASA Langley Research Center, Hampton, VA, USA

Sonic Boom Modeling Technical Challenge

Sullivan, Brenda M.; October 31, 2007; 15 pp.; In English; Fundamental Aeronautics 2007 Annual Meeting, 30 Oct. - 1 Nov. 2007, New Orleans, LA, USA; Original contains color illustrations

Contract(s)/Grant(s): WBS 984754.02.07.07.18.03; No Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: <http://hdl.handle.net/2060/20070036733>

This viewgraph presentation reviews the technical challenges in modeling sonic booms. The goal of this program is to develop knowledge, capabilities and technologies to enable overland supersonic flight. The specific objectives of the modeling are: (1) Develop and validate sonic boom propagation model through realistic atmospheres, including effects of turbulence (2) Develop methods enabling prediction of response of and acoustic transmission into structures impacted by sonic booms (3) Develop and validate psychoacoustic model of human response to sonic booms under both indoor and outdoor listening conditions, using simulators.

CASI

Human Reactions; Sonic Booms; Aerodynamic Noise; Flight Simulation; Mathematical Models

03

AIR TRANSPORTATION AND SAFETY

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

20070035054 Military Academy, West Point, NY USA

Comparing Organic vs. Handoff UAV Support to the Maneuver Company

Burk, Roger C; Burk, Robin K; Jun 2007; 68 pp.; In English

Contract(s)/Grant(s): Proj-DSE-R-0728

Report No.(s): AD-A469275; ORCEN-DSE-TR-0728; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA469275>

The US Army has plans to deploy a dedicated Unmanned Aerial Vehicle (UAV) system at every echelon in order to provide responsive support to the battlefield commanders. However, there are disadvantages to fielding such a large number of different and separately controlled vehicles. This research addresses one key part of this issue of selecting the right mix of UAV systems: How shall a company be supported? We consider two alternatives for the company commander, loosely based on systems currently under development: (1) the 'Organic' system, which consists of two vehicle-transported VTOL vehicles of ~50 kg each assigned to each company and flying missions when needed; and (2) the 'Handoff' system, a 100-200 kg vehicle in the air constantly during operations, maintained and launched at the battalion level, but handed off as needed to the companies, which have Level IV control capability. We focus on performance measures that are strongly affected by the architecture and on finding closed-form approximations that allow extensive sensitivity analysis. We use high-level queuing and Markov chain models to estimate performance. We find that under some circumstances maneuver companies are better served by the 'Handoff' system. We also identify performance and scenario parameters that have a strong effect on this and consequently deserve more study. This inquiry originated as a group project given to several teams of cadets taking SE450: Project Management and System Design. Though it was originally purely an academic exercise, the methods and results of

several of the teams were of great interest. The authors were inspired to develop the best of the cadets' ideas, adding their own contributions to produce this work. We include in this report some remarks on how well the project worked in helping the cadets understand how to approach a complex systems engineering problem typical of those faced by the Army.

DTIC

Deployment; Drone Vehicles; Pilotless Aircraft

20070035082 Civil Aerospace Medical Inst., Oklahoma City, OK, USA

Antiemetics with Concomitant Sedative Use in Civil Aviation Pilot Fatalities: From 2000 to 2006

Botch, Sabra R.; Johnson, Robert D.; October 2007; 13 pp.; In English

Contract(s)/Grant(s): AM-B-05-TOX-204

Report No.(s): DOT/FAA/AM-07/29; No Copyright; Avail.: CASI: [A03](#), Hardcopy

Many drugs commonly used for the treatment of various ailments can be dangerous when used in combination. Antiemetics and sedatives are two drug classes that contain compounds that may have harmful side effects when mixed. A drug such as chlorpheniramine with antiemetic properties can dramatically increase the negative side effects of numerous drugs in the sedative class. This phenomenon is especially dangerous for pilots. Although many of these compounds are considered disqualifying and are not allowed by the FAA, their use does occur in the pilot community. Pilots that use these drugs may be unaware of the danger that can arise when compounds from these two drug classes are taken together. Our laboratory was interested in evaluating the circumstances surrounding accidents in which the pilot was found positive for drugs from each of these two classes. Epidemiological, toxicological, and aeromedical findings from pilots involved in such accidents were collected for a 7-year period, 2000 - 2006. Case histories, accident information, and the probable cause of the aviation accidents were obtained from the National Transportation Safety Board (NTSB). Toxicological information was obtained from the Civil Aerospace Medical Institute's (CAMI's) Forensic Toxicology Research Laboratory. There were 2,184 fatal aviation accidents over this time period. Of these accidents, 26 were found positive for compounds from both the antiemetic and the sedative drug classes. All 26 aircraft were operated under 14 CFR Part 91 as general aviation. All pilots involved in these accidents were male; 21 tested positive for a disqualifying substance that may have affected their ability to control the aircraft.

Author

Aircraft Accidents; Antiemetics and Antinauseants; Sedatives; Civil Aviation; Toxicology

20070035141 Military Academy, West Point, NY USA

Comparing Organic vs. Handoff UAV Support to the Maneuver Company

Burk, Roger C; Burk, Robin K; Jun 2007; 68 pp.; In English

Contract(s)/Grant(s): Proj-DSE-R-0728

Report No.(s): AD-A469275; ORCEN-DSE-TR-0728; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA469275>

The US Army has plans to deploy a dedicated Unmanned Aerial Vehicle (UAV) system at every echelon in order to provide responsive support to the battlefield commanders. However, there are disadvantages to fielding such a large number of different and separately controlled vehicles. This research addresses one key part of this issue of selecting the right mix of UAV systems: How shall a company be supported? We consider two alternatives for the company commander, loosely based on systems currently under development: (1) the 'Organic' system, which consists of two vehicle-transported VTOL vehicles of ~50 kg each assigned to each company and flying missions when needed; and (2) the 'Handoff' system, a 100-200 kg vehicle in the air constantly during operations, maintained and launched at the battalion level, but handed off as needed to the companies, which have Level IV control capability. We focus on performance measures that are strongly affected by the architecture and on finding closed-form approximations that allow extensive sensitivity analysis. We use high-level queuing and Markov chain models to estimate performance. We find that under some circumstances maneuver companies are better served by the 'Handoff' system. We also identify performance and scenario parameters that have a strong effect on this and consequently deserve more study. This inquiry originated as a group project given to several teams of cadets taking SE450: Project Management and System Design. Though it was originally purely an academic exercise, the methods and results of several of the teams were of great interest. The authors were inspired to develop the best of the cadets' ideas, adding their own contributions to produce this work. We include in this report some remarks on how well the project worked in helping the cadets understand how to approach a complex systems engineering problem typical of those faced by the Army.

DTIC

Deployment; Drone Vehicles; Pilotless Aircraft

20070035161 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

A Systems Engineering Approach to Analyzing Weather Input Sensitivities of the Joint Precision Air Drop System

Gemas, David L; Jun 2007; 163 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): Proj-ENP-JON-07-164

Report No.(s): AD-A470065; AFIT/GSE/ENY/07J-01; XC-516THWING; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470065>

The USA Air Force is partnering with the USA Army as well as allied nations to develop a revolutionary advance in logistical support known as the Joint Precision Air Drop System (JPADS). The focus of this study is to develop a process to quantitatively analyze system sensitivities to various types of weather inputs and the corresponding effect on system accuracy. Weather balloons were used to provide representative 'truth' to which forecast weather could be compared. Each data type was fed into the JPADS Mission Planner to produce navigation points which could then be compared statistically. The process was tested on a limited data set to provide a first look at the variables of forecast resolution and lead-time. Initial results indicate best system accuracy is achieved for lowest forecast resolution (i.e., 45 km vs. 5 km data) and shortest lead-time (i.e., <12 hrs vs. >12 hrs). This result will not only allow for better accuracy of JPADS, but also reduce bandwidth and transmission time necessary to send weather forecast data to the warfighter.

DTIC

Air Drop Operations; Airdrops; Systems Engineering; Weather

20070035278 Library of Congress, Washington, DC USA

Military Airlift: C-17 Aircraft Program

Bolkcom, Christopher; Jun 5, 2007; 33 pp.; In English

Report No.(s): AD-A470260; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470260>

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. DOD planned to end C-17 production at 180 aircraft in FY2007, but both authorizers and appropriators voiced concern over that plan. Appropriators provided \$2 billion in un-requested funding to purchase 10 additional C-17 aircraft and directed DOD to fund the program in FY2008. The C-17 program is at the center of a number of airlift debates that confront policymakers. These issues include, but may not be limited to airlift needs and requirements, cost and budget, and industrial base issues.

DTIC

C-17 Aircraft; Transport Aircraft

20070035481 Institute for Scientific Research, Fairmont, WV USA

Intelligent Flight Control Simulation Research Program

Stolarik, Brian; Feb 2007; 17 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): FA8650-04-C-3402; Proj-A052

Report No.(s): AD-A470308; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Between December 2002 and September 2006, the Institute for Scientific Research, Inc. (ISR) performed basic and applied research for the Air Force Research Laboratory/Control Sciences Division's (AFRL/VAC). Under the program, entitled 'Intelligent Flight Control Simulation Research Laboratory,' a variety of technologies were investigated or developed during the course of the research for AFRL/VAC. The majority of scientific and technical deliverables as a result of the research activities were open literature publications, periodic research reports, customer briefing materials, customer briefings, simulation software and simulation software manuals. This report summarizes the Automated Aerial Refueling, and Multiple Agent Coordinated Control efforts.

DTIC

Control Simulation; Educational Resources; Flight Control; Refueling

20070035505 Executive Office of the President, Washington, DC USA

National Strategy for Aviation Security

Mar 26, 2007; 30 pp.; In English

Report No.(s): AD-A470339; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The security and economic prosperity of the USA depend significantly upon the secure operation of its aviation system

and use of the world's airspace by the Nation, its international partners, and legitimate commercial interests. Terrorists, criminals, and hostile nation-states have long viewed aviation as a target for attack and exploitation. The tragic events of September 11, 2001 and the Heathrow plot of August 2006 are telling reminders of the threats facing aviation and the intent and capabilities of adversaries that mean to do harm to the USA and its people. In June 2006, building upon the Administration's successful efforts since 9/11, the President directed the development of a comprehensive National Strategy for Aviation Security (hereafter referred to as the Strategy') to protect the Nation and its interests from threats in the Air Domain. The Secretary of Homeland Security, in accordance with National Security Presidential Directive-47/Homeland Security Presidential Directive-16 (NSPD-47/HSPD-16), will coordinate the operational implementation of the Strategy, including the integration and synchronization of related Federal programs and initiatives. Aviation security is best achieved by integrating public and private aviation security global activities into a coordinated effort to detect, deter, prevent, and defeat threats to the Air Domain, reduce vulnerabilities, and minimize the consequences of and expedite the recovery from, attacks that might occur. The Strategy aligns Federal government aviation security programs and initiatives into a comprehensive and cohesive national effort involving appropriate Federal, State, local, and tribal governments and the private sector to provide active layered aviation security for, and support defense in-depth of the USA.

DTIC

Aerial Reconnaissance; Aircraft Safety; Airspace; Flight Safety; Security; Surveillance; Terrorism

20070035538 Naval Postgraduate School, Monterey, CA USA

Experimental Investigation of High-Pressure Steam Induced Stall of a Transonic Rotor

Koessler, Joseph J; Jun 2007; 115 pp.; In English; Original contains color illustrations

Report No.(s): AD-A470402; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This thesis addresses the problem of optimizing the U.S. Army's Light Tactical Wheeled Vehicle (LTWV) fleet over the next 15 years. To achieve these ends we created a multiple objective decision analysis (MODA) model which assigns a value to each vehicle in the LTWV fleet, as well as a linear program (LP) which allows decision makers to find feasible modernization strategies for the LTWV fleet subject to multiple constraints such as budget and operational readiness. The MODA assigns a value to every individual vehicle variant depending upon its measures of performance in several categories. Those values are used by the LTWV LP to prescribe solutions for decision makers. We implemented the LTWV LP using notional data and ran initial analyses to demonstrate the program's validity. Possible analyses include varying any of the LTWV LP inputs, such as operational, budgetary, and age requirements, as well as procurement availability bounds. The project serves as a conceptual framework for future refinement of the decision tool requested by the U.S. Tank-Automotive and Armaments Command (TACOM).

DTIC

High Pressure; Jet Aircraft; Linear Programming; Rotors; Steam

20070036121 Air Force Research Lab., Wright-Patterson AFB, OH USA

Investigation and Root Cause Analysis Guideline for Undetected Cracking Incidents in Safety-of-Flight Aircraft Structure

Brausch, John; Butkus, Larry; Jan 2007; 69 pp.; In English

Contract(s)/Grant(s): Proj-4349

Report No.(s): AD-A470673; AFRL-ML-WP-TR-2007-4113; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470673>

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

DTIC

Airframes; Cracks; Inspection; Nondestructive Tests; Safety

20070036326 Naval War Coll., Newport, RI USA

Coercive Effects-based Operations Targeting Enemy Resolve: No Bang for the Buck

Rieke, Dennis R; May 10, 2007; 25 pp.; In English

Report No.(s): AD-A470842; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Since the advent of the airplane air warfare theorists, and arguably strategists, have often overstated or misrepresented the capabilities of air power. There is no doubt that air power has capabilities and advantages that far outweigh conventional naval and ground forces. The ability to strike at your enemy over great distances, with great accuracy and at speeds unattainable by conventional forces puts air power in a class all it's own. It has arguably redefined the definition of the center of mass. It can be inherently strategic in nature in that it often allows for an attack of the strategic or operational center of gravity without the confrontation of conventional naval and ground forces. But, however swift and lethal air power may be, it is not above operational art application. Applying airpower to achieve aims vice objectives is at best a means of attaining ambiguous results and is a misuse of the capability. Air power has had a long history of coercive attempts. Success, if achieved, is thus likely to be as much the product of accident and good fortune as of design and skill. The use of air power must have clear theater-strategic or operational objectives with quantifiable rates of progress and not immeasurable effects. This lack of understanding can lead to the belief that air power alone, with it's many advantages over land and naval forces, can defeat the enemy; an erroneous conclusion that can only result in the unnecessary loss of personnel, material and time.

DTIC

Coercivity; Warfare

20070036737 Civil Aerospace Medical Inst., Oklahoma City, OK, USA

Time Series Analyses of Integrated Terminal Weather System Effects on System Airport Efficiency Ratings

Pfeiderer, Elaine M.; Goldman, Scott M.; Chidester, Thomas; October 2007; 30 pp.; In English; Original contains black and white illustrations

Contract(s)/Grant(s): AM-B07-HRR-521

Report No.(s): DOT/FAA/AM-07/28; No Copyright; Avail.: CASI: [A03](#), Hardcopy

The FAA has initiated efforts to improve weather information, forecasting, and dissemination to enhance both safety and operational efficiency. The FAA has also adopted the System Airport Efficiency Rate (SAER) as a metric of facility operating efficiency that accounts for weather by using either actual demand or the facility-set arrival rate as the denominator, reflecting a reduction in the published ability to handle departures or arrivals due to prevailing weather conditions. Interventions aimed at improving performance should be observable in our metrics. However, acceptance and widespread use of the SAER raises the question of whether a weather-adjusted measure is sensitive enough to evaluate the efficacy of interventions aimed at improving performance during inclement weather. One such intervention is the Integrated Terminal Weather System (ITWS). In the present study, we applied time series analysis to average daily and monthly SAERs at 13 airports. We modeled SAER data at each airport prior to ITWS implementation and then tested whether each ITWS build (i.e., subsequent software updates and added functionality) affected SAER values. Though some statistically significant effects were found (both positive and negative), the patterns of these effects were not consistent enough to draw any definite conclusions. The fact that we were unable to make a clear determination about the effectiveness of ITWS implementation suggests that the SAER may 'control out' the variance needed to detect the consequences of interventions. Thus, it is imperative that the raw data from which they are derived remain readily available to evaluate the efficacy of changes to the system, because simply monitoring facility and system effectiveness measures may obscure or discount intervention effects. This implies a requirement for the future: As we pursue the concepts, technologies, and procedures necessary to Next Generation Air Traffic capabilities, it is absolutely vital that we also plan for their assessment and evaluation.

Author

Airports; System Effectiveness; Time Series Analysis; Weather; Aviation Meteorology

20070036746 Army Command and General Staff Coll., Fort Leavenworth, KS USA

Information Operations as a Counter to US Air Dominance: A Rival's Perspective

Harris, Jr, David A; May 2, 2007; 63 pp.; In English; Original contains color illustrations

Report No.(s): AD-A470650; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470650>

The purpose of this monograph is to answer the question of what lessons over the past ten years of US air operations have foreign militaries integrated into their doctrine and organizations to counter US air dominance. By examining the air campaigns in Kosovo, Afghanistan, and Iraq through the lens of Chinese and Russians analysts, information operations has been the key lesson learned to counter US air dominance. From this analysis, some broader conclusions were made concerning

the conduct IO in peace-time, the confusion surrounding IO terminology, the challenges of identifying deception in the targeting and operational analysis process, and the integration of IO and air superiority objectives within a campaign.

DTIC

IO; Airspace; United States; Military Operations

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.

20070035085 NASA Dryden Flight Research Center, Edwards, CA, USA

Quiet Spike(TradeMark) Build-up Ground Vibration Testing Approach

Spivey, Natalie D.; Herrera, Claudia Y.; Truax, Roger; Pak, Chan-gi; Freund, Donald; November 2007; 36 pp.; In English; Original contains color illustrations

Report No.(s): NASA/TM-2007-214625; H-2735; Copyright; Avail.: CASI: [A03](#), Hardcopy

Flight tests of the Gulfstream Aerospace Corporation s Quiet Spike(TradeMark) hardware were recently completed on the National Aeronautics and Space Administration Dryden Flight Research Center F-15B airplane. NASA Dryden uses a modified F-15B (836) airplane as a testbed aircraft to cost-effectively fly flight research experiments that are typically mounted underneath the airplane, along the fuselage centerline. For the Quiet Spike(TradeMark) experiment, instead of a centerline mounting, a forward-pointing boom was attached to the radar bulkhead of the airplane. The Quiet Spike(TradeMark) experiment is a stepping-stone to airframe structural morphing technologies designed to mitigate the sonic-boom strength of business jets flying over land. Prior to flying the Quiet Spike(TradeMark) experiment on the F-15B airplane several ground vibration tests were required to understand the Quiet Spike(TradeMark) modal characteristics and coupling effects with the F-15B airplane. Because of flight hardware availability and compressed schedule requirements, a 'traditional' ground vibration test of the mated F-15B Quiet Spike(TradeMark) ready-for-flight configuration did not leave sufficient time available for the finite element model update and flutter analyses before flight-testing. Therefore, a 'nontraditional' ground vibration testing approach was taken. This report provides an overview of each phase of the 'nontraditional' ground vibration testing completed for the Quiet Spike(TradeMark) project.

Author

Airframes; Costs; Flight Tests; NASA Programs; Vibration Tests; Ground Tests; Fuselages; Flutter Analysis; Bulkheads

20070035087 NASA Dryden Flight Research Center, Edwards, CA, USA

NASA ER-2: Flying Laboratory for Earth Science Studies

Navarro, Robert; October 25, 2007; 22 pp.; In English; 33rd Society of Mexican-American Engineers and Scientists (MAES) International Symposium and Career Fair, 25-27 Oct. 2007, Albuquerque, NM, USA; Original contains color and black and white illustrations; No Copyright; Avail.: CASI: [A03](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20070035087>

This viewgraph presentation gives an overview of the NASA ER-2 aircraft. The contents include: 1) ER-2 Specifications; 2) ER-2 Basic Configuration; 3) ER-2 Payload Areas: Nose Area; 4) ER-2 Payload Areas: SuperPod Fore and Aftbody; 5) ER-2 Payload Areas: SuperPod Midbody; 6) ER-2 Payload Areas: Q-Bay; 7) ER-2 Payload Areas: Q-Bay Hatch Designs; 8) ER-2 Payload Areas: External Pods; 9) ER-2 Electrical/Control Interface; 10) ER-2 Typical Flight Profile; 11) Tropical Composition, Cloud and Climate Coupling TC-4; 12) TC-4 Timeline; 13) TC4 Area of Interest; 14) ER-2 TC4 Payload; 15) A/C ready for fuel; 16) ER-2 Pilot being suited; 17) ER-2 Taxing; 18) ER-2 Pilot post flight debrief; and 19) NASA ER-2: Flying Laboratory for Earth Science Studies and Remote Sensing.

CASI

Earth Sciences; Remote Sensing; Aircraft Configurations; U-2 Aircraft; NASA Programs

20070035091 NASA Dryden Flight Research Center, Edwards, CA, USA

2005 PathfinderPlus Aero-Elastic Research Flight

Navarro, Robert; November 2005; 13 pp.; In English; 31st Society of Mexican-American Engineers and Scientists (MAES) Symposium, 1-6 Nov. 2005, San Jose, CA, USA; Original contains color illustrations; No Copyright; Avail.: CASI: [A03](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20070035091>

This viewgraph presentation describes the 2005 Pathfinder along with an investigation of its aeroelastic responses. The

contents include: 1) HALE Class of Vehicles; 2) Aero-elastic Research Flights Overall Objective; 3) General Arrangement; 4) Sensor Locations; 5) NASA Ramp Operations; 6) Lakebed Operations; 7) 1st Flight Data Set; 8) Tool development / data usage; 9) HALE Tool Development & Validation; 10) Building a HALE Foundation; 11) Compelling Needs Drive HALE Efforts; and 12) Team Photo

CASI

Aeroelasticity; Flight Tests; Aircraft Design; Remotely Piloted Vehicles; Mars Pathfinder

20070035125 NASA Dryden Flight Research Center, Edwards, CA, USA

Helios Prototype Vehicle Mishap: Technical Findings, Recommendations, and Lessons Learned

DelFrate, John; October 09, 2007; 31 pp.; In English; Aerospace Control and Guidance Systems Committee Meeting No. 100, 9-12 Oct. 2007, Cocoa Beach, FL, USA; Original contains color and black and white illustrations; No Copyright; Avail.:

CASI: [A03](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20070035125>

This viewgraph presentation reviews the findings of the 'Investigation of the Helios Prototype Aircraft Mishap.' The presentation examines the background of the Helios project, a description of the mishap, observations concerning the mishap and analysis results, proximate and root causes and technical recommendations and lessons learned.

CASI

Solar Powered Aircraft; Aircraft Accident Investigation; Aviation Meteorology; Wind Shear; Prototypes

20070035126 NASA Dryden Flight Research Center, Edwards, CA, USA

F-15 IFCS: Intelligent Flight Control System

Bosworth, John; [2007]; 25 pp.; In English; Original contains color illustrations; No Copyright; Avail.: CASI: [A03](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20070035126>

This viewgraph presentation describes the F-15 Intelligent Flight Control System (IFCS). The goals of this project include: 1) Demonstrate revolutionary control approaches that can efficiently optimize aircraft performance in both normal and failure conditions; and 2) Demonstrate advance neural network-based flight control technology for new aerospace systems designs.

CASI

Aerospace Systems; F-15 Aircraft; Flight Control; Control Systems Design; Aircraft Design

20070035157 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

Critical Life Prediction Research on Boron-Enhanced Ti-6Al-4V

Schwendiman, Kevin A; May 2007; 143 pp.; In English; Original contains color illustrations

Report No.(s): AD-A470054; AFIT/GAE/ENY/07-J24; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470054>

Research on boron-enhanced Ti-6-4 has demonstrated the following improvements to the Ti-6-4 alloy: up to 40% increase in ultimate tensile strength, up to 30% increase in modulus/stiffness, while maintaining greater than 10% ductility at RT conditions. The increased properties are attributed to small additions of boron (-or= wt%), which refine the microstructure and result in a small volume fraction (~6 vol%) of fine TiB whiskers. Previous research indicates potential for substantial improvements in fatigue, fatigue crack growth, and fracture toughness. However, uncertainty regarding these second-tier mechanical properties is currently limiting implementation of this class of titanium alloys. This study of fatigue variability of a powder-metallurgy, boron-enhanced Ti-6-4 alloy identifies the most prevalent damage mechanism and elucidates the impact on fatigue design limits. The alloy was produced via a unique prealloyed powder-metallurgy process. The powder mesh size used was -35, which equates to powder particles with a diameter of 500 micrometers and smaller. Specimens were ultimately machined from a rolled plate. The mean fatigue behavior compared favorably with available data on conventional Ti-6-4, both wrought and powder-metallurgy product forms. However, inclusions in the material were responsible for a few poor fatigue results, which ultimately govern the fatigue design limits. Variability assessment and fatigue crack growth analyses indicate that if the frequency and size of inclusions can be reduced, this material could become a more viable alternative for select turbine engine and aircraft applications.

DTIC

Aluminum Alloys; Boron; Life (Durability); Predictions; Titanium Alloys; Vanadium Alloys

20070035168 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

Damage Considerations of a Flexible Micro Air Vehicle Wing Using 3-D Laser Vibrometry

Mendoza, Jr, Leo L; Jun 2007; 94 pp.; In English; Original contains color illustrations

Report No.(s): AD-A470077; AFIT/GAE/ENY/07-J13; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470077>

In recent years there has been a major push towards a new class of unmanned aerial vehicles: micro air vehicles. A great amount of research has been done towards the aerodynamics, aeroelasticity, construction, and flight characteristics of flexible wing micro air vehicles. However, there has not been much research done regarding possible structural deficiencies of a flexible micro air vehicle wing. The focus of this research is to evaluate the effects of damage on a flexible micro air vehicle wing, particularly its natural frequencies and mode shapes, using three dimensional laser vibrometry. The flexible micro air vehicle wing studied was based on a University of Florida micro air vehicle wing design and was examined using measurements from the Polytec 400-3D Scanning Vibrometer. Comparisons of the wing's natural frequencies and displacements were made between the wing's undamaged and damaged states.

DTIC

Damage; Drone Vehicles; Flexible Wings; Lasers; Vibration Measurement; Vibration Meters

20070035242 Air Force Research Lab., Wright-Patterson AFB, OH USA

Tradeoff Analysis Tools for Hybrid NDE-SHM Life Management Strategies (Preprint)

Aldrin, John C; Medina, Enrique A; Allwine, Daniel A; Knopp, Jeremy S; Mar 2007; 19 pp.; In English

Contract(s)/Grant(s): F33615-03-C-5226; Proj-4349

Report No.(s): AD-A470184; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470184>

Hybrid life management strategies for new and aging aircraft have been proposed that combine traditional non-destructive evaluation (NDE) methods and recently developed structural health monitoring (SHM) technologies. In recent times, a usual aim for managing the life of aircraft components that are critical or that are subject to fatigue or corrosion damage is to attempt development of in situ damage detection systems that can indicate when more detailed inspection is necessary. This creates a need for decisions about the type and settings of sensors and signal processing algorithms for the health monitoring system, and system type, settings, and scheduling for NDE. How well these systems are matched will have great influence on overall maintenance cost, aircraft availability and system reliability. In this presentation, a software package is presented for integrating NDE and SHM design with product life management models.

DTIC

Computer Programs; Maintenance; Nondestructive Tests; Tradeoffs

20070035248 Touchstone Research Lab. Ltd., Triadelphia, WV USA

Development of Spray Costing Methods and Materials to Replace Aluminum Cladding of Aging Aircraft for Corrosion Protection

Murty, Gollapudi S; Agarwal, Arvind; Jun 15, 2007; 29 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): FA9550-06-C-0113

Report No.(s): AD-A470203; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470203>

The objective of this AF STTR Phase I work was to develop spray coating methods and new coating materials for corrosion protection of aging aircraft. The requirements are that the coatings should be easily depot applied and also the temperature of the skin should not exceed 150 deg C during the process. This is to preserve the original temper of the substrate. Plasma spray and cold spray coating methods were selected for this study. The process parameters of the coating methods were optimized to meet the above requirements. The explored coating materials consist of crystalline materials [AA 1100 for 2024-T3 & Al-2 Wt % Zn alloy for 7075-T6] and aluminum based bulk metallic glass (BMG) precursor materials [Al-5Fe-5Gd & Al-8Ni-5Y (atom %)]. Crystalline coating materials were cold sprayed onto substrate coupons at ASB Industries, Barberton, Ohio. Plasma spraying of crystalline and BMG materials was done at FIU, Miami, FL. The evaluations of the coated coupons include microstructural characterization, tensile tests and corrosion tests. The results are summarized below.

DTIC

Aircraft; Aluminum; Cladding; Corrosion Prevention; Cost Estimates; Protective Coatings; Sprayers

20070035251 Virginia Univ., Charlottesville, VA USA

Controlling Environmental Fatigue in Aerospace Al Alloys by Multiscale Crack Tip Measurements and Modeling

Gangloff, Richard P; Feb 2007; 11 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): F49620-03-1-0155

Report No.(s): AD-A470209; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470209>

The objective of this research is to quantitatively establish the governing crack tip mechanics conditions and damage mechanisms pertinent to environmental crack propagation. The central goals are: (1) to develop accurate predictions of crack tip stresses and plastic strains for incorporation into micromechanical descriptions of crack growth, (2) to validate crack tip mechanics models by high resolution experiments, and (3) to resolve physical characteristics of fatigue crack tip hydrogen damage. Environment has a dominant and deleterious effect on fatigue crack propagation in airframe and engine components. Despite this known fact, a fundamental understanding of environment-enhanced fatigue remains elusive. We have recently examined in detail the characteristics of plasticity and crack path during environmental fatigue cracking in airframe aluminum alloys using state-of-the-art diffraction-based tools, nanoindentation and continuum mechanics modeling. For aerospace aluminum alloys, environmental fatigue crack advance most likely involves the interaction of environment-produced H, crack tip plastic strain accumulation, and local normal stress [1]. In particular, we focus explored the possibility that strain gradients elevate crack tip stresses to a level where significant H accumulation would be expected. The interaction of this H with the level of accumulated plasticity, and the crystallographic characteristics of the resulting damage were probed experimentally. The understanding developed within this program will advance the management of fatigue durability of airframe components; by providing guidance to future alloy development, chemical-environment control schemes, and fracture mechanics-based performance prognosis.

DTIC

Aerospace Environments; Airframes; Aluminum Alloys; Continuum Mechanics; Crack Propagation; Crack Tips; Engine Parts; Hydrogen; Metal Fatigue

20070035252 Library of Congress, Washington, DC USA

F-22A Raptor

Bolkcom, Christopher; Jun 12, 2007; 23 pp.; In English

Report No.(s): AD-A470212; CRS-RL31673; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470212>

The F-22A Raptor is a next-generation fighter/attack aircraft that features the latest stealth technology to reduce detection by radar. Using more advanced engines and avionics than the current F-15 Eagle, the F-22A is intended to maintain U.S. Air Force capabilities against more sophisticated enemy aircraft and air defenses in the 21st century. This report examines the Air Force's F-22A Raptor program, including costs and schedule; considers several key issues, and concludes with a synopsis of recent legislative activity on the program. In 1986, two contractors were selected to build competing prototypes, Lockheed's YF-22 and Northrop's YF-23, which were flight tested in late 1990. In April 1991, the Air Force selected Lockheed's YF-22 design for full-scale development, now termed System Development and Demonstration (SDD). The aircraft is powered by Pratt & Whitney's F119 engine, selected in competition with General Electric's F120 engine. In December 2005, the Air Force announced that the 12 F-22 aircraft with the 27th Fighter Squadron, 1st Fighter Wing, Langley Air Force Base, had reached initial operational capability (IOC). A 184-aircraft program was estimated by the Department of Defense (DoD) in September 2006 to cost about \$65.2 billion in actual prior-year and projected out-year expenditures. The Administration's FY2007 budget requested \$2.6 billion for the F-22A program, and the authority to enter into a multiyear procurement (MYP) for the final 3 years of production. Congress granted both these requests. Congress denied the Air Force's request to incrementally fund F-22 procurement. Some question the urgency of procuring the F-22A when production of comparable or better aircraft by other countries appears unlikely. Others argue that the F-22A should be produced in large numbers to cope with future threats from more advanced air defenses of potential enemies and to maintain the preeminent U.S. position in aviation technology and production.

DTIC

Armed Forces (United States); Costs; Federal Budgets; Fighter Aircraft; Government Procurement; Stealth Technology

20070035253 Library of Congress, Washington, DC USA

Potential F-22 Raptor Export to Japan

Bolkcom, Christopher; Chanlett-Avery, Emma; Jul 2, 2007; 7 pp.; In English

Report No.(s): AD-A470213; CRS-RS22684; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470213>

Japan has expressed interest in purchasing the F-22A Raptor aircraft from the USA. Although the export of the plane is now prohibited by U.S. law, Congress has recently and may again consider repealing this ban. Arguments for the sale include potential benefits to the U.S. aircraft industry, contribution to the defense of Japan and the region surrounding it, and promotion of U.S. interoperability with the Japanese military. Arguments against the transfer include concerns about technology proliferation, the potential for undermining regional stability, and Japan's legal and budgetary concerns about enhancing its military. There appear to be at least five U.S. alternative combat aircraft to the F-22 for Japan. Each aircraft presents strengths and weaknesses in terms of operational capabilities, and also vis-a-vis the security, proliferation, and industrial base issues outlined in this report. These alternatives are the F-35 Joint Strike Fighter (JSF), the F/A/18E/F Super Hornet, the F-15 Eagle, Unmanned Combat Aerial Vehicles (UCAV), or European aircraft. This report will be updated as warranted.

DTIC

Fighter Aircraft; International Trade; Japan; Stealth Technology

20070035256 Cognitive Engineering Research Inst., Mesa, AZ USA

Acquisition and Retention of Team Coordination in Command-and-Control

Cooke, Nancy J; Gorman, Jamie; Pedersen, Harry K; Winner, Jennifer; Duran, Jasmine; Taylor, Amanda; Amazeen, Polemnia G; Andrews, Dee; Rowe, Leah; May 15, 2007; 235 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): FA9550-04-1-0234; FA8650-04-6442

Report No.(s): AD-A470220; FP2007-A001-1; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470220>

This report describes the technical progress accomplished under Air Force Office of Scientific Research (AFOSR) (grant FA9550-04-1-0234) and Air Force Research Lab Funding (grant FA8650-04-6442). This project took place in the context of simulated Uninhabited Air Vehicle (UAV) command-and-control. In Experiment 1 we addressed the development of team coordination with experience and over lengthy intervals without practice in situations in which the team retains the same or different members over time. Team coordination is characterized by timely and adaptive information exchange among team members. A procedural model of team coordination was developed and used to generate a model-based metric of team coordination. This metric was then applied to track coordination development in two experiments. Results from the first experiment, showing a team performance decrement and a longer-term process benefit due to longer retention intervals or changes in team composition were used to guide the development of a dynamical systems model of the acquisition and retention of team coordination. The model was then used to generate additional predictions that were tested empirically in a second experiment. In the second experiment, coordination was trained using a rigid procedural model, cross training, or perturbations in the environment constraining coordination. Results indicated that perturbation training resulted in superior team performance across more difficult missions. The dynamical systems model, coupled with the empirical results, generated various implications for training command-and-control. These results suggest that changes to team composition and to a lesser extent, longer retention intervals, may result in temporary performance decrements, but in the long run may be beneficial for building adaptive teams.

DTIC

Cognition; Command and Control; Coordination; Drone Vehicles; Pilotless Aircraft

20070035258 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

Qualitative Knowledge Construction for Engineering Systems: Extending the Design Structure Matrix Methodology in Scope and Procedure

Bartolomei, Jason E; Jun 2007; 195 pp.; In English; Original contains color illustrations

Report No.(s): AD-A470222; AFIT-CI07-0059; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470222>

This thesis presents a new modeling framework and research methodology for the study of engineering systems. The thesis begins with a formal conceptualization of Engineering Systems based upon a synthesis of various literatures. Using this conceptualization, a new modeling framework is presented called the Engineering Systems Matrix (ESM). The ESM is an improvement to existing system-level modeling frameworks, such as the Design Structure Matrix (DSM), by providing a

dynamic, end-to-end representation of an engineering system. In support of this contribution, a new research methodology is presented called Qualitative Knowledge Construction (QKC). QKC can be thought of as a Bayesian-type approach to grounded theory. The methodology integrates qualitative social science with quantitative methods by developing a procedure for translating textual reports of observations, interview transcripts, system documentation, and figures into coded data represented in the ESM. The thesis develops the ESM framework and the QKC methodology in the context of - a real world engineering system, a US Air Force miniature uninhabited air vehicle (MAV) product development system.

DTIC

Aircraft; Construction; Engineering; Expert Systems; Knowledge Representation; Matrices (Mathematics)

20070035452 Congressional Budget Office, Washington, DC USA

Tactical Combat Forces of the USA Air Force: Issues and Alternatives

May 1984; 92 pp.; In English

Report No.(s): AD-A470269; No Copyright; Avail.: Defense Technical Information Center (DTIC)

In the past few years, the Congress has restrained spending on tactical aircraft in the Air Force. These funding decisions, and similar ones that could be debated in the future, will have important effects on the Air Force's ability to expand the size of its tactical air forces while also modernizing those forces with new aircraft and retiring older planes. This analysis by the Congressional Budget Office (CBO) presents the effects of the Administration's current tactical aircraft plans on costs and modernization. It also presents alternatives to the Administration's plans. The results in this study, which was requested by the Defense Subcommittee of the Senate Committee on Appropriations, are preliminary and will be expanded in a subsequent publication. In keeping with CBO's mandate to provide objective analysis, the study contains no recommendations.

DTIC

Alternatives; Armed Forces (United States); Combat; Costs; United States

20070035462 Dayton Univ., OH USA

Micro-Stress Bound Estimate Enabled Optimization of Structural Composite Repair for the Next Generation Aircraft

Iarve, Endel V; Lipton, Robert; Feb 28, 2007; 42 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): FA9550-04-1-0142; Proj-2304

Report No.(s): AD-A470281; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The completed effort integrated the rigorous microlevel (fiber, matrix, sizing) stress bound recently obtained by Lipton [1,2] under AFOSR sponsorship with the AFRL-developed ply level multibasis spline approximation stress analysis tools [3-5]. A robust multiscale analysis framework was developed and applied within and beyond the scope of the present grant. The developments included extension of the stress bound estimates in heterogeneous materials with periodic microstructure to include residual stress effects and, notably, regions of nonperiodic microstructure. Such regions included ply interfaces in fiber reinforced composite materials, which are present in all laminated composite structures. The improved accuracy of the multiscale analysis was verified by comparison with three-dimensional analysis of model cross ply composite laminate, where fibers were modeled explicitly. Our analysis capability for the first time addressed the composition of the repair patch of a composite scarf repair in addition to more conventional geometric parameters, such as scarf angle and repair depth. We found that altering the conventional ply by ply replacement schema of the repair patch does not lead to premature failure, but may delay the failure of the adhesive and increase the strength of the repaired composite. This work is well coordinated with the Materials Integrity Branch of the Air Force Research Laboratory's Materials and Manufacturing Directorate, which is presently executing an experimental program to verify our findings. We have transitioned the periodic RVE based micromechanical failure criterion evaluation algorithm to Sikorsky Aircraft, where it was applied to failure analysis of helicopter flex beam. We are also using our methodology to investigate the applicability of various micromechanical failure criteria to failure prediction of composites under complex states of stress.

DTIC

Composite Structures; Fiber Composites; Helicopters; Laminates; Stress Analysis

20070035495 Defence Science and Technology Organisation, Victoria, Australia

Conformal Load-Bearing Antenna Structure for Australian Defence Force Aircraft

Callus, Paul J; Mar 2007; 50 pp.; In English; Original contains color illustrations

Report No.(s): AD-A470328; DSTO-TR-1963; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Conformal Load-Bearing Antenna Structure (CLAS) replaces separate aircraft structure and antennas such as blades, wires and dishes, with electromagnetic radiators embedded in the structure. This approach reduces weight, drag and signature,

and enhances electromagnetic performance, damage resistance and structural efficiency. However the design, manufacture, certification and through-life-support of CLAS are more complex than for its non-integrated counterparts. The first half of this report describes the advantages and limitations of CLAS and the factors to be considered when deciding whether to incorporate CLAS into Australian Defence Force aircraft. The second half of this report describes the state-of-the-art in CLAS technology through a review of the open-source literature. It focuses on USA Air Force CLAS programs where demonstrators for Very High Frequency/Ultra High Frequency (VHF/UHF) and X-band communication applications have been successfully designed, analysed, manufactured and tested. Current programs include demonstrator X-band and UHF radars. CLAS will form part of the load-bearing airframe structure of the F-35 Joint Strike Fighter. It is predicted that the ongoing completion of demonstrator programs and the performance advantages likely to be realised by operational systems will lead to a gradual acceptance of this technology and an increase in the number of aircraft types containing CLAS in the ten year timeframe.

DTIC

Aircraft Antennas; Australia; Fighter Aircraft; Jet Aircraft

20070035515 Air Force Packaging Technology and Engineering Facility, Wright-Patterson AFB, OH USA

Development of the C-17 Nose Landing Gear Container, CNU-691/E

Sullivan, Joel A; Evans, Susan J; Apr 2007; 47 pp.; In English; Original contains color illustrations

Report No.(s): AD-A470353; AFPTEF-07-R-01; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The Air Force Packaging Technology Engineering Facility (AFPTEF) was tasked with the design of a new shipping and storage container for the C-17 Nose Landing Gear (NLG) in March of 2004. The new container will replace the wood crates presently used. The current containers' lack of mechanical and environmental protection prompted AFPTEF's design of a new container. The container developed, CNU-691/E, will protect the NLG mechanically and environmentally. The CNU-691/E, designed to ARF1967A, is an aluminum, long-life, controlled breathing, reusable container. The container passed all qualification tests per ASTM D4169. The CNU-691/E container will not only meet the users' requirements but will also provide an economic saving for the Air Force. The savings will be thousands of dollars over the twenty-year life span of the container.

DTIC

Landing Gear; Noses (Forebodies); Transport Aircraft

20070035804 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

Compressive Creep Behavior of NEXTEL(TradeMark) 720/Alumina Ceramic Matrix Composite at 1200 Degrees C in Air and in Steam Environment

Szymczak, Neil R; Jun 17, 2006; 231 pp.; In English; Original contains color illustrations

Report No.(s): AD-A470140; AFIT/GAE/ENY/07-J20; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470140>

The aerospace community continues to push the envelope in engineering aircraft that fly higher, faster, and safer while operating with a greater degree of efficiency. To meet these operational requirements innovative aerospace components must be designed to operate in aggressive environments. This research will investigate the ultimate compressive strength and the compressive creep behavior of Nextel(TM) 720/Alumina ceramic matrix composite at 1200 deg. C in air and 100% steam environments. The effects of creep loading history on the tensile and compressive material behavior will also be examined. The primary strengths of the N720/A composite are its oxide/oxide composition which inherently resists oxidation and a porous matrix which enables crack deflection producing enhanced matrix damage tolerance. Mechanical testing showed a significant decrease in the compressive performance of N720/A when exposed to steam environment. Conversely, N720/A specimens tested in compressive creep in air experienced an increase in compressive performance. SEM analysis showed that densification of the alpha-alumina matrix occurred in both test environments. In air densification sinters the matrix resulting in a strengthening effect. Whereas, in steam environment analysis shows the addition of hydrogen induces hydrothermal softening of the matrix resulting in a significant loss of the compressive performance of N720/A.

DTIC

Aluminum Oxides; Ceramic Matrix Composites; Compressibility; Creep Properties; Damage; High Temperature; Steam; Tolerances (Mechanics)

20070035809 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

CFD Analysis of a T-38 Wing Fence

Solfelt, Daniel A; Jun 2007; 72 pp.; In English; Original contains color illustrations

Report No.(s): AD-A470052; AFIT/GAE/ENY/07-J19; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470052>

A computational study of the effects of a wing fence on the T-38 Talon was performed. RANS simulations were conducted using the CFD solver AVUS to examine the flow around the T-38 and the fence at a Reynolds number of 10 million. The T-38 was modeled as a half aircraft with a symmetry plane down the center line and did not include the empennage. The engine inlet and exhaust were modeled as sink and source boundary conditions using mass flow and pressure specifications. Two fence geometries placed 26' from the wing tip were tested. The first fence, called a simple fence, ran chordwise on the upper surface of the wing. It did not produce significant benefits. The second fence geometry, called the extended fence, wrapped around the leading edge of the wing and produced a 4.9% increase in the lift coefficient at 15 degrees angle of attack. It was found that the vortices generated by the fence energized the flow outboard the fence, increasing lift. The extended fence generated vortices significantly stronger than the simple fence, resulting in a higher lift coefficient at 15 degrees angle of attack. These findings indicate that the T-38 high angle of attack performance would be improved by the addition of an extended wing fence.

DTIC

Airfoil Fences; Computational Fluid Dynamics; Jet Aircraft; T-38 Aircraft; Training Aircraft

20070035820 Library of Congress, Washington, DC USA

Tactical Aircraft Modernization: Issues for Congress

Bolkcom, Christopher; Jun 8, 2007; 19 pp.; In English

Report No.(s): AD-A470196; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470196>

This report examines DOD's four largest tactical aircraft modernization programs. The background section provides a brief description of each program, and a discussion of how tactical aircraft fit into military air operations: the missions they typically perform and how they contrast to longer-range combat aircraft. The Analysis section examines a number of policy issues including affordability, capability required, force structure, service roles and missions, industrial base, and transformation. The paper concludes with a synopsis of recent congressional action on these programs. The Defense Department plans to buy the F-22 fighter for the Air Force, the F/A-18E/F fighter/attack plane for the Navy, and the V-22 tilt-rotor aircraft for the Marines and Air Force special operations, as well as pursue a joint-service program to develop a multirole Joint Strike Fighter (JSF) aircraft in three variants, some of which might be operational around 2012. Decisions in Congress and the Defense Department regarding these aircraft programs may have important long-term implications. The F-22 and F/A-18E/F are in full-rate production. The V-22 is now in transition from research-development (R&D) to procurement and could remain in production for decades. The next-generation combat aircraft that are expected to result from joint-service efforts now getting underway through the Joint Strike Fighter (JSF) program might be in production through the 2020s. Decisions about the funding of these programs will influence the future of individual U.S. aircraft manufacturers, and may well affect the division of combat roles and missions among the services in the next century.

DTIC

Military Operations; Fighter Aircraft

20070035825 OR Concepts Applied, Whittier, CA USA

Testing Adaptive Levels of Automation (ALOA) for UAV Supervisory Control

Johnson, Rubin; Leen, Michael; Goldberg, Daniel; Mar 24, 2007; 33 pp.; In English

Contract(s)/Grant(s): FA8650-05-C-6547; Proj-3005

Report No.(s): AD-A470315; No Copyright; Avail.: Defense Technical Information Center (DTIC)

OR Concepts Applied has designed and implemented a human factors test bed to evaluate adaptive autonomy schemes and a range of levels of autonomy for UAV supervisory control. The test bed includes a high fidelity simulation that interfaces with a mission control element (MCE) that supports multi-vehicle control. The MCE uses OPUS mission planning tools to provide the operator with optimization and analysis decision aids. SA Technologies, Inc. was instrumental in helping to create

user interface elements to help maintain high levels of situation awareness even when the level of automation is increased. The test bed provides a variety of tools for researchers to create scenarios, alter adaptive schemas, and collect experimental data.

DTIC

Aircraft; Pilotless Aircraft; Adaptation; Human Factors Engineering; Automation

20070035854 NASA Dryden Flight Research Center, Edwards, CA, USA

Results of NASA/DARPA Automatic Probe and Drogue Refueling Flight Test

Schweikhard, Keith; October 25, 2007; 23 pp.; In English; Original contains color and black and white illustrations; No Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: <http://hdl.handle.net/2060/20070035854>

Summary: Designed, developed and successfully tested a prototype system to autonomously perform probe to drogue refueling. Demonstrated acquisition and tracking capability of the video tracking subsystem. Demonstrated autonomous rendezvous capability. Demonstrated the ability to plug in a turn. Demonstrated the ability to plug in mild turbulence.

Derived from text

Air to Air Refueling; Target Acquisition; Flight Tests; Prototypes

20070035868 NASA Dryden Flight Research Center, Edwards, CA, USA

Limits to Open Class Performance?

Bowers, Albion H.; September 02, 2007; 22 pp.; In English; Tehachapi Soaring Club Meeting, 2 Sep. 2007, Tehachapi, CA, USA; Original contains color and black and white illustrations; No Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: <http://hdl.handle.net/2060/20070035868>

This viewgraph presentation describes the limits to open class performance. The contents include: 1) Standard Class; 2) 15m/Racing Class; 3) Open Class; and 4) Design Solutions associated with assumptions, limiting parameters, airfoil performance, current trends, and analysis.

CASI

Aircraft Performance; Aircraft Design; Structural Weight; Aerodynamics

20070035908 NASA Ames Research Center, Moffett Field, CA, USA

Stability Analysis of the Slowed-Rotor Compound Helicopter Configuration

Floros, Matthew W.; Johnson, Wayne; Submitted to American Helicopter Society to be published in volume 52, no. 3, pp. 239-253, July 2007; [2007]; 20 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): 23-065-40-10; No Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: <http://hdl.handle.net/2060/20070035908>

The stability and control of rotors at high advance ratio are considered. Teetering, articulated, gimballed, and rigid hub types are considered for a compound helicopter (rotor and fixed wing). Stability predictions obtained using an analytical rigid flapping blade analysis, a rigid blade CAMRAD II model, and an elastic blade CAMRAD II model are compared. For the flapping blade analysis, the teetering rotor is the most stable, showing no instabilities up to an advance ratio of 3 and a Lock number of 18. A notional elastic blade model of a teetering rotor is unstable at an advance ratio of 1.5, independent of pitch frequency. Analysis of the trim controls and blade flapping shows that for small positive collective pitch, trim can be maintained without excessive control input or flapping angles.

Author

Compound Helicopters; Configuration Management; Rotary Wings; Stability Tests; Mathematical Models

20070035912 NASA Dryden Flight Research Center, Edwards, CA, USA

Phoenix Missile Hypersonic Testbed (PMHT): System Concept Overview

Jones, Thomas P.; October 22, 2007; 18 pp.; In English; Original contains color illustrations; No Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: <http://hdl.handle.net/2060/20070035912>

A viewgraph presentation of the Phoenix Missile Hypersonic Testbed (PMHT) is shown. The contents include: 1) Need and Goals; 2) Phoenix Missile Hypersonic Testbed; 3) PMHT Concept; 4) Development Objectives; 5) Possible Research

Payloads; 6) Possible Research Program Participants; 7) PMHT Configuration; 8) AIM-54 Internal Hardware Schematic; 9) PMHT Configuration; 10) New Guidance and Armament Section Profiles; 11) Nomenclature; 12) PMHT Stack; 13) Systems Concept; 14) PMHT Preflight Activities; 15) Notional Ground Path; and 16) Sample Theoretical Trajectories.

CASI

Hypersonics; General Overviews; Systems Engineering; Missile Systems; Flight Tests

20070035934 NASA Dryden Flight Research Center, Edwards, CA, USA

Autonomous Airborne Refueling Demonstration Phase I Flight Test Results

Dibley, Ryan; August 22, 2007; 20 pp.; In English; 2007 Atmospheric Flight Mechanics Conference and Exhibit, 20-23 Aug. 2007, Hilton Head, SC, USA; Original contains color illustrations; No Copyright; Avail.: CASI: [C01](#), CD-ROM: [A03](#), Hardcopy

This viewgraph presentation provides flight test results of the automatic in-flight refueling of an Uninhabited Aerial Vehicle (UAV) using an automated hose-and-drogue refueling method. The program objective was to demonstrate one fully automatic engagement between the receiver and tanker aircraft. Systems involved, concept of operations, results and conclusions are included.

Derived from text

Pilotless Aircraft; Air to Air Refueling; Tanker Aircraft; Flight Tests

20070036074 Brigham Young Univ., Provo, UT USA

Cooperation and Consensus Seeking for Teams of Unmanned Air Vehicles

McLain, Timothy W; Beard, Randal W; Jun 30, 2007; 69 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): FA9550-04-1-O209

Report No.(s): AD-A470589; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470589>

This report describes research in the area of cooperative control of unmanned air vehicles carried out at Brigham Young University with the support of AFOSR during the period from April 2004 to March 2007. Our research focused on cooperative control of unmanned air vehicles (UAVs). Under this AFOSR supported effort, we have sought to accomplish three primary objectives: 1) extend our current theoretical approach to encompass broader classes of cooperative control problems, 2) develop strategies for building consensus among a team of vehicles with inconsistent sensory information, and 3) experimentally demonstrate the effectiveness of our cooperative control strategies on a team of small UAVs.

DTIC

Control Theory; Drone Vehicles

20070036117 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

A Comparison of Film Cooling Techniques in a High Speed, True Scale, Fully Cooled Turbine Vane Ring

Umholtz, Michael J; Jun 2007; 69 pp.; In English; Original contains color illustrations

Report No.(s): AD-A470649; AFIT/GAE/ENY/07-J21; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470649>

An effort was undertaken to understand the impact of different film cooling configurations in a true scale turbine vane for three proprietary airfoil designs. The measurements for this study were taken at the USA Air Force Turbine Research Facility (TRF). The TRF enabled heat transfer data to be obtained on full scale turbine hardware under realistic engine conditions. The surface heat flux of the turbine blades was analyzed using the impulse response method. The overall effectiveness was compared between airfoil types at 60% span over varying streamwise locations on both suction and pressure surfaces. Using an approximated massflow, a comparison of the overall effectiveness with respect to massflow rate could be made between airfoils at three different airfoil locations. The shaped hole and slot cooling configurations were found to have higher average overall effectiveness for lower massflow rates than the multiple hole configuration based on the conditions tested.

DTIC

Airfoils; Film Cooling; Heat Flux; Heat Transfer; High Speed; Mass Flow; Turbines; Vanes

20070036344 Air Force Academy, Colorado Springs, CO USA

Controlling Unmanned Aerial Vehicles During Crisis Response

Sward, Ricky E; Cooper, Stephen; Apr 2006; 19 pp.; In English

Report No.(s): AD-A470874; USAFA-TR-06-1; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The purpose of this project was to continue our research on Unmanned Aerial Vehicles (UAVs) and their usefulness during

a response to a crisis situation. In previous work we have shown that both the video feed and the location of the UAV can be displayed in a command center to increase the situational awareness of commanders. The research presented here will build on our previous work and improve the situational awareness tool available to the commander. This tool is referred to as the UAV Situational Awareness Tool (UAVSAT).

DTIC

Drone Vehicles; Emergencies; Management Methods; Pilotless Aircraft; Software Development Tools

20070036406 Air Force Packaging Technology and Engineering Facility, Wright-Patterson AFB, OH USA

Development of the C-17 Fan Thrust Reverser Container, CNU-688/E

Boals, Mark W; Evans, Susan J; Oct 2006; 55 pp.; In English

Contract(s)/Grant(s): Proj-05-P-102

Report No.(s): AD-A470979; AFPTEF-06-R-06; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The Air Force Packaging Technology and Engineering Facility (AFPTEF) was tasked with the design of a new shipping and storage container for the C-17 Fan Thrust Reverser (FTR) in March of 2004. The new container is designed to replace the wood crate and wood frame assembly presently used. The current containers lack of mechanical protection, environmental protection, handling issues, and left and right container requirements prompted AFPTEF's design of a new container. The new container will protect the FTR both mechanically and environmentally, hold either the left or right FTR, and make it easier to maneuver during worldwide shipment and storage. The CNU-688/E, designed to SAE ARP1967A, is an aluminum, long-life, controlled breathing, reusable shipping and storage container. The new container passed all qualification tests per ASTM D4169. The CNU-688/E container not only meets users requirements but will also provide an economic saving for the Air Force. The savings will be thousands of dollars over the twenty-year life span of the container.

DTIC

Engine Parts; Thrust Reversal; Transport Aircraft

20070036409 Air Force Packaging Technology and Engineering Facility, Wright-Patterson AFB, OH USA

Development of the C-17 - Main Landing Gear Post Container, CNU-677/E

Bozzuto, Matthew P; Evans, Susan J; Apr 2007; 45 pp.; In English

Contract(s)/Grant(s): Proj-04-P-103

Report No.(s): AD-A470982; AFPTEF-06-R-03; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The Air Force Packaging Technology Engineering Facility (AFPTEF) was tasked with the design of a new shipping and storage container for the C-17 MLG Post in March of 2004. The new container is designed to replace the wood container that was previously used. The main problem with the wood design was corrosion due to inadequate environmental control and protection. In addition, there were two different container configurations to accommodate a left or right post. AFPTEF applied proven container design methods to solve the corrosion problem as well as simplified the container configuration to accept either right or left posts, eliminating the need for different containers. The CNU-677/E, designed to SAE ARP1967A, is an aluminum, long-life, controlled breathing, reusable shipping and storage container. The new container, CNU-677/E, protects the Post mechanically and environmentally. The container passed all qualification tests per ASTM D4169. The CNU-677/E container not only meets user requirements but also provides an economic saving for the Air Force. The savings will be thousands of dollars per MLG post over the twenty-year life span of the container.

DTIC

Engineering; Landing Gear

20070036412 Air Force Packaging Technology and Engineering Facility, Wright-Patterson AFB, OH USA

Development of the C-17 Nose Radome Container, CNU-674/E

Boals, Mark W; Evans, Susan J; Feb 27, 2006; 46 pp.; In English

Contract(s)/Grant(s): Proj-04-P-104

Report No.(s): AD-A470985; AFPTEF-06-R-04; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The Air Force Packaging Technology Engineering Facility (AFPTEF) was tasked with the design of a new shipping and storage container for the C-17 Radome in March of 2004. The new container is designed to replace the wood and fiberglass shell container presently used. The current containers lack of mechanical and environmental protection as well as handling issues prompted AFPTEF's design of a new container. The new container will protect the Radome both mechanically and environmentally and make it easier to maneuver during worldwide shipment and storage. The CNU-674/E, designed to SAE ARP1967A, is an aluminum, long-life, controlled breathing, reusable shipping and storage container. The new container

passed all qualification tests per ASTM D4169. The CNU-674/E container will not only meet the users requirements but will also provide an economic saving for the Air Force. The savings will be thousands of dollars over the twenty-year life span of the container.

DTIC

Engineering; Noses (Forebodies); Radomes

20070036674 Oak Ridge Inst. for Science and Education, TN USA

Occupational Jet Fuel Exposure and Invasive Cancer Occurrence in the USA Air Force, 1989-2003

D'Mello, Tiffany A; Yamane, Grover K; Jan 2007; 17 pp.; In English

Report No.(s): AD-A470651; IOH-RS-BR-TR-2007-0001; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470651>

To measure the association between occupational jet fuel exposure and invasive cancer occurrence in the U.S. Air Force (USAF). Cancer data from January 1, 1989 to December 31, 2003 were extracted from a U.S. military cancer registry and linked to information from the Air Force Personnel Center. Based on job descriptions, et fuel exposure was categorized as high, moderate or low. Conditional logistic regressions were used to calculate odds ratios for fuel exposure with cancer occurrence as the primary outcome of interest. The odds ratios for cancer occurrence in the moderate and high exposure groups were 0.84 (95% CI 0.65-1.09) and 0.73 (95% CI 0.32-1.64), respectively, when compared to the low exposure group. A null association was observed between occupational jet fuel exposure and invasive cancer in the USAF.

DTIC

Cancer; Exposure; Flight Crews; Fuel Systems; Jet Engine Fuels; Personnel; United States

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.

20070035824 Naval Postgraduate School, Monterey, CA USA

Stall Precursor Determination of an LM-2500 Gas Turbine

Dahl, Gustave C; Jun 2007; 85 pp.; In English; Original contains color illustrations

Report No.(s): AD-A470100; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470100>

This thesis presents an analysis of data taken from several stall initiation events for an LM-2500 gas turbine engine. Specifically, the time series of three separate pressure signals located at stages 3, 6, and 15 were analyzed utilizing fast Fourier transform, power spectral density, and an autocorrelation technique to determine the best and most reliable indicator to stall. The spectral analyses performed showed that rotating precursor waves that travel at approximately half rotor speed were the best indicators. Several algorithms were used and it was determined that stall wave perturbations can be identified reliable about 880 revolutions prior to the stall. This work indicates that a single pressure signal located at stage 3 on an LM-2500 gas turbine can be used to give advance warning to a stall more than 2 seconds prior to the stall event.

DTIC

Gas Turbines; Gas Turbine Engines; Rotor Speed; Aerodynamic Stalling

20070036459 Toledo Univ., OH, USA; NASA Glenn Research Center, Cleveland, OH, USA

An Evaluation of High Temperature Airframe Seals for Advanced Hypersonic Vehicles

DeMange, Jeffrey J.; Dunlap, Patrick H.; Steinetz, Bruce M.; Drlik, Gary J.; October 2007; 25 pp.; In English; 43rd AIAA/ASME/SAE/ASEE Joint Propulsion Conference and Exhibit, 8-11 Jul. 2007, Cincinnati, OH, USA; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 659877.02.03.0529.01

Report No.(s): NASA/TM-2007-215043; AIAA Paper-2007-5743; E-16229; Copyright; Avail.: CASI: [A03](#), Hardcopy

High temperature seals are required for advanced hypersonic airframe applications. In this study, both spring tube thermal barriers and innovative wafer seal systems were evaluated under relevant hypersonic test conditions (temperatures, pressures, etc.) via high temperature compression testing and room temperature flow assessments. Thermal barriers composed of a Rene

41 spring tube filled with Saffil insulation and overbraided with a Nextel 312 sheath showed acceptable performance at 1500 F in both short term and longer term compression testing. Nextel 440 thermal barriers with Rene 41 spring tubes and Saffil insulation demonstrated good compression performance up to 1750 F. A silicon nitride wafer seal/compression spring system displayed excellent load performance at temperatures as high as 2200 F and exhibited room temperature leakage values that were only 1/3 those for the spring tube rope seals. For all seal candidates evaluated, no significant degradation in leakage resistance was noted after high temperature compression testing. In addition to these tests, a superalloy seal suitable for dynamic seal applications was optimized through finite element techniques.

Author

Airframes; High Temperature; Seals (Stoppers); Hypersonic Vehicles; Heat Resistant Alloys; Thermal Protection; Refractory Materials

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.

20070036738 Embry-Riddle Aeronautical Univ., Daytona Beach, FL, USA; Civil Aerospace Medical Inst., Oklahoma City, OK, USA

Preliminary Results of an Experiment to Evaluate Transfer of Low-Cost, Simulator-Based Airplane Upset-Recovery Training

Rogers, Rodney. O.; Boquet, Albert; Howell, Cass; DeJohn, Charles; October 2007; 23 pp.; In English; Original contains black and white illustrations

Report No.(s): DOT/FAA/AM-07/27; Copyright; Avail.: CASI: [A03](#), Hardcopy

Many air transport training programs provide simulator-based upset-recovery instruction for company pilots. However, no research exists to demonstrate that such training transfers to an airplane in flight. We report on an in-progress FAA-funded research experiment to evaluate upset-recovery training transfer. Participant pilots are trained using low-cost desktop flight simulation, then subjected to serious in-flight upsets in an aerobatic airplane. Preliminary results comparing the performance of trained and control group pilots suggest that simulator-based training may improve a pilot's ability to recover an airplane from an upset. We summarize prior research, describe the experiment, and present results of Phase-One testing. We also detail planned refinements in Phase-Two flight training and testing that we hope will strengthen the results of our research. Although we are conducting flight testing in a general aviation airplane, our research has important implications for heavy aircraft upset recovery trainers.

Author

Flight Simulation; Training Devices; Training Simulators; Aircraft Spin; Pilot Training; Aircraft Control

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)*.

20070036120 Army Command and General Staff Coll., Fort Leavenworth, KS USA

Air Base Defense in the Twenty-First Century

Christensen, Glen E; Apr 12, 2007; 50 pp.; In English

Report No.(s): AD-A470671; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470671>

Throughout its history, the USA Air Force has struggled with the most efficient and effective way to provide for its own air base ground defense. This monograph submits a solution intended to end the debate. In an effort to provide the most comprehensive answer possible, the monograph contains two key parts. The first part is a historical study of the Air Force's air base ground defense dilemma, including the U.S. Army Air Forces' attempts to solve the problem in World War II. This history is followed by a discussion of the U.S. Air Force's continuing efforts to solve the dilemma, starting with air base defense issues in Korea and continuing through the current Global War on Terrorism. The second part of the monograph is a historical case study of two Air Forces that faced similar issues: the UK's Royal Air Force and the German Luftwaffe of

World War II. Each employed different methodologies and subsequently achieved different results. The results of the analysis contained in this monograph provide a clear answer. To solve the air base ground defense problem, the U.S. Air Force will have to accept risk with regard to resource constraints to mitigate risk to expeditionary operations. Failure to embrace the capability necessary to engage and defeat threats to deployed airmen and resources in the future will have a direct impact on the U.S. Air Force's ability to sustain global reach and global power in the Twenty-First Century.

DTIC

Airports; Military Air Facilities; Protection; Terminal Facilities; Vulnerability

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*.

20070034727 Caltagirone Italian Space Agency, Rome, Italy

COSMO-SkyMed Interoperability, Expandability and Multi-Sensor Capabilities: The Keys for Full Multi-Mission Spectrum Operations

De Luca, Giuseppe F; Rum, Giovanni; Caltagirone, Francesco; De Carlo, Pasquale M; Marano, Graziano; Angino, Giuseppe; Piemontese, Matteo; Aug 1, 2006; 34 pp.; In English

Report No.(s): AD-A469910; No Copyright; Avail.: Defense Technical Information Center (DTIC)

No abstract available

Earth Observations (From Space); Earth Orbits; Interoperability; Multisensor Applications; Spectra

20070035464 Air Force Research Lab., Hanscom AFB, MA USA

Spacecraft Charging - Present Situation and Some Problems

Lai, Shu T; Jun 2007; 11 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): Proj-5021

Report No.(s): AD-A470283; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The geosynchronous environment is the most important region in the magnetosphere for spacecraft charging because the plasma temperature can be very high; the plasma density is sometimes very low, and most communications satellites are there. It is now well understood that, for a given surface material, there exists a critical plasma temperature above which spacecraft charging to negative potentials occurs. High energy (MeVs) electrons and ions penetrate into material to different depth. At energies below 100 MeV, electrons penetrate deeper than ions, and may remain in a deep layer, causing a high electric field. High energy 'killer electrons' can cause deep dielectric charging and spacecraft anomalies. Studies of correlations of coronal mass Ejections, and exo-events, when a satellite gets outside of the magnetosphere are needed. Spacecraft used for planetary studies can also be affected. More study is also needed to determine whether surface charging or deep dielectric charging is more damaging to satellites.

DTIC

Anomalies; Communication Satellites; Dielectrics; Plasma Temperature; Spacecraft Charging

20070035808 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

Development and Testing of the Rigidizable Inflatable Get-Away-Special Experiment

O'Neal, Brady D; Jun 2007; 216 pp.; In English; Original contains color illustrations

Report No.(s): AD-A470053; AFIT/GAE/ENY/07-J16; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470053>

The purpose of this research project is to develop the Rigidizable Inflatable Get-Away-Special Experiment (RIGEX) from a computer-based model into a space-qualified prototype. Past research projects have developed RIGEX's command and control, structural analysis, and integration with the orbiter. This thesis details the organization, assembly, and test planning for the RIGEX protoflight model. Strict requirements imposed by the National Aeronautics and Space Administration (NASA)

must be fulfilled for any payload to travel into space. Based on the requirements set forth by NASA documentation, this thesis establishes appropriate assembly procedures for the construction of a space payload. Detailed design changes are described, as well as any problems encountered during assembly. Various lessons learned throughout the course of this project are discussed.

DTIC

Aerospace Systems; Get Away Specials (STS); Inflatable Structures; Prototypes

20070036331 Naval War Coll., Newport, RI USA

Offensive Counter Space Operations: Capabilities, Command, and Considerations

Hanson, David G; May 10, 2007; 28 pp.; In English

Report No.(s): AD-A470852; No Copyright; Avail.: Defense Technical Information Center (DTIC)

U.S. dependency on space and an increased potential for conflict in space have led to a new form of warfare aimed at denying the adversary access to space. Offensive Counter Space is yet another tool the Joint Force Commander can use to subdue an enemy who possesses or simply has access to space. Three questions arise when planning for and executing these types of operations in a theater Joint Task Force: (1) What types of forces should be employed? (2) What should the command and control structure look like? (3) What global considerations should be made during mission planning? This paper first explains why space is important to the enemy in today's political and military environment. It continues by answering each of the three questions above. First, the most effective execution of Offensive Counter Space missions is through the joint force employment of aircraft, missiles, counter space technologies, and special operations. Next, unity of command is secured by placing all forces with an OCS mission under the Joint Force Air Component Commander in a Joint Task Force construct. Finally, it is stressed that global secondary space effects must be taken into account and that U.S. Strategic Command expertise can assist in these planning efforts. Conclusions and recommendations are made in regards to potential Joint Task Force organizational structures, rewriting the space operations joint publication, creating a new counter space operations joint publication addressing these and other issues, and adding a Universal Joint Task for offensive counter space operations. Only through these changes will the joint force understand how to best conduct these operations, enhance U.S. capabilities in these areas, and allow for the best chance of success when denying an enemy access to space.

DTIC

Airspace; Command and Control; Military Operations; Planning; Space Missions

20070036346 University of Southern California, Los Angeles, CA USA

Data-Driven Robust Control Design: Unfalsified Control

Safonov, Michael G; Dec 1, 2006; 19 pp.; In English; Original contains color illustrations

Report No.(s): AD-A470877; No Copyright; Avail.: Defense Technical Information Center (DTIC)

No abstract available

Aerospace Systems; Control; Control Theory

20070036719 Schafer Corp., Huntsville, AL, USA

Unleashing Gen Y: Marketing Mars to Millennials

Leahy, Bart D.; Hidalgo, Loretta; Kloberdanz, Cassie; August 30, 2007; 21 pp.; In English; Mars Society Convention, 30 Aug. - 1 Sep. 2007, Los Angeles, CA, USA; Original contains black and white illustrations; Copyright; Avail.: CASI: [A03](#), Hardcopy

Space advocates need to engage Generation Y (born 1977-1999). This outreach is necessary to recruit the next generation of scientists and engineers to explore Mars. Space advocates in the non-profit, private, and government sectors need to use a combination of technical communication, marketing, and politics, to develop messages that resonate with Gen Y. Until now, space messages have been generated by and for college-educated white males; Gen Y is much more diverse, including as much as one third minorities. Young women, too, need to be reached. My research has shown that messages emphasizing technology, fun, humor, and opportunity are the best means of reaching the Gen Y audience of 60 million (US population is 300 million). The important things space advocates must avoid are talking down to this generation, making false promises, or expecting them to 'wait their turn' before they can participate. This is the MTV generation! We need to find ways of engaging Gen Y now to build a future where human beings can live and work on the planet Mars. In addition to the messages themselves,

advocates need to keep up with Gen Y' s social networking and use of iPods, cell phones, and the Internet. NASA and space advocacy groups can use these tools for 'viral marketing,' where young people share targeted space-related information via cell phones or the Internet because they like it. Overall, Gen Y is a socially dynamic and media-savvy group; advocates' space messages need to be sincere, creative, and placed in locations where Gen Y lives. Mars messages must be memorable!

Author

Messages; Age Factor; Marketing; Mars (Planet); Space Exploration; Aerospace Industry

20070036793 NASA Marshall Space Flight Center, Huntsville, AL, USA

Why We Explore: The Value of Space Exploration for Future Generations

Cook, Stephen A.; Armstrong, Robert C., Jr.; September 18, 2007; 2 pp.; In English; AIAA Space 2007, 18-20 Sep. 2007, Long Beach, CA, USA; Original contains color illustrations; No Copyright; Avail.: CASI: **A01**, Hardcopy

ONLINE: <http://hdl.handle.net/2060/20070036793>

The National Aeronautics and Space Administration (NASA) and its industry partners are making measurable progress toward delivering new human space transportation capabilities to serve as the catalyst for a new era of discovery, as directed by the U.S. Vision for Space Exploration. In the interest of ensuring prolonged support, the Agency encourages space advocates of all stripes to accurately portray both the tangible and intangible benefits of space exploration, especially its value for future generations. This may be done not only by emphasizing the nation's return on its aerospace investment, but also by highlighting enabling security features and by promoting the scientific and technological benefits that accrue from the human exploration of space. As America embarks on a new era of leadership and international partnership on the next frontier, we are poised to master space by living off-planet on the Moon to prepare astronauts for longer journeys to Mars. These and other relevant facts should be clearly in the view of influential decision-makers and the American taxpayers, and we must increasingly involve those on whom the long-term sustainability of space exploration ultimately depends: America's youth. This paper will examine three areas of concrete benefits for future generations: fundamental security, economic enterprise, and high-technology advancements spurred by the innovation that scientific discovery demands.

Author

Space Exploration; Constellation Program; Manned Space Flight; Space Commercialization; Government/Industry Relations

13

ASTRODYNAMICS

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

20070036312 Texas A&M Univ., College Station, TX USA

Stability and Transition Analysis for Reentry Tool, STAR

Reed, Helen L; Jan 2006; 28 pp.; In English

Contract(s)/Grant(s): FA9550-05-1-0273

Report No.(s): AD-A470787; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The effort is primarily to accelerate delivery of an improved stability and transition analysis tool. The initial goal is to aid contractors supported under the DARPA FALCON program in the development and test of Common Aero Vehicle (CAV) maneuvering reentry configurations. Under this effort, state-of-the-art computational tools developed for hypersonic boundary layer stability research will be integrated into a user-friendly package (the Stability and Transition Analysis for Reentry tool, STAR). STAR will be based on Parabolized Stability Equation (PSE) solvers, with additional modules to account for crossflow, transient growth, and roughness effects. Previous flight and ground test data will be analyzed for validation and calibration of the new tool, and stability and transition on actual contractor-provided CAV configurations will be analyzed computationally in concert with ground tests of the same configurations.

DTIC

Boundary Layer Transition; Computational Fluid Dynamics; Reentry Vehicles; Software Development Tools; Stability Tests

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)*.

20070035178 RAND Corp., Santa Monica, CA USA

Space Command Sustainment Review: Improving the Balance Between Current and Future Capabilities

Tripp, Robert S; Lynch, Kristin F; Harrison, Shawn; Drew, John G; Roll, Jr, Charles R; Jan 2007; 169 pp.; In English

Contract(s)/Grant(s): F49642-01-C-0003; FA7014-06-C-0001

Report No.(s): AD-A470092; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470092>

The ability to access and continuously operate in space is vital to economic, social, and military interests of the USA. Sustaining space capabilities is a complex undertaking. In this monograph, we examine options for improving AFSPC support and sustainment of U.S. Air Force space systems by evaluating the effectiveness and efficiency of current policies related to processes, force development, doctrine, information systems and tools, and organization from command perspective. The purpose of this monograph is to examine options for improving the sustainment of U.S. Air force space systems, not by evaluating individual systems but by looking across AFSPC. By understanding current policies, we are able to suggest improvements in process, training and education, doctrine, systems and tools, and assignment of responsibilities from a command perspective. To this end, we used an expanded strategies-to-tasks framework as a 'lens' for evaluating space system sustainment policies. This expanded framework incorporates resource allocation processes and constraints in space system sustainment considerations. It also describes how space system sustainment resources and processes can be related to space capabilities and joint operational effects.

DTIC

Aerospace Systems; Maintainability; System Effectiveness

20070035886 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Practical Cleanroom Operations Constraints

Hughes, David; Ginyard, Amani; [2007]; 19 pp.; In English; Original contains color illustrations; No Copyright; Avail.:

CASI: A03, Hardcopy

ONLINE: <http://hdl.handle.net/2060/20070035886>

This viewgraph presentation reviews the GSFC Cleanroom Facility i.e., Spacecraft Systems Development and Integration Facility (SSDIF) with particular interest in its use during the development of the Wide Field Camera 3 (WFC3). The SSDIF is described and a diagram of the SSDIF is shown. A Constraint Table was created for consistency within Contamination Control Team. This table is shown. Another table that shows the activities that were allowed during the integration under given WFC3 condition and activity location is presented. Three decision trees are shown for different phases of the work: (1) Hardware Relocation, Hardware Work, and Contamination Control Operations.

CASI

Spacecraft Contamination; Satellite Instruments; Clean Rooms; Assembling

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*.

20070035200 Naval Postgraduate School, Monterey, CA USA

An Assessment of the World Wide Merged Cloud Analysis using Interactive Graphics

Horsman, II, Stephen J; Jun 2007; 59 pp.; In English; Original contains color illustrations

Report No.(s): AD-A470121; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470121>

The Air Force Weather Agency (AFWA) uses the World Wide Merge Cloud Analysis (WWMCA) to display cloud amounts onto a hemispheric stereographic projection map. The goal of this study was to verify the WWMCA against real-time surface weather observations in the same spatial and temporal scale. The utilization of MapServer, a Geographic Information

System (GIS) tool, to make these comparisons was essential in this study. The comparisons were 10 different Air Force bases across the continent of the USA for 16 days. Discrepancies existed between the dry climate and fair climate regions as compared to more active weather regions. Nellis and Travis AFBs had a higher number of verified observations compared to the other eight bases. Maxwell AFB had the highest percentage of poorly verified observations with 44% from the observer only results. Overall, the WWMCA did not verify well with a verification rate of 27% and a miss rate of 32%. The results show that the AFWA needs to find ways to further improve cloud model output. This study shows some of the shortcomings of WWMCA cloud model data and the potential benefits to AFWA if improvements are made to cloud model output.

DTIC

Atmospheric Models; Clouds (Meteorology); Computer Graphics; Forecasting; Military Air Facilities; Observation; Proving; Satellite Imagery; Weather

20070035267 Naval Research Lab., Bay Saint Louis, MS USA

The Development of Imaging Spectrometry of the Coastal Ocean

Davis, Curtiss O; Carder, Kendall L; Gao, Bo-Cai; Lee, Zhong-Ping; Bissett, W P; Jul 11, 2007; 5 pp.; In English; Original contains color illustrations

Report No.(s): AD-A470235; NRL/PP/7330-06-6228; No Copyright; Avail.: Defense Technical Information Center (DTIC) ONLINE: <http://hdl.handle.net/100.2/ADA470235>

The Coastal Zone Color Scanner (CZCS) on NASA's Nimbus-7 satellite (1978-1986) demonstrated the utility of ocean color measurements for studying the dynamics of the ocean. The CZCS worked well for the continental shelf and open ocean regions. However, it did not have the spectral and spatial resolution needed to deal with the complexity of the coastal ocean. With the goal of developing tools suitable for the coastal ocean we initiated studies using the Airborne Visible-InfraRed Imaging Spectrometer (AVIRIS) in 1989. This paper reviews the progress from those initial studies to the current state of imaging spectrometry for the coastal ocean.

DTIC

Artificial Satellites; Coasts; Imaging Techniques; Infrared Imagery; Oceans; Spectrometers

20070035275 Naval Research Lab., Bay Saint Louis, MS USA

Effects of Nutrients and Physical Forcing on Satellite-Derived Optical Properties Near the Mississippi River Delta

Green, Rebecca; Gould, Richard; Martinolich, Paul; Jul 17, 2007; 8 pp.; In English; Original contains color illustrations

Report No.(s): AD-A470254; NRL/PP/7330-06-6318; No Copyright; Avail.: Defense Technical Information Center (DTIC) ONLINE: <http://hdl.handle.net/100.2/ADA470254>

We investigated the effects of various chemical and physical forcing mechanisms on optical properties near the Mississippi River delta using a multi-year time series of satellite imagery. Recent cruise data has provided in situ measurements to ground-truth satellite estimates of partitioned absorption (phytoplankton, detritus, sediment, and colored dissolved organic matter components). In our time series analyses, we addressed long-term time scales of variability (2002-2004) using monthly composite SeaWiFS imagery and fifteen different physical forcing variables. Correlation and stepwise regression analyses, performed on each image pixel, revealed which forcing mechanisms were most responsible for optical variability. For example, Mississippi River nitrate concentration explained only a portion of the seasonal variability observed in phytoplankton absorption on the Louisiana shelf, and physical factors, such as river discharge and wind speed were as important in determining variability. Such observations have management implications for hypoxia in terms of mandates to decrease nutrient loading to the Mississippi River watershed. Our goal is to develop a robust statistical model for optical prediction. To this end, we applied our stepwise regression model to physical properties for 2005, a year not included in model development. Our model fairly well predicted a (ph)(443) on the Louisiana-Texas shelf, with an average error of ~30%. In the future, we hope to improve our predictions using seasonally specific models and to analyze shorter time scales (days to weeks) of variability.

DTIC

Mississippi River (US); Optical Properties; Satellite Imagery; Satellite Observation

20070035507 Naval Research Lab., Bay Saint Louis, MS USA

Fine-Resolution Satellite-Based Sea Surface Temperatures over the Global Ocean

Kara, A B; Barron, C N; May 22, 2007; 17 pp.; In English; Original contains color illustrations

Report No.(s): AD-A470341; NRL/JA/7320-06-7015; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The accuracy and relative merits of two sets of daily global sea surface temperature (SST) analyses are examined and

compared. The 1/8 Modular Ocean Data Analysis System (MODAS) of the Naval Research Laboratory (NRL) is based only on infrared satellite retrievals. The 1/2 Real-Time, Global (RTG) SST analysis of the National Centers for Environmental Prediction (NCEP) supplements infrared satellite observations with ship and buoy data. The accuracy of both products is reported, providing potential users of either data set a common basis to assess the strengths and weaknesses of either product. Differences between the two show the impact of horizontal resolution, inclusion of source data streams, and different assumptions regarding error covariances. The global average of the root-mean-square (RMS) SST difference between MODAS and RTG is found to be 0.51 degrees C, with almost no mean bias. A global set of yearlong daily SST time series from moored buoys during 2002-2005 provides extensive validation data for this study. Comparisons at the locations of these 420 yearlong time series give a median RMS SST difference of 0.40 degrees C between MODAS and RTG. RMS error relative to the buoy observations is comparable, 0.38 degrees C for MODAS and 0.36 degrees C for RTG. The seasonal cycle of SST is well produced by both products with respect to the buoys with a median correlation coefficient of 0.94 for both products. Overall, higher resolution is an advantage for MODAS in improving pattern of daily SSTs, while including in Situ SSTs is an advantage for RTG.

DTIC

Data Processing; Meteorological Satellites; Ocean Data Acquisitions Systems; Ocean Surface; Sea States; Sea Surface Temperature

20070035787 National Security Space Office, Washington, DC USA

Plan for Operationally Responsive Space: a Report to Congressional Defense Committees

Apr 17, 2007; 24 pp.; In English

Report No.(s): AD-A470387; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Challenges in global political affairs have placed increasing demands on the way the USA uses space capabilities to achieve national security objectives. The recent National Security Presidential Directive-49 (NSPD-49) on National Space Policy, dated August 31, 2006, reaffirms the USA commitment to certain key principles in the areas of space law and policy for guiding the conduct of space activities. Implementing courses of action to achieve the goals and objectives associated with these principles will require increasing situational awareness and adaptability to the threat, as well as an ability to evolve the total suite of space capabilities to address emerging threats in new ways. The DoD Executive Agent for Space and the Commander USSTRATCOM have engaged key stakeholders in the National Security Space community to respond to Congress by setting forth a plan for the acquisition of capabilities for Operationally Responsive Space (ORS). The Department of Defense is committed to improving the Nation's means to develop, acquire, field and employ space capabilities in shortened timeframes and more affordable ways. We recognize the need for innovation and responsiveness in delivering space capabilities to all users. This plan outlines our way ahead to establish the essential infrastructure to focus ORS efforts to evolve space capabilities across the National Security Space Enterprise. This report was developed pursuant to Section 913(c) of the John Warner National Defense Authorization Act for Fiscal Year 2007 (P.L. 109-364).

DTIC

Aerospace Engineering; Security

20070035788 National Security Space Office, Washington, DC USA

National Positioning, Navigation and Timing (PNT) Architecture Workshop at Volpe, 26 April 2007

Apr 17, 2007; 47 pp.; In English; Original contains color illustrations

Report No.(s): AD-A470386; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This briefing gives an overview of the format of the National PNT Architecture Workshop at Volpe National Transportation Systems Center in Cambridge, MA, on 26 Apr 2007, looking at the architecture development process, its current status and where it is headed. The PNT is a system of systems designed to guide government-provided positioning, navigation and timing systems.

DTIC

Global Positioning System; Navigation; Positioning; Time Measurement

20070035812 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

Final Development, Testing, and Flight Preparation of the Rigidizable Get-Away-Special Experiment (RIGEX)

Miller, Zachary R; Jun 2007; 366 pp.; In English; Original contains color illustrations

Report No.(s): AD-A470304; AFIT/GAE/ENY/07-J14; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The purpose of this research is to support the final development of the Rigidizable Inflatable Get-Away-Special

Experiment (RIGEX). The RIGEX program is an experimental initial step in developing large-scale rigidizable inflatable structures, which can be utilized in space applications. The primary intent of RIGEX is to verify and validate ground testing of inflation and rigidization methods for inflatable space structures against a zero-gravity space environment. This is performed by designing a Canister for All Payload Ejections (CAPE) experiment to collect data on space rigidized structures for validation of ground testing methods. The results presented in this thesis provide documentation needed to meet the requirements set forth by the National Aeronautics and Space Administration (NASA) for launching a payload into space. This thesis establishes a process for appropriately ground testing the components of RIGEX in an environment similar to space and explains future testing required. Methods for charging and testing the performance of the onboard inflation system are also discussed. Additionally, the steps taken to replace the onboard imaging system are explained. Throughout the course of assembling the RIGEX protoflight model, several complications were encountered and the design was modified, which are presented along with an as-built final assembly drawing package. Lastly, the procedure for handling RIGEX during its future progression is illustrated.

DTIC

Aerospace Systems; Computer Aided Design; Flight Tests; Get Away Specials (STS); Inflatable Structures; Payloads

20070036303 Naval War Coll., Newport, RI USA

Towards Improved Operational Command and Control of Space Weapons

Davis, Chad J; May 10, 2007; 26 pp.; In English

Report No.(s): AD-A470762; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Recently, discussions concerning the weaponization of space have begun to reach a crescendo. Political and military leaders within the USA have started expanding the national discussion regarding this highly debated topic. This paper will not focus on the weaponization debate as a matter of policy, but rather will offer options for operational command and control of space weapons hypothetically deployed. Two broad categories are analyzed: command and control using reachback, and command and control from within the theater commander's operational area. The latter is divided into two possibilities: creation of a Joint Force Space Component Command (JFSCC) or creation of a Joint Force Air and Space Component Command (JFASCC). With doctrinal guidance as a starting point, each of these options for space strike command and control is analyzed according to its advantages and disadvantages to the operational commander. The paper concludes with a rationale for future Joint Force Commanders to create a Joint Forces Space Component Command to best command and control space strike assets.

DTIC

Command and Control; Space Weapons; Warfare

20070036325 Naval War Coll., Newport, RI USA

Space Power: A Critical Strength and a Critical Vulnerability of the US Military

Morgan, Dewitt; Goldizen, Derrill; May 10, 2007; 31 pp.; In English

Report No.(s): AD-A470836; No Copyright; Avail.: Defense Technical Information Center (DTIC)

In January 2007, China successfully tested a direct-ascent anti-satellite (ASAT) weapon, launching a kinetic kill vehicle staged atop a ballistic missile to destroy an aging weather satellite orbiting 537 miles above earth. Though not the first such test US space agencies had detected nor necessarily the most aggressive, as Air Force Chief of Staff General T. Michael Moseley explained to members of the Senate Armed Services Committee, the January test confirmed China 'can attrit and literally kill satellites.' Few would counter the assertion space systems have become critical to the efficacy of the instruments of national power, but to what extent do capabilities such as those demonstrated by China's ASAT testing threaten the successful conduct of the nation's diplomatic, information, military, and economic activities? This paper specifically seeks to determine whether a potential adversary's ability to conduct counterspace operations makes space power a critical vulnerability of the US military. Iraq's 2003 counterspace operations provide proof positive the unchallenged space superiority the US military has enjoyed since Desert Storm can no longer be taken for granted. The USA disproportionate dependence on highly vulnerable space systems provides its enemies a recognizable opportunity to degrade the effectiveness of American forces that they are increasingly willing and capable of exploiting. By incorporating threat-based considerations into operational plans, wargames, and exercises, theater commanders can better prepare their forces for the operational implications of 'war in space.'

DTIC

China; Military Spacecraft; Missiles; Satellite Communication; Scientific Satellites; Threat Evaluation; Vulnerability

20070036356 Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Wesseling, Germany
Present and Future Airborne and Space-borne Systems

Keydel, Wolfgang; Feb 1, 2007; 29 pp.; In English; Original contains color illustrations
Report No.(s): AD-A470890; No Copyright; Avail.: Defense Technical Information Center (DTIC)
No abstract available

Artificial Satellites; Interferometry; Polarimetry; Synthetic Aperture Radar

20070036451 Virginia Univ., Charlottesville, VA USA

Report of the IAU/IAG Working Group on Cartographic Coordinates and Rotational Elements: 2006

Seidelmann, P K; Archinal, B A; A'hearn, M F; Conrad, A; Consolmagno, G J; Hestroffer, D; Hilton, J L; Krasinsky, G A; Neumann, G; Oberst, J; Jan 2007; 27 pp.; In English
Report No.(s): AD-A471037; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Every three years the IAU/IAG Working Group on Cartographic Coordinates and Rotational Elements revises tables giving the directions of the poles of rotation and the prime meridians of the planets, satellites, minor planets, and comets. This report introduces improved values for the pole and rotation rate of Pluto, Charon, and Phoebe, the pole of Jupiter, the sizes and shapes of Saturn satellites and Charon, and the poles, rotation rates, and sizes of some minor planets and comets. A high precision realization for the pole and rotation rate of the Moon is provided. The expression for the Sun's rotation has been changed to be consistent with the planets and to account for light travel time.

DTIC

Comets; Coordinates; Mapping; Planets

20070036787 NASA Marshall Space Flight Center, Huntsville, AL, USA

J-2X: Progress on the Ares Upper Stage Engine

Byrd, Thomas D.; Kynard, Michael H.; September 18, 2007; 3 pp.; In English; AIAA Space 2007 Conference and Exposition, 18-20 Sep. 2007, Long Beach, CA, USA; Original contains color and black and white illustrations; No Copyright; Avail.: CASI: [A01](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20070036787>

NASA's Vision for Exploration requires a safe, reliable, affordable upper stage engine to power the Ares I Crew Launch Vehicle (CLV) and the Ares V Cargo Launch Vehicle (CaLV). The J-2X engine epitomizes NASA's philosophy of employing legacy knowledge, heritage hardware, and commonality to carry the next generation of explorers into low-Earth orbit and out into the solar system. As envisioned by the Exploration Systems Architecture Study (ESAS), the reference lunar mission would begin by launching the Ares V into orbit with the Earth Departure Stage (EDS) transporting the Lunar Surface Access Module (LSAM), followed by the Ares I, carrying the Orion Crew Exploration Vehicle, which would rendezvous with the EDS/LSAM before beginning its journey to the Moon.

Author

Ares I Upper Stage; Crew Exploration Vehicle; NASA Space Programs; J-2 Engine; Launch Vehicle Configurations

16

SPACE TRANSPORTATION AND SAFETY

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

20070035083 NASA Langley Research Center, Hampton, VA, USA

Independent Review Support for Phoenix Mars Mission Robotic Arm Brush Motor Failure

McManamen, John P.; Pellicciotti, Joseph; DeKramer, Cornelis; Dube, Michael J.; Peeler, Deborah; Muirhead, Brian K.; Sevilla, Donald R.; Sabahi, Dara; Knopp, Michael D.; October 2007; 59 pp.; In English; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 510505.01.07.01.06

Report No.(s): NASA/TM-2007- 215084; NESC-RP-07-13/06-050-E; L-19419; Copyright; Avail.: CASI: [A04](#), Hardcopy

The Phoenix Project requested the NASA Engineering and Safety Center (NESC) perform an independent peer review of the Robotic Arm (RA) Direct Current (DC) motor brush anomalies that originated during the Mars Exploration Rover (MER) Project and recurred during the Phoenix Project. The request was to evaluate the Phoenix Project investigation efforts

and provide an independent risk assessment. This includes a recommendation for additional work and assessment of the flight worthiness of the RA DC motors. Based on the investigation and findings contained within this report, the IRT concurs with the risk assessment Failure Cause / Corrective Action (FC/CA) by the project, 'Failure Effect Rating '3"; Major Degradation or Total Loss of Function, Failure Cause/Corrective Action Rating Currently '4"; Unknown Cause, Uncertainty in Corrective Action.'

Author

Robot Arms; Mars Exploration; Rover Project; Safety; Ratings; Assessments

17

SPACE COMMUNICATIONS, SPACECRAFT COMMUNICATIONS, COMMAND AND TRACKING

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

20070035876 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

Simulation Modeling and Performance Evaluation of Space Networks

Jennings, Esther H.; Segui, John; September 12, 2006; 19 pp.; In English; Space Internetworking Workshop (SIW5), 12-14 Sep. 2006, Hanover, MD, USA; Original contains color illustrations; Copyright; Avail.: Other Sources

ONLINE: <http://hdl.handle.net/2014/40352>

In space exploration missions, the coordinated use of spacecraft as communication relays increases the efficiency of the endeavors. To conduct trade-off studies of the performance and resource usage of different communication protocols and network designs, JPL designed a comprehensive extendable tool, the Multi-mission Advanced Communications Hybrid Environment for Test and Evaluation (MACHETE). The design and development of MACHETE began in 2000 and is constantly evolving. Currently, MACHETE contains Consultative Committee for Space Data Systems (CCSDS) protocol standards such as Proximity-1, Advanced Orbiting Systems (AOS), Packet Telemetry/Telecommand, Space Communications Protocol Specification (SCPS), and the CCSDS File Delivery Protocol (CFDP). MACHETE uses the Aerospace Corporation's Satellite Orbital Analysis Program (SOAP) to generate the orbital geometry information and contact opportunities. Matlab scripts provide the link characteristics. At the core of MACHETE is a discrete event simulator, QualNet. Delay Tolerant Networking (DTN) is an end-to-end architecture providing communication in and/or through highly stressed networking environments. Stressed networking environments include those with intermittent connectivity, large and/or variable delays, and high bit error rates. To provide its services, the DTN protocols reside at the application layer of the constituent internets, forming a store-and-forward overlay network. The key capabilities of the bundling protocols include custody-based reliability, ability to cope with intermittent connectivity, ability to take advantage of scheduled and opportunistic connectivity, and late binding of names to addresses. In this presentation, we report on the addition of MACHETE models needed to support DTN, namely: the Bundle Protocol (BP) model. To illustrate the use of MACHETE with the additional DTN model, we provide an example simulation to benchmark its performance. We demonstrate the use of the DTN protocol and discuss statistics gathered concerning the total time needed to simulate numerous bundle transmissions

Author

Communication Networks; Simulation; Space Communication; System Effectiveness; Communication Satellites

20070036046 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

THz Sources for Space

Siegel, Peter H.; Ward, John; Maiwald, Frank; Mehdi, Imran; March 1, 2007; 33 pp.; In English; Department of Defense Advisory Group on Electron Devices Special Technology Area Review on COmpact THZ Sources, 28 Feb. - 2 Mar. 2007, Arlington, WA, USA; Original contains color and black and white illustrations; Copyright; Avail.: Other Sources

ONLINE: <http://hdl.handle.net/2014/40332>

Terahertz is the primary frequency for line and continuum radiation from cool (5-100K) gas (atoms and molecules) and dust. This viewgraph presentation reviews the reasons for the interest in Terahertz Space Applications; the Terahertz Space Missions: in the past, present and planned for the future, Terahertz source requirements and examples of some JPL instruments; and a case study for a flight deliverable: THz Local Oscillators for ESA's Herschel Space Telescope

CASI

Technology Utilization; Superhigh Frequencies; Spacecraft Instruments; Interferometers; Remote Sensing

20070036261 NASA Goddard Space Flight Center, Greenbelt, MD, USA

The Earth Based Ground Stations Element of the Lunar Program

Gal-Edd, Jonathan; Fatig, Curtis; Schier, James; Lee, Charles; September 24, 2007; 8 pp.; In English; 13th Ka and Broadband Communications Conference, 24-26 Sep. 2007, Turin, Italy; Original contains black and white illustrations; Copyright; Avail.: CASI: [A02](#), Hardcopy

The Lunar Architecture Team (LAT) is responsible for developing a concept for building and supporting a lunar outpost with several exploration capabilities such as rovers, colonization, and observatories. The lunar outpost is planned to be located at the Moon's South Pole. The LAT Communications and Navigation Team (C&N) is responsible for defining the network infrastructure to support the lunar outpost. The following elements are needed to support lunar outpost activities: A Lunar surface network based on industry standard wireless 802.xx protocols, relay satellites positioned 180 degrees apart to provide South Pole coverage for the half of the lunar 28-day orbit that is obscured from Earth view, earth-based ground stations deployed at geographical locations 120 degrees apart. This paper will focus on the Earth ground stations of the lunar architecture. Two types of ground station networks are discussed. One provides Direct to Earth (DTE) support to lunar users using Ka-band 23/26Giga-Hertz (GHz) communication frequencies. The second supports the Lunar Relay Satellite (LRS) that will be using Ka-band 40/37GHz (Q-band). This paper will discuss strategies to provide a robust operational network in support of various lunar missions and trades of building new antennas at non-NASA facilities, to improve coverage and provide site diversification for handling rain attenuation.

Author

Lunar Bases; Lunar Communication; Communication Networks; Bandwidth; Radio Communication; Ground Stations; Antennas

20070036657 NASA Glenn Research Center, Cleveland, OH, USA

Dilution of Precision-Based Lunar Navigation Assessment for Dynamic Position Fixing

Sands, Obed S.; Connolly, Joseph W.; Welch, Bryan W.; Carpenter, James R.; Ely, Todd A.; Berry, Kevin; January 18, 2006; 9 pp.; In English; ION NTM 2006, 18-20 Jan. 2006, Monterey, CA, USA; Original contains color illustrations; No Copyright; Avail.: CASI: [A02](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20070036657>

The NASA Vision for Space Exploration is focused on the return of astronauts to the Moon. While navigation systems have already been proven in the Apollo missions to the moon, the current exploration campaign will involve more extensive and extended missions requiring new concepts for lunar navigation. In contrast to Apollo missions, which were limited to the near-side equatorial region of the moon, missions under the Exploration Systems Initiative will require navigation on the moon's limb and far-side. As these regions have poor Earth visibility, a navigation system comprised solely of Earth-based tracking stations will not provide adequate navigation solutions in these areas. In this paper, a Dilution of Precision (DoP) based analysis of the performance of a network of Moon orbiting satellites is provided. The analysis extends previous analysis of a Lunar Network (LN) of navigation satellites by providing an assessment of the capability associated with a variety of assumptions. These assumptions are with regard to the navigation receiver and satellite visibility. The assessment is accomplished by making appropriately formed estimates of DoP. Different adaptations of DoP (i.e. GDoP, PDoP, etc.) are associated with a different set of assumptions regarding augmentations to the navigation receiver or transceiver. A significant innovation described in this paper is the 'Generalized' Dilution of Precision. In the same sense that the various versions of DoP can be represented as a functional of the observability grammian, Generalized DoP is defined as a functional of the sum of observability grammians associated with a batch of radiometric measurements. Generalized DoP extends the DoP concept to cases in which radiometric range and range-rate measurements are integrated over time to develop an estimate of user position (referred to here as a 'dynamic' solution.) Generalized DoP allows for the inclusion of cases in which the receiver location is underdetermined when assessed in the usual 'kinematic' sense. The Generalized DoP concept is thereby a method to assess the navigation capability associated with constellations with sparse coverage. This alleviates the burden of performing a full 'covariance analysis' for each point on the surface of the Moon.

Author

Geometric Dilution of Precision; Lunar Bases; Navigation Satellites; Moon; Satellite Networks; Tracking Networks

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*.

20070035077 NASA Glenn Research Center, Cleveland, OH, USA

Full-Scale System for Quantifying Leakage of Docking System Seals for Space Applications

Dunlap, Patrick H., Jr.; Daniels, Christopher C.; Steinetz, Bruce M.; Erker, Arthur H.; Robbie, Malcolm G.; Wasowski, Janice L.; Drlik, Gary J.; Tong, Michael T.; Penney, Nicholas; October 2007; 32 pp.; In English; 43rd Joint Propulsion Conference and Exhibit, 8-11 Jul. 2007, Cincinnati, OH, USA; Original contains color illustrations

Contract(s)/Grant(s): WBS 644423.06.31.04.01.03.22

Report No.(s): NASA/TM-2007-215024; AIAA Paper 2007-5742; E-16218; Copyright; Avail.: CASI: [A03](#), Hardcopy

NASA is developing a new docking and berthing system to support future space exploration missions to low-Earth orbit, the Moon, and Mars. This mechanism, called the Low Impact Docking System, is designed to connect pressurized space vehicles and structures. NASA Glenn Research Center is playing a key role in developing advanced technology for the main interface seal for this new docking system. The baseline system is designed to have a fully androgynous mating interface, thereby requiring a seal-on-seal configuration when two systems mate. These seals will be approximately 147 cm (58 in.) in diameter. NASA Glenn has designed and fabricated a new test fixture which will be used to evaluate the leakage of candidate full-scale seals under simulated thermal, vacuum, and engagement conditions. This includes testing under seal-on-seal or seal-on-plate configurations, temperatures from -50 to 50 C (-58 to 122 F), operational and pre-flight checkout pressure gradients, and vehicle misalignment (plus or minus 0.381 cm (0.150 in.)) and gapping (up to 0.10 cm (0.040 in.)) conditions. This paper describes the main design features of the test rig and techniques used to overcome some of the design challenges.

Author

Leakage; Space Exploration; Seals (Stoppers); Fabrication; Technology Utilization; Aerospace Vehicles; Spacecraft Docking

20070035735 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Observing Mode Attitude Controller for the Lunar Reconnaissance Orbiter

Calhoun, Philip C.; Garrick, Joseph C.; [2007]; 9 pp.; In English; 20th International Symposium on Space FLight Dynamics, 24-28 Sep. 2007, Annapolis, MD, USA; No Copyright; Avail.: CASI: [A02](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20070035735>

The Lunar Reconnaissance Orbiter (LRO) mission is the first of a series of lunar robotic spacecraft scheduled for launch in Fall 2008. LRO will spend at least one year in a low altitude polar orbit around the Moon, collecting lunar environment science and mapping data to enable future human exploration. The LRO employs a 3-axis stabilized attitude control system (ACS) whose primary control mode, the 'Observing mode', provides Lunar Nadir, off-Nadir, and Inertial fine pointing for the science data collection and instrument calibration. The controller combines the capability of fine pointing with that of on-demand large angle full-sky attitude reorientation into a single ACS mode, providing simplicity of spacecraft operation as well as maximum flexibility for science data collection. A conventional suite of ACS components is employed in this mode to meet the pointing and control objectives. This paper describes the design and analysis of the primary LRO fine pointing and attitude re-orientation controller function, known as the 'Observing mode' of the ACS subsystem. The control design utilizes quaternion feedback, augmented with a unique algorithm that ensures accurate Nadir tracking during large angle yaw maneuvers in the presence of high system momentum and/or maneuver rates. Results of system stability analysis and Monte Carlo simulations demonstrate that the observing mode controller can meet fine pointing and maneuver performance requirements.

Author

Lunar Orbiter; Low Altitude; Polar Orbits; Lunar Environment; Reconnaissance; Attitude Control; Pointing Control Systems; Design Analysis; Feedback Control

20070035921 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

Life Cycle of a Mission

Bothwell, Mary; October 5, 2004; 5 pp.; In English; Girl Scout Master Trainers: Life Cycle of a Mission, 5 Oct. 2004, Pasadena, C, USA; Original contains black and white illustrations; Copyright; Avail.: Other Sources

ONLINE: <http://hdl.handle.net/2014/40498>

A viewgraph presentation describing the the six phases of a space mission is shown. The contents include: 1) What Does

Planning Involve?; 2) Designing the Flight System; 3) Building the Flight System; 4) Testing the Flight System; 5) Flying the Mission; and 6) Analyzing the Data.

CASI

Space Missions; Systems Engineering; Space Exploration; Flight Tests

20070035971 California Univ., Santa Barbara, CA, USA; Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

Parallel Estimators and Communication in Spacecraft Formations

Smith, Roy S.; Hadaegh, Fred Y.; July 4, 2005; 6 pp.; In English; 16th International Federation of Automatic Control (IFAC) World Congress, 4-8 Jul. 2005, Prague, Czech Republic; Original contains black and white illustrations; Copyright; Avail.: Other Sources

ONLINE: <http://hdl.handle.net/2014/40564>

This paper investigates the closed-loop dynamics of systems controlled via parallel estimators. This structure arises in formation flying problems when each spacecraft bases its control action on an internal estimate of the complete formation state. For LTI systems a separation principle shows that the necessary and sufficient conditions for overall system stability are more stringent than the single controller case; the controllers' open-loop dynamics necessarily appear in the closed-loop dynamics. Communication amongst the spacecraft can be used to specify the complete system dynamics and a framework for integrating the design of the communication links into the formation flying control design problem is presented.

Author

Formation Flying; Feedback Control; Communication Networks; Systems Engineering; Design Analysis

20070035980 NASA Langley Research Center, Hampton, VA, USA

A-Train Mission Operations Working Group: CALIPSO Mission Status

Cisewski, Michael S.; MacDonnell, David G.; Queruel, Nadege; Verhappen, Carlous A.; Treppe, Charles R.; October 22, 2007; 40 pp.; In English; A-Train-Lille 07: Symposium on Bringing Together A-Train Observations and Modelling to Understand Aerosols and Clouds, 33-35 Oct. 2007, Lille Grand-Palais, France; Original contains color illustrations

Contract(s)/Grant(s): WBS 653967.07.05.01; Copyright; Avail.: CASI: **A03**, Hardcopy

This series of viewgraphs presents an introduction to the status of the Cloud-Aerosol Lidar and Infrared Pathfinder Satellite Observation (CALIPSO), lessons learned during CALIPSO inclination maneuvers, the planning for CALIPSO's inclination maneuver to take place in 2009, examines a decision whether to precess or not, the plans to change CALIPSO's pitch, and the plans to change CALIPSO's pitch from the viewpoint of the payload.

CASI

Meteorological Satellites; CALIPSO (Pathfinder Satellite); Earth Observations (From Space); Mission Planning; Trajectory Planning

20070035981 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

Thermal Cycle Lifetest of Swaged Cathode Heaters

Polk, Jay; Ramesham, Rajeshuni; February 28, 2007; 19 pp.; In English; IMAP 2nd Advanced Technology Workshop on Reliability of Advanced Packages and Devices in Extreme Cold Environments, 27-31 Feb. 2007, Arcadia, CA, USA; Original contains color and black and white illustrations; Copyright; Avail.: Other Sources

ONLINE: <http://hdl.handle.net/2014/40346>

This viewgraph presentation reviews the thermal cycling test for the Dawn mission. The flight system, the mission requirements, and the Ion Propulsion System (IPS) are shown. The Dawn mission requires periodic thruster shutdown for data transmission and coast periods. The thermal cycling test is designed to simulate approximately three complete mission profiles. The results of the tests are reviewed.

CASI

Mission Planning; Thermal Cycling Tests; Heating Equipment; Asteroid Missions; Heaters; Heating; Temperature Control

20070036002 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

On the Detection of Energetically Efficient Trajectories for Spacecraft

Dellnitz, Michael; Junge, Oliver; Lo, Martin; Thiere, Bianca; July 19, 2001; 8 pp.; In English; AAS/AIAA Astrodynamics

Specialists Conference, 30 Jul. - 2 Aug. 2001, Quebec City, Canada; Original contains black and white illustrations; Copyright; Avail.: Other Sources

ONLINE: <http://hdl.handle.net/2014/40517>

We propose a new method for the detection of energy-efficient trajectories for spacecraft. Via a so called target-shooting approach a pseudo-orbit between the relevant points in space is constructed in a simple model of the problem. This approximate trajectory is meant to serve as input for a more sophisticated direct method in order to compute a true trajectory in the full model. We demonstrate the applicability of the new method by considering the redesign of part of the trajectory of the NASA/JPL Genesis discovery mission.

Author

Spacecraft Trajectories; Genesis Mission; Targets

20070036012 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

Dynamics of Drag Free Formations in Earth Orbit

Ploen, Scott R.; Scharf, Daniel P.; Hadaegh, Fred. Y.; Acikmese, A. Behcet; November 8, 2004; 8 pp.; In English; SPIE 4th International Asia-Pacific Environmental Remote Sensing Symposium, 8 Nov. 2004, Honolulu, HI, USA; Original contains black and white illustrations; Copyright; Avail.: Other Sources

ONLINE: <http://hdl.handle.net/2014/40543>

In this paper the translational equations of motion of a formation of n spacecraft in Earth orbit, n (sub f) of which are drag-free spacecraft, are derived in a coordinate-free manner using the balance of linear momentum and direct tensor notation. A drag-free spacecraft consists of a spacecraft bus and a proof mass shielded from external disturbances in an internal cavity. By controlling the spacecraft so that the proof mass remains centered in the cavity, the spacecraft follows a purely gravitational orbit. The results described in this paper provide a first step toward coupling drag-free control technology with formation flying in order to mitigate the effect of differential aerodynamic drag on formation flying missions (e.g., Earth imaging applications) in low Earth orbit.

Author

Drag Reduction; Aerodynamic Drag; Equations of Motion; Formation Flying; Low Earth Orbits; Spacecraft Orbits; Spacecraft Motion

20070036043 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

The Cassini Spacecraft Design and Operations

Webster, Julie L.; February 13, 2005; 10 pp.; In English; Space Technology and Application International Forum (STAIF), 13-17 Feb. 2005, Albuquerque, NM, USA; Original contains color and black and white illustrations; Copyright; Avail.: Other Sources

ONLINE: <http://hdl.handle.net/2014/40544>

Designed and funded in the pre-'better, faster, cheaper' era, Cassini was built to be the one mission to Saturn for many years to come. Its complement of twelve Orbiter science instruments and the Huygens Probe make Cassini one of the most complex missions ever flown. With a seven-year cruise and Saturn Orbit Insertion now over, Cassini is settling in to perform a very ambitious prime mission over the next four years. This paper provides an overview of the spacecraft design and the mission operations to date.

Author

Cassini Mission; Spacecraft Design; Space Probes; Huygens Probe

20070036044 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

Robust Load-Sharing Control of Spacecraft Formations

Garcia-Sanz, M.; Hadaegh, Fred Y.; July 4, 2005; 6 pp.; In English; 16th IFAC World Congress, 4-8 Jul. 2005, Prague, Czech Republic; Original contains black and white illustrations

Contract(s)/Grant(s): PR2004-0217; Copyright; Avail.: Other Sources

ONLINE: <http://hdl.handle.net/2014/40542>

This paper focuses on the design of autonomous and collaborative control strategies to govern the relative distances among multiple spacecraft in formation with no ground intervention. A coordinate load-sharing control structure for formation flying and a methodology to control their dynamic models with slow time-varying and uncertain parameters are the main

objectives of this work. The method is applied to a deep space formation example, where the uncertainty in spacecraft fuel masses is also considered.

Author

Formation Flying; Spacecraft Control; Automatic Control; Dynamic Models; Control Systems Design

20070036626 NASA Goddard Space Flight Center, Greenbelt, MD, USA

New Observations of the Heliospheric Magnetic Field from the Voyager Spacecraft

Burlaga, Leonard F.; [2007]; 1 pp.; In English; 2007 American Geophysical Union (AGU) Fall Meeting, 10-14 Dec. 2007, San Francisco, CA, USA; No Copyright; Avail.: Other Sources; Abstract Only

We review recent observations of variations of the heliospheric magnetic field $B(t)$ made by Voyager 1 and 2 (V1 and V2), and we discuss the boundary conditions needed for models to explain the observations. Usually, observations from a spacecraft close to the Sun, such as ACE, WIND or Ulysses are used as input to a time-dependent model. Generally, the predicted profile $B(t)$ can be compared directly with the observed profile only when either V1 or V2 is approximately radially aligned with a near-Sun spacecraft; this happens rarely and only for a brief time interval. The Bastille Day events illustrate this situation. In the absence of radial alignment of the spacecraft it is possible to predict the development of a global structure (a GMIR) with data from ACE or WIND, if they obtain a representative sample the flows that merge to form a GMIR. When latitudinal gradients are small and when there is statistical homogeneity in the azimuthal direction, it is possible to predict the statistical properties of the large-scale fluctuations of $B(t)$ observed by V1 or V2 during a year or so. We illustrate this situation with observations from the recent solar maximum and the declining phase of the solar cycle. Predictions of detailed observations made by V1 and V2 under general conditions (e.g., when there is a large latitudinal gradient) require boundary conditions as a function of time on a surface, such as a Sun-centered sphere with a radius of 1 AU. These conditions can only be provided by global solar observations. We suggest the feasibility of such an approach, using V2 observations for 2005 and 2006. The prediction of observations in the heliosheath requires the solution of the 3-D boundary problem for the supersonic solar wind and propagation of solar wind through the termination shock into the heliosphere. The properties of $B(t)$ observed in the heliosheath have not yet been predicted.

Author

Heliosphere; Magnetic Fields; Voyager 1 Spacecraft; Voyager 2 Spacecraft

20070036650 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

Precision Formation Delta-V Requirements for Distributed Platforms in Earth Orbit

Scharf, Daniel P.; Hadaegh, Fred Y.; Ploen, Scott R.; November 9, 2004; 13 pp.; In English; SPIE Remote Sensing of the Atmosphere, Ocean, Environment, and Space Conference, 8 Nov. 2004, Honolulu, HI, USA; Original contains black and white illustrations; Copyright; Avail.: Other Sources

ONLINE: <http://hdl.handle.net/2014/40508>

Distributed spacecraft flying in formation can overcome the resolution limitations of monolithic, Earth-sensing systems. However, formation spacecraft must now expend fuel to counteract disturbances and the gravity gradients between spacecraft. We consider three different formation architectures and determine the $(\Delta v)_{nu}$ required to maintain relative positions at accuracies from 0.1 to 10 m ($1(\sigma)$). The three architectures considered are: (i) Leader/Follower, in which individual spacecraft controllers track with respect to a passive, leader spacecraft, (ii) Center of Formation, in which individual spacecraft controllers track with respect to the geometric center of the formation, and (iii) Iterated Virtual Structure, in which a formation template is fit each timestep and individual spacecraft controllers track with respect to the fitted template.

Author

Formation Flying; Earth Orbits; Controllers; Detection; Gravitation

20070036726 NASA Marshall Space Flight Center, Huntsville, AL, USA

NASA-STD-4005 and NASA-HDBK-4006, LEO Spacecraft Solar Array Charging Design Standard

Ferguson, Dale C.; September 25, 2007; 1 pp.; In English; Space Photovoltaic Research and Technology XX, 25-27 Sep. 2007, Cleveland, OH, USA; No Copyright; Avail.: Other Sources; Abstract Only

Two new NASA Standards are now official. They are the NASA LEO Spacecraft Charging Design Standard (NASA-STD-4005) and the NASA LEO Spacecraft Charging Design Handbook (NASA-HDBK-4006). They give the

background and techniques for controlling solar array-induced charging and arcing in LEO. In this paper, a brief overview of the new standards is given, along with where they can be obtained and who should be using them.

Author

Low Earth Orbits; Spacecraft Charging; Solar Arrays

20070036792 NASA Marshall Space Flight Center, Huntsville, AL, USA

Ares I Crew Launch Vehicle Project: Forward Plan to Preliminary Design Review

Dumbacher, Daniel L.; Reuter, James L.; September 18, 2007; 2 pp.; In English; AIAA Space 2007, 18-20 Sep. 2007; Original contains color illustrations; No Copyright; Avail.: CASI: [A01](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20070036792>

The Exploration Launch Projects Office, located at NASA's Marshall Space Flight Center, conducted the Ares I Crew Launch Vehicle System Requirements Review (SRR) at the end of 2006, a mere year after the project team was assembled. In Ares' first year, extensive trade studies and evaluations were conducted to refine the design initially recommended by the Exploration Systems Architecture Study, conceptual designs were analyzed for fitness, and the contractual framework was assembled to enable a development effort unparalleled in American space flight since the Space Shuttle. Now, the project turns its focus to the Preliminary Design Review (PDR), scheduled for 2008. Taking into consideration the findings of the SRR, the design of the Ares I is being tightened and refined to meet the operability, reliability, and affordability goals outlined by the Constellation Program. As directed in NASA Procedure and Regulation (NPR) 7123, NASA Systems Engineering Procedural Requirements, the Ares I SRR examined 'the functional and performance requirements defined for the system and the preliminary program or project plan and ensures that the requirements and the selected concept will satisfy the mission.' The SRR was conducted to ensure the system- and element-level design and interface requirements are defined prior to proceeding into the project's design phase. The Exploration Launch Projects Control Board convened on December 19, 2006, and accepted the findings of the SRR and the go-forward plan proceeding to PDR. Based upon these findings, the Ares project believes that operability must drive the vehicle's design, and that a number of design challenges, including system mass and reliability, must be addressed as part of the progress to PDR.

Derived from text

Ares I Launch Vehicle; Design Analysis; Project Planning; Spacecraft Design; Systems Engineering

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SPACECRAFT INSTRUMENTATION AND ASTRIONICS

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

20070035964 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

Onboard Autonomy on the Earth Observing One Mission

Chien, Steve; Sherwood, Robert L.; Tran, Daniel; Cichy, Benjamin; Rabideau, Gregg; Castano, Rebecca; Davies, Ashley; Mandl, Dan; Frye, Stuart; Trout, Bruce; Hengemihle, Jerry; D'Agostino, Jeff; Shulman, Seth; Ungar, Stephen; Brakke, Thomas; Boyer, Darrell; Van Gaasbeck, Jim; Greeley, Ronald; Doggett, Thomas; Baker, Victor; Dohm, James; Ip, Felipe; September 20, 2004; 8 pp.; In English; AIAA First Intelligence Systems Technical Conference, 20-22 Sep. 2004, Chicago, IL, USA; Original contains black and white illustrations; Copyright; Avail.: Other Sources

ONLINE: <http://hdl.handle.net/2014/40525>

The Earth Observing One Spacecraft is currently flying The Autonomous Sciencecraft Experiment (ASE) - onboard autonomy software to improve science return. The ASE software enables the spacecraft to autonomously detect and respond to science events occurring on the Earth. ASE includes software systems that perform science data analysis, mission planning, and run-time robust execution. In this article we describe the autonomy flight software and how it enables a new paradigm of autonomous science and mission operations.

Author

Autonomy; Applications Programs (Computers); Data Processing; Earth Observations (From Space); Spacecraft

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*.

20070035497 Army Tank-Automotive Research and Development Command, Warren, MI USA

Ground Vehicle Power and Mobility Overview

Hitchcock, Jennifer; May 30, 2007; 28 pp.; In English; Original contains color illustrations

Report No.(s): AD-A470330; TARDEC-17216; No Copyright; Avail.: Defense Technical Information Center (DTIC)

No abstract available

Combat; Electric Propulsion; Mobility

20070035914 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

Charged Particle Effects on Solar Sails - An Overview

Garrett, Henry B.; Minow, Joseph I.; September 28, 2004; 9 pp.; In English; Solar Sail Technology and Applications Conference, 28-29 Sep. 2004, Greenbelt, MD, USA; Original contains color and black and white illustrations; Copyright;

Avail.: Other Sources

ONLINE: <http://hdl.handle.net/2014/40526>

The NASA In-Space Propulsion Program is currently sponsoring a comprehensive look at the effects of the charged particle environment on the first generation of Solar Sail propulsion systems. As part of this, a joint NASA MSFC/JPL team is investigating the effects of spacecraft charging on the preliminary ISP Solar Sail mission designs. This paper will begin by reviewing the plasma environments being proposed for such missions--these range from the ambient solar wind at approximately 1 AU in the ecliptic plane, approximately 0.5 AU solar-polar orbit, and geosynchronous orbit. Following a discussion of the critical design issues associated with Solar Sails from a charging standpoint, a simple Sail configuration for modeling purposes will be presented. Results for the various environments will be illustrated in terms of the estimated surface potentials for the Solar Sail using the NASCAP-2K charging analysis program. Based on these potentials, representative plasma flow fields and potential contours surrounding the Solar Sail will then be presented. The implications of these results--the surface potentials and plasma flow--will be discussed in the context of their effects on Solar Sail operations and structural configurations.

Author

Charged Particles; Solar Sails; Propulsion System Configurations; Propulsion System Performance; Solar Wind; Spacecraft Charging; Plasmas (Physics); Spacecraft Design

20070036010 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

An Overview of the VHITAL Program: A Two-Stage Bismuth Fed Very High Specific Impulse Thruster with Anode Layer

Sengupta, Anita; Marrese-Reading, Colleen; Capelli, Mark; Scharfe, David; Tverdokhlebov, Sergey; Semenkin, Sasha; Tverdokhlebov, Oleg; Boyd, Ian; Keidar, Michael; Yalin, Azer; Markusic, Tom; Polzin, Kurt; October 31, 2005; 13 pp.; In English; 29th International Electric Propulsion conference, 21 Oct. - 4 Nov. 2005, Princeton, NJ, USA; Original contains black and white illustrations

Report No.(s): IEPC-2005-238; Copyright; Avail.: Other Sources

ONLINE: <http://hdl.handle.net/2014/40557>

The Very High Isp Thruster with Anode Layer (VHITAL) is a two stage Hall thruster program that is a part of NASA's Prometheus Program in NASA's New Exploration Systems Mission Directorate (ESMD). It is a potentially viable low-cost alternative to ion engines for near-term NEP applications with the growth potential to support mid-term and far-term NEP missions... This paper will present an overview of the thruster fabrication, pre-existing TAL 160 demonstration, feed system development, lifetime assessment, contamination assessment, and mission study activities performed to date.

Author

Hall Thrusters; Specific Impulse; Feed Systems; Systems Engineering; Fabrication; Ion Engines; High Impulse

20070036024 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

Design and Optimization of Low-thrust Orbit Transfers Using Q-law and Evolutionary Algorithms

Lee, Seungwon; vonAllmen, Paul; Fink, Wolfgang; Petropoulos, Anastassios; Terrile, Richard; March 5, 2005; 14 pp.; In

English; IEEE Aerospace Conference, 5-12 Mar. 2005, Big Sky, MT, USA; Original contains black and white illustrations; Copyright; Avail.: Other Sources
ONLINE: <http://hdl.handle.net/2014/40522>

Future space missions will depend more on low-thrust propulsion (such as ion engines) thanks to its high specific impulse. Yet, the design of low-thrust trajectories is complex and challenging. Third-body perturbations often dominate the thrust, and a significant change to the orbit requires a long duration of thrust. In order to guide the early design phases, we have developed an efficient and efficacious method to obtain approximate propellant and flight-time requirements (i.e., the Pareto front) for orbit transfers. A search for the Pareto-optimal trajectories is done in two levels: optimal thrust angles and locations are determined by Q-law, while the Q-law is optimized with two evolutionary algorithms: a genetic algorithm and a simulated-annealing-related algorithm. The examples considered are several types of orbit transfers around the Earth and the asteroid Vesta.

Author

Design Optimization; Ion Engines; Propulsion; Specific Impulse; Genetic Algorithms

20070036669 NASA Marshall Space Flight Center, Huntsville, AL, USA

Advances in Radiation-Tolerant Solar Arrays for SEP Missions

O'Neill, Mark J.; Eskenazi, Michael I.; Ferguson, Dale C.; September 17, 2007; 3 pp.; In English; 30th International Electric Propulsion Conference, 17-20 Sep. 2007, Florence, Italy; Original contains black and white illustrations; Copyright; Avail.: CASI: [A01](#), Hardcopy

As the power levels of commercial communications satellites reach the 20 kWe and higher, new options begin to emerge for transferring the satellite from LEO to GEO. In the past electric propulsion has been demonstrated successfully for this mission - albeit under unfortunate circumstances when the kick motor failed. The unexpected use of propellant for the electric propulsion (EP) system compromised the life of that vehicle, but did demonstrate the viability of such an approach. Replacing the kick motor on a satellite and replacing that mass by additional propellant for the EP system as well as mass for additional revenue-producing transponders should lead to major benefits for the provider. Of course this approach requires that the loss in solar array power during transit of the Van Allen radiation belts is not excessive and still enables the 15 to 20 year mission life. In addition, SEP missions to Jupiter, with its exceptional radiation belts, would mandate a radiation-resistant solar array to compete with a radioisotope alternative. Several critical issues emerge as potential barriers to this approach: reducing solar array radiation damage, operating the array at high voltage (>300 V) for extended times for Hall or ion thrusters, designing an array that will be resistant to micrometeoroid impacts and the differing environmental conditions as the vehicle travels from LEO to GEO (or at Jupiter), producing an array that is light weight to preserve payload mass fraction - and to do this at a cost that is lower than today's arrays. This paper will describe progress made to date on achieving an array that meets all these requirements and is also useful for deep space electric propulsion missions.

Author

Solar Arrays; Radiation Tolerance; Electric Propulsion; Space Missions; Radiation Damage; Low Earth Orbits; High Voltages; Communication Satellites; Hall Thrusters

20070036670 NASA Marshall Space Flight Center, Huntsville, AL, USA

The New NASA-STD-4005 and NASA-HDBK-4006, Essentials for Direct-Drive Solar Electric Propulsion

Ferguson, Dale C.; September 17, 2007; 1 pp.; In English; 30th International Electric Propulsion Conference, 17-20 Sep. 2007, Florence, Italy; No Copyright; Avail.: Other Sources; Abstract Only

High voltage solar arrays are necessary for direct-drive solar electric propulsion, which has many advantages, including simplicity and high efficiency. Even when direct-drive is not used, the use of high voltage solar arrays leads to power transmission and conversion efficiencies in electric propulsion Power Management and Distribution. Nevertheless, high voltage solar arrays may lead to temporary power disruptions, through the so-called primary electrostatic discharges, and may permanently damage arrays, through the so-called permanent sustained discharges between array strings. Design guidance is needed to prevent these solar array discharges, and to prevent high power drains through coupling between the electric propulsion devices and the high voltage solar arrays. While most electric propulsion systems may operate outside of Low Earth Orbit, the plasmas produced by their thrusters may interact with the high voltage solar arrays in many ways similarly to Low Earth Orbit plasmas. A brief description of previous experiences with high voltage electric propulsion systems will be given in this paper. There are two new official NASA documents available free through the NASA Standards website to help in designing and testing high voltage solar arrays for electric propulsion. They are NASA-STD-4005, the Low Earth Orbit Spacecraft Charging Design Standard, and NASA-HDBK-4006, the Low Earth Orbit Spacecraft Charging Design Handbook. Taken together, they can both educate the high voltage array designer in the engineering and science of spacecraft charging

in the presence of dense plasmas and provide techniques for designing and testing high voltage solar arrays to prevent electrical discharges and power drains.

Author

Electric Propulsion; Solar Electric Propulsion; High Voltages; Propulsion System Configurations; Electrostatics; Propulsion System Performance

20070036780 Jacobs Engineering Group, Inc., Huntsville, AL, USA

Scaling of Performance in Liquid Propellant Rocket Engine Combustors

Hulka, James R.; March 07, 2007; 87 pp.; In English; 20th Memorial meeting of the Northern Section of the Japan Society for Aeronautical and Space Sciences (JSASS), 7-9 Mar. 2007, Sendai, Japan; Original contains black and white illustrations; No Copyright; Avail.: CASI: A05, Hardcopy

ONLINE: <http://hdl.handle.net/2060/20070036780>

This paper discusses scaling of combustion and combustion performance in liquid propellant rocket engine combustion devices. In development of new combustors, comparisons are often made between predicted performance in a new combustor and measured performance in another combustor with different geometric and thermodynamic characteristics. Without careful interpretation of some key features, the comparison can be misinterpreted and erroneous information used in the design of the new device. This paper provides a review of this performance comparison, including a brief review of the initial liquid rocket scaling research conducted during the 1950s and 1960s, a review of the typical performance losses encountered and how they scale, a description of the typical scaling procedures used in development programs today, and finally a review of several historical development programs to see what insight they can bring to the questions at hand.

Author

Combustion Chambers; Liquid Propellant Rocket Engines; Propulsion System Performance; Combustion Efficiency; Propulsive Efficiency; Scaling

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*.

20070035211 Lockheed Martin Aeronautical Systems, Marietta, GA USA

Mechanical and Microstructural Effects of Cold Spray Aluminum on Al 7075 Using Kinetic Metallization and Cold Spray Processes (Preprint)

Barnes, John; Champagne, Victor; Ballard, Donna; Eden, Timothy J; Shoffner, Brent; Potter, John K; Wolfe, Douglas E; Jan 2007; 25 pp.; In English

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

Report No.(s): AD-A470138; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470138>

The objective of this study was to examine how the deposition of a thin layer of Commercially Pure (CP) Al on thin plates of Al-7075 T6 affects the tensile properties of the substrate. The CP Al was deposited using both Cold Spray and Kinetic Metallization. Cold Spray utilizes both He and N₂ as the carrier gas and a supersonic nozzle while Kinetic Metallization uses only He as the carrier gas and a sonic or friction compensated nozzle. A test matrix was established to evaluate the coatings applied by both methods. Characterization of the coatings included microstructural analysis, hardness measurements, and tensile, S-N fatigue and bend tests. Results of the characterization are presented.

DTIC

Aluminum; Aluminum Coatings; Deposition; Metallizing; Microstructure; Sprayers

20070035517 Bari Univ., Italy

Assessing the Effects of Soil Humic and Fulvic Acids on Germination and Early Growth of Native and Introduced Grass Varieties

Senesi, Nicola; May 22, 2007; 33 pp.; In English

Contract(s)/Grant(s): N62558-05-P-0179

Report No.(s): AD-A470355; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The presence of humic acid (HA) generally affects positively and at various extent the germination and early growth of

all varieties examined but in some cases negative effects are measured on the early growth. However, the response of the species varieties, examined either singularly or in combination by two, does not show any specific trend as a function of either the type or concentration of HA. This result can be ascribed to the fact that the three HAs used for the germination and early growth experiments do not show any significant differences in their compositional, functional and structural parameters determined by chemical methods and spectroscopic techniques. Thus, it is impossible to find out any direct relationship between HA chemical and physicochemical parameters, or concentration, and germination and growth response of the four varieties examined either singularly or in combination by two.

DTIC

Germination; Grasses; Soils

20070035580 Wien Univ., Austria

Research on Organic Chemistry of Ferrocene

Schloegl, K; Jan 1962; 26 pp.; In English

Report No.(s): AD-A470488; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Surface-chromatography on Silica-jelly (Kieselgel-G) using benzene-ethanol-mixtures or hexane as solvents has proved to be a very useful analytical method for rapid separation and identification of ferrocene-derivatives.

DTIC

Ferrocenes; Organic Chemistry

20070035781 Concurrent Technologies Corp., Johnstown, PA USA

Environmental Technology Verification Coatings and Coating Equipment Program (ETV CCEP). High Transfer Efficiency Spray Equipment - Generic Verification Protocol (Revision 0)

Fisher, Robert J; Sep 30, 2006; 59 pp.; In English

Contract(s)/Grant(s): W74V8H-04-D-0005

Report No.(s): AD-A470549; NDCEE-0428; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The Environmental Technology Verification (ETV) Program has been established by the U.S. Environmental Protection Agency (EPA) to verify the performance characteristics of innovative environmental technologies across all media and report this objective information to the states, buyers, and users of environmental technology; thus, accelerating the entrance of these new technologies into the marketplace. Verification organizations oversee and report verification activities based on testing and quality assurance protocols developed with input from major stakeholders and customer groups associated with the technology area. ETV consists of six technology centers. Information about each of these centers can be found on the Internet at <http://www.epa.gov/etv/>. EPA's ETV Program, through the National Risk Management Research Laboratory (NRMRL), Air Pollution Prevention and Control Division (APPCD) has partnered with Concurrent Technologies Corporation (CTC), through the National Defense Center for Environmental Excellence (NDCEE), to verify innovative coatings and coating equipment technologies for reducing air emissions from coating operations. Pollutant releases to other media are considered in less detail. The following protocol outlines the basis for completing an ETV verification test of High-Transfer Efficiency Spray Guns.

DTIC

Coating; Coatings; Protocol (Computers); Quality Control; Sprayers

20070035849 Institute for Organic Chemistry TNO, Utrecht, Netherlands

Synthesis of Organotin Polymers by Poly-Addition

Noltes, J G; van der Kerk, G J; Jan 1962; 15 pp.; In English

Report No.(s): AD-A470439; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The results of a synthetic program directed towards the preparation of IVth main group organometallic polymers are presented. The main body of the report is concerned with the synthesis of linear polymers having a carbon chain regularly interrupted by tin (and in some cases other IVth group) atoms. Such polymers have been obtained by means of true poly-addition reactions (hydrogen transfer polymerization) involving an organotin dihydride and either a dienic or a diynic or a monoyne C compound. The synthesis of Vth group organometal-substituted polystyrenes carbon chain polymers containing the organometallic moiety as a substituent group as well as of a series of poly-p-phenylenesilanes-polymers consisting of chains of p-phenylene groups connected by dialkyl(aryl) silane groups are dealt with briefly.

DTIC

Organometallic Compounds; Organometallic Polymers; Carbon

20070036053 Ohio State Univ., Columbus, OH USA

Injection and Scattering of Polarized Spins at Nanoscale Polymer Interfaces

Epstein, Arthur J; May 31, 2004; 15 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAAD19-01-1-0562

Report No.(s): AD-A470558; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470558>

We made excellent progress several directions. We demonstrated that V[TCNE]₂ is a room temperature fully spin polarized magnetic semiconductor of interest for spintronic applications, including spin valves. We increased the coercivity (which is crucial for spintronics device) of the parent material V[TCNE]₂ by doping with ions that have large magnetocrystalline anisotropy (Co, Fe, etc.). For Co and Fe substantially higher coercive fields, H_c, than the pure V[TCNE]₂ (275 Oe for x = 0.3 and 1100 Oe for x = 0.05 at 5 K, respectively) were realized, while in case of Ni H_c does not exceed 14 Oe. T_c for the materials with x > 0.3 exceeds 300 K. We extended MR measurements to very high magnetic fields (up to 32 T) to observe the remarkable linear MR behavior below the ordering temperature predicted for this magnetic semiconductor. Ferrimagnetic resonance (FMR) studies have been performed on V[TCNE]₂ using high frequency microwaves (240 GHz) to enhance the spectral resolution. Effective magnetization, M_{eff}, intensity and linewidth behaviors of individual peaks indicate long-range magnetic ordering and also the presence of glassy nature due to the formation of multi-domains. XANES studies performed at ANL, show that vanadium ions are coordinated by 6 nitrogen atoms.

DTIC

Injection; Magnetoresistivity; Scattering; Semiconductors (Materials)

20070036306 Edgewood Chemical Biological Center, Aberdeen Proving Ground, MD USA

Infrared Spectroscopic Observations on the Fate of Organophosphorus Compounds Exposed to Atmospheric Moisture. Part 3

Piffath, Ronald J; May 2007; 549 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): Proj-3RDC11

Report No.(s): AD-A470771; ECBC-TR-392; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This report is part three in a three part series dedicated to observing the degradation of organophosphorus compound-exposure to atmospheric moisture as a function of time. The investigation continues with Phosphines, Phosphites, Phosphonites, Phosphinites, Phosphoric Acids, Phosphonic Acids, Phosphinic Acids, Phosphine Oxides, Phosphoric Halides, Phosphonates, Phosphinic Halides, Phosphinates, Phosphates, P-N Compounds, P=S (Thiono) Compounds, P-S (Thiolo) Compounds, P=Se Compounds, P-O-P (Pyro) Compounds, other P-Compounds, and Inorganic Compounds. Experimental observation of chemical degradation is interpreted from the measured infrared over the 4000 to 400 wavenumber region. Infrared band assignments are reported and newly formed compounds are identified. The final fate of the compound from starting material is reported. Infrared stack plots are provided illustrating the chemical changes as a function of time.

DTIC

Atmospheres; Atmospheric Moisture; Infrared Spectroscopy; Moisture; Organic Phosphorus Compounds

20070036322 Wyoming Univ., Laramie, WY USA

Novel Surfactants and Their Applications, Including Mustard Decontamination

Jaeger, David A; Jun 30, 2007; 15 pp.; In English

Contract(s)/Grant(s): DAAD19-03-1-0342

Report No.(s): AD-A470818; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The results of research in six studies is summarized. Each of the studies involved the synthesis and characterization of examples of a novel class of surfactants with general structure 1. The darkened circles represent headgroups, and the wavy lines, hydrocarbon chains. Thus these surfactants contain two terminal headgroups connected to a central headgroup by hydrocarbon chains. For ease of discussion, we use the term 'shamrock' to describe surfactants belonging to class 1, denoting their triple-headed character and reflecting the fact that shamrocks have leaflets in groups of three. Some of the shamrock surfactants were evaluated in the decontamination of mustard simulant 13.

DTIC

Decontamination; Hydrocarbons; Surfactants

20070036375 Case Western Reserve Univ., Cleveland, OH USA

High Temperature Resistant Organic/Inorganic Hybrid Polymers: An Architectural Study

Rowan, Stuart; Weder, Christoph; Apr 18, 2007; 16 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAAD19-03-1-0208

Report No.(s): AD-A470916; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This project addressed the development of a new class of metal/organic supramolecular polymers, which are prepared by the self-assembly of ditopic ligands and appropriate metal ions. The ditopic ligand consists of two 2,6-bis(1'-methylbenzimidazolyl)pyridine ligands, which are connected to each other by either a conjugated poly(p-phenylene ethynylene) (PPE) core or a poly(p-xylyene) (PPX) core. The metal/organic supramolecular polymers based on ditopic poly(p-xylyene) macromonomers were investigated as easy-to-process high-temperature-resistant materials. We demonstrated that these supramolecular materials are indeed easily processable in common organic solvents and that their thermal stability is very similar to that of common (but intractable) poly(p-xylenes). In addition, investigations of metallo-supramolecular polymers based on the ditopic poly(p-phenylene ethynylene) macromonomers have demonstrated the potential of these systems as sensors for chemical warfare agents. In particular, we have shown that these materials and selected derivatives exhibit significant changes in fluorescence in the presence of organophosphates and that different organophosphates show different responses.

DTIC

High Temperature; Organic Materials; Polymers

20070036671 Army Construction Engineering Research Lab., Champaign, IL USA

Investigation of Mechanical Processes for Removing Lead-Based Paint (LBP) from Wood Siding

Falk, Robert H; Janowiak, John; Lampo, Richard G; Napier, Thomas R; Cosper, Stephen D; Drozd, Susan A; Larson, Steven; Smith, Edgar D; Sep 2006; 131 pp.; In English; Original contains color illustrations

Report No.(s): AD-A470943; ERDC/CERL-TR-06-30; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The U.S. Army is responsible for thousands of World War II-era wooden temporary buildings that must be removed in order to reduce Department of Defense (DoD) real property inventories. Most of those buildings were used long past their intended service lives and were well maintained. They contain large quantities of reusable wood materials with a significant potential resale value. Standard demolition procedures would destroy the value of that material and create new land filling costs. Demolition would also incur considerable ancillary costs related to compliance with environmental regulations on the handling and disposal of debris contaminated with lead-based paint (LBP). In order to promote DoD strategic waste management goals, decrease costs, recover value from past infrastructure investments, and reduce long-term liability, the U.S. Army Engineer Research and Development Center worked with other government agencies and private-sector partners to investigate the feasibility of salvaging high-quality wood from obsolete buildings and remanufacturing it into value-added products. Criteria for success included process efficiency, human and environmental safety, and potential marketability of the remanufactured products. This report documents investigations using both conventional and specially designed woodworking equipment to remove LBP from salvaged wood siding while concurrently remilling it into new profiles.

DTIC

Buildings; Paints; Waste Management; Wood

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COMPOSITE MATERIALS

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

20070035071 NASA Langley Research Center, Hampton, VA, USA

Prediction of Size Effects in Notched Laminates Using Continuum Damage Mechanics

Camanho, D. P.; Maimi, P.; Davila, C. G.; February 21, 2007; 46 pp.; In English; Original contains color and black and white illustrations

Contract(s)/Grant(s): FA8655-06-1-3072; WBS 732759.07.09; Copyright; Avail.: CASI: A03, Hardcopy

This paper examines the use of a continuum damage model to predict strength and size effects in notched carbon-epoxy laminates. The effects of size and the development of a fracture process zone before final failure are identified in an experimental program. The continuum damage model is described and the resulting predictions of size effects are compared with alternative approaches: the point stress and the inherent flaw models, the Linear-Elastic Fracture Mechanics approach, and the strength of materials approach. The results indicate that the continuum damage model is the most accurate technique

to predict size effects in composites. Furthermore, the continuum damage model does not require any calibration and it is applicable to general geometries and boundary conditions.

Author

Epoxy Matrix Composites; Damage; Continuum Mechanics; Continuum Modeling; Notch Strength; Laminates; Fracture Mechanics

20070035078 NASA Langley Research Center, Hampton, VA, USA; Politecnico di Turin, Turin, Italy

Refinement of Timoshenko Beam Theory for Composite and Sandwich Beams Using Zigzag Kinematics

Tessler, Alexander; DiSciuva, Marco; Gherlone, Marco; November 2007; 45 pp.; In English; Original contains black and white illustrations

Contract(s)/Grant(s): WBS 984754.02.07.07.15.04

Report No.(s): NASA/TP-2007-215086; L-19411; Copyright; Avail.: CASI: A03, Hardcopy

A new refined theory for laminated-composite and sandwich beams that contains the kinematics of the Timoshenko Beam Theory as a proper baseline subset is presented. This variationally consistent theory is derived from the virtual work principle and employs a novel piecewise linear zigzag function that provides a more realistic representation of the deformation states of transverse shear flexible beams than other similar theories. This new zigzag function is unique in that it vanishes at the top and bottom bounding surfaces of a beam. The formulation does not enforce continuity of the transverse shear stress across the beam's cross-section, yet is robust. Two major shortcomings that are inherent in the previous zigzag theories, shear-force inconsistency and difficulties in simulating clamped boundary conditions, and that have greatly limited the utility of these previous theories are discussed in detail. An approach that has successfully resolved these shortcomings is presented herein. This new theory can be readily extended to plate and shell structures, and should be useful for obtaining accurate estimates of structural response of laminated composites.

Author

Sandwich Structures; Composite Structures; Shear Stress; Transverse Loads; Laminates; Deformation; Boundary Conditions

20070035201 Naval Postgraduate School, Monterey, CA USA

Analytical Modeling of Composite-to-Composite (Scarf) Joints in Tension and Compression

Greene, Todd R; Jun 2007; 87 pp.; In English; Original contains color illustrations

Report No.(s): AD-A470122; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470122>

Fracture mechanics-based multi-level computational modeling and simulation techniques were developed to predict failure strengths of composite scarf joints under tension or compression. Global, local, and element level models were used in the study to calculate the energy release rates at the scarf joints. The study showed that explicit modeling of the resin layer at the scarf joint, where cracks initiate, was important for accurate prediction of the joint failure strengths. In addition, the consideration of the joint interface slope in the fracture model was important especially for compressive joint failure strengths. In terms of the mixed failure criteria for crack propagation, the interactive biquadratic criterion was found to be useful for reliable prediction of joint failure strengths. The predicted strengths were in good agreement with experimental data, which were obtained for two different kinds of polymer composites: e-glass/epoxy and carbon/epoxy.

DTIC

Compressive Strength; Cracks; Epoxy Matrix Composites; Mathematical Models; Scarf Joints; Tensile Strength

20070035234 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

Effects of Prior Aging at 191 C on Creep Response of IM7/BMI 5250-4

Salvia, Robert A; Jun 2007; 109 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): Proj-2005-025

Report No.(s): AD-A470172; AFIT/GAE/ENY/07-J23; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470172>

The creep behavior of IM7/BMI 5250-4 with fiber orientations of [+ or - 45] and [0/90] that were aged in air at 191 C for up to 1000 hours was evaluated. The total weight loss during the aging process was also evaluated. Weight loss due to aging was 0.64% for the [0/90] fiber orientation and 0.72% for the [+ or - 45] fiber orientation. Tensile tests to failure were conducted to establish tensile properties. The [0/90] specimens have a much higher stiffness and Ultimate Tensile Strength (UTS) values than the [+ or - 45] specimens. The tensile tests of the aged specimens revealed that the Ultimate Tensile Strength of the

composite decreased and the modulus increased with increasing prior aging time. Creep tests were conducted at 191 C. The creep tests were of 100 hour duration and were followed by unloading to zero stress and 60 hours of recovery at zero stress.
DTIC

Composite Materials; Creep Properties; Prepregs; Tensile Strength

20070035235 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

Effects of Prior Aging on the Creep Response of Carbon Fiber Reinforced PMR-15 Neat Resin at 288 C in an Air Environment

Back, Christopher A; Jun 2007; 124 pp.; In English; Original contains color illustrations

Report No.(s): AD-A470174; AFIT/GAE/ENY/07-J02; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470174>

The mechanical response of carbon fiber reinforced PMR-15 neat resin with a + or - 45 fiber orientation was investigated at 288 C. Mechanical testing was performed on unaged specimens and specimens that were aged up to 1000 hours in an air environment. Tensile tests were performed to determine Young's modulus of elasticity and Ultimate Tensile Strength. Creep tests were performed at creep stress levels of 30 and 60 MPa. Creep periods of at least 25 h in duration were followed by recovery at zero stress. Duration of the recovery period was at least twice the time of the creep period. Oxidation layer growth and weight loss measurements were also taken as a function of aging time. Unaged test specimens accumulated creep strains of ~1.7% at 60 MPa and ~1.1% at 30 MPa. After 1000 h of aging the test specimens accumulated creep strains of ~0.5% at 60 MPa and ~0.1% at 30 MPa. It is clear that with prior aging time, there is a reduction in creep strain accumulation. Prior aging did not appear to significantly influence recovery at zero stress. The experimental data revealed that weight loss and oxidation layer growth increase with increasing aging time at elevated temperature. After 500 h of aging, the rectangular plus or minus 45 carbon fiber reinforced PMR-15 composite had ~0.95% weight loss compared to ~0.5% at 250 h. The oxidation layer growth at 500 h was ~0.97 mm for the cut surface and ~0.32 mm for the molded surface. After 1000 h the oxidation layer growth was ~1.5 mm for the cut surface and ~0.33 mm for the molded surface. It is apparent that the cut side of the specimen with the fibers exposed to the oxidizing environment experiences a thicker oxidation layer growth.

DTIC

Carbon Fibers; Creep Properties; Fiber Composites; Resins

20070035236 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

Effect of Prior Aging on Fatigue Behavior of IM7/BMI 5250-4 Composite at 191 C

Ladrado, Christine G; Jun 2007; 97 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): Proj-2005-158; Proj-005-025

Report No.(s): AD-A470175; AFIT/GAE/ENY/07-J10; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470175>

IM7/BMI 5250-4 with carbon fiber orientations [+ or - 45] and [0/90] were aged in air at 191 C for up to 1000 hours. The weight loss was analyzed during the aging process. Tension to failure tests were performed on both the unaged and aged specimens to establish a baseline for the Ultimate Tensile Strengths and Young's Modulus. Tension-tension cyclic load fatigue testing was conducted on the specimen to determine the effect of prior aging on the fatigue response of the composite. Cyclic strain accumulation was not influenced by prior aging, but it was influenced by the stress levels applied. [+ or - 45] specimens lost 0.2% more weight than the [0/90] specimens from aging in air.

DTIC

Composite Materials; Polymer Matrix Composites

20070035239 Universal Energy Systems, Inc., Dayton, OH USA

Thermally Induced Stress Intensity in a Homogeneous Plate Containing a Finite Length Crack (Preprint)

Jefferson, George; May 2007; 16 pp.; In English

Contract(s)/Grant(s): FA8650-04-D-5233; Proj-2311

Report No.(s): AD-A470181; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470181>

The delamination of orthotropic laminates containing finite-length cracks and subject to thermal gradients is examined. The exact limiting case solutions for infinitesimal- and infinite-length cracks are known, and are equal to each other when the

crack length is approximately equal to the plate thickness. However, in the transition region of crack length from about 1 to 5 times the plate thickness, both limit solutions overestimate the energy release by 20-100%. Hence, an analysis was developed to better predict the energy release rate for such finite-length cracks. The model is a modification of the infinite-crack analysis of Hutchinson and Lu (1995, ASME J. Eng. Mat. Tech., 117 (4) pp. 386-390) and provides a closed form expression for the elastic energy release rate in a plane-strain orthotropic flat plate that agrees well with numerical values for cracks of length approximately half of the plate thickness and larger. The analytic result is shown to agree well with finite element results over a wide range of crack lengths, depths and interface conductivity, both for isotropic and orthotropic materials.

DTIC

Crack Propagation; Cracks; Delaminating; Steady State; Stress Intensity Factors; Temperature Effects

20070035911 NASA Langley Research Center, Hampton, VA, USA

Nanoscale Subsurface Imaging of Nanocomposites via Resonant Difference-Frequency Atomic Force Ultrasonic Microscopy

Cantrell, Sean A.; Cantrell, John H.; Lillehei, Peter T.; [2007]; 8 pp.; In English; SAMPE Fall Technical Conference 2007, 19 Oct. - 1 Nov. 2007, Cincinnati, OH

Contract(s)/Grant(s): WBS 698259.02.07.07.02; No Copyright; Avail.: CASI: A02, Hardcopy

ONLINE: <http://hdl.handle.net/2060/20070035911>

A scanning probe microscope methodology, called resonant difference-frequency atomic force ultrasonic microscopy (RDF-AFUM), has been developed. The method employs an ultrasonic wave launched from the bottom of a sample while the cantilever of an atomic force microscope engages the sample top surface. The cantilever is driven at a frequency differing from the ultrasonic frequency by one of the contact resonance frequencies of the cantilever. The nonlinear mixing of the oscillating cantilever and the ultrasonic wave at the sample surface generates difference-frequency oscillations at the cantilever contact resonance. The resonance-enhanced difference-frequency signals are used to create amplitude and phase-generated images of nanoscale near-surface and subsurface features. RDF-AFUM phase images of LaRC-CP2 polyimide polymer containing embedded nanostructures are presented. A RDF-AFUM micrograph of a 12.7 micrometer thick film of LaRC-CP2 containing a monolayer of gold nanoparticles embedded 7 micrometers below the specimen surface reveals the occurrence of contiguous amorphous and crystalline phases within the bulk of the polymer and a preferential growth of the crystalline phase in the vicinity of the gold nanoparticles. A RDF-AFUM micrograph of LaRC-CP2 film containing randomly dispersed carbon nanotubes reveals the growth of an interphase region at certain nanotube-polymer interfaces.

Author

Atomic Force Microscopy; Imaging Techniques; Nanocomposites; Resonant Frequencies; Ultrasonic Radiation; Mathematical Models; Nanotechnology

20070036104 Texas Univ., Austin, TX USA

Mechanical Properties of G-10 Glass-Epoxy Composite

Ravi-Chandar, K; Satapathy, S; Aug 8, 2007; 12 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAAD17-01-D-0001-0012

Report No.(s): AD-A470630; IATR-0466; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470630>

The mechanical properties of G10 glass-epoxy composites were determined in compression and tension tests.

DTIC

Epoxy Matrix Composites; Glass; Glass Fiber Reinforced Plastics; Mechanical Properties

20070036298 North Carolina State Univ., Raleigh, NC USA

High-Performance Substrates for SERS Detection via Microphotonic Photopolymer Characterization and Coating With Functionalized Hydrogels

Velev, Orlin D; Nov 26, 2006; 21 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAAD19-02-1-0287

Report No.(s): AD-A470746; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The goal of this research project in collaboration with ARL-Edgewood was to design, characterize and fabricate a new generation of stable and highly enhancing SERS substrates for sensors with continuous detection of chemical agents in water streams. We completed a detailed systematic study of hierarchically templated SERS substrates in thin films. In this task, convective assembly at high volume fractions was used to assemble gold nanoparticles into structured porous films templated

by colloidal crystals. The control over the film structure allowed optimizing their performance for potential sensor applications. The primary focus of the second newer research direction was the fabrication of nanostructured gold substrates in the form of millimeter and sub-millimeter dots for on-chip assays. The know-how gained from completion of previous research goals was used to fabricate SERS micropatches in small volumes with controlled micro and nanostructure for highly selective, high sensitivity assays. The process was modeled and a procedure for fabricating SERS microassay patches was formulated. The technique developed allows us to create in the next stages of our research a new generation of miniature arrays of SERS-based sensors.

DTIC

Characterization; Coating; Nanostructures (Devices); Photopolymers; Raman Spectra; Substrates; Thin Films

20070036721 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

Advances in Materials and System Technology for Portable Fuel Cells

Narayanan, Sekharipuram R.; March 11, 2007; 21 pp.; In English; Indo-US Workshop on Emerging Trends in Energy Technology, 11-16 Mar. 2007, New Delhi, India; Original contains color and black and white illustrations; Copyright; Avail.: Other Sources

ONLINE: <http://hdl.handle.net/2014/40348>

This viewgraph presentation describes the materials and systems engineering used for portable fuel cells. The contents include: 1) Portable Power; 2) Technology Solution; 3) Portable Hydrogen Systems; 4) Direct Methanol Fuel Cell; 5) Direct Methanol Fuel Cell System Concept; 6) Overview of DMFC R&D at JPL; 7) 300-Watt Portable Fuel Cell for Army Applications; 8) DMFC units from Smart Fuel Cell Inc, Germany; 9) DMFC Status and Prospects; 10) Challenges; 11) Rapid Screening of Well-Controlled Catalyst Compositions; 12) Screening of Ni-Zr-Pt-Ru alloys; 13) Issues with New Membranes; 14) Membranes With Reduced Methanol Crossover; 15) Stacks; 16) Hybrid DMFC System; 17) Small Compact Systems; 18) Durability; and 19) Stack and System Parameters for Various Applications.

CASI

Fuel Cells; Systems Engineering; Technology Utilization; Materials Science; Mechanical Properties

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INORGANIC, ORGANIC AND PHYSICAL CHEMISTRY

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

20070035159 Naval Postgraduate School, Monterey, CA USA

Heat Conduction Analysis of Randomly Dispersed Single-Walled Carbon Nanotubes

Felder, Eric D; Jun 2007; 53 pp.; In English; Original contains color illustrations

Report No.(s): AD-A470059; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470059>

This thesis studies the effective thermal conductivity of randomly oriented, percolated carbon nanotubes. To that end, a multiscale analysis approach was adopted. At the nanoscale, molecular dynamics simulation was performed to determine the thermal conductivity coefficient of a single carbon nanotube. Then, thermal conductivity of two carbon nanotubes positioned at different angles were studied after determining the equilibrium positions of the two nanotubes at various relative positions. Finally, using the data obtained in the previous analyses, the effective thermal conductivity of randomly oriented carbon nanotubes was calculated using the finite element model where each nanotube was modeled as a continuous rod.

DTIC

Carbon Nanotubes; Conductive Heat Transfer

20070035160 Rice Univ., Houston, TX USA

Sidewall Covalent Functionalization of Single Wall Carbon Nanotubes through C-N Bond Forming Reactions of Fluoronanotubes with Urea, Guanidine and Thiourea (Preprint)

Pulikkathara, Merlyn X; Khabashesku, Valery N; Apr 2007; 22 pp.; In English

Contract(s)/Grant(s): FA8650-05-D-1912-T06; Proj-2302

Report No.(s): AD-A470062; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470062>

Sidewall covalent functionalization of carbon nanotubes is necessary to achieve smaller bundles, link to other functional

moieties, and to aid in better dispersion in composites. In the present study, we present a one-step functionalization method which uses fluorinated single wall carbon nanotubes (F-SWNTs) as starting materials in the reactions with either urea, thiourea, or guanidine. Through these reactions, the derivatives with terminal amide and heteroamide groups on the nanotube sidewalls have been prepared. The products still contain some residual fluorine creating bifunctional nanotubes. These derivatives were characterized by Raman spectroscopy, Fourier transform infrared (FTIR), thermo gravimetric analysis (TGA), scanning electron microscopy (SEM), x-ray photoelectron spectroscopy (XPS), transmission electron microscopy (TEM) and atomic force microscopy (AFM). Compared to fluorinated tubes, the urea-F-SWNTs, among the three derivatives, have shown the highest stability in water and aqueous urea solutions, thereby creating new opportunities for biomedical applications with nanotubes. These bifunctional derivatives will aid in creating an interface between the SWNTs and polymers, which will result in much stronger composites. The three derivatives are easily and rapidly synthesized, and the method can be easily scaled up for applications such as creating an integrated polymer network for stronger composites, coatings, for use in biomedical applications and nanoelectronic devices.

DTIC

Carbon Nanotubes; Covalence; Covalent Bonds; Guanidines; Joints (Junctions); Nanotubes; Thioureas; Ureas; Walls

20070035237 Colorado State Univ., Fort Collins, CO USA

Sequential Electrolytic Degradation of Energetic Compounds in Groundwater

Gilbert, Dave; Sale, Tom; Nov 12, 2004; 81 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): Proj-ER-1234

Report No.(s): AD-A470176; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470176>

In 2002, SERDP funded CSU to conduct proof of concept studies to evaluate sequential electrolytic degradation of energetic compounds using flow through electrolytic reactors (e-barriers). In 2003, SERDP provided supplemental funding for a more detailed analysis of reaction mechanisms and products. This report includes detailed results from these efforts. The results from the first phase suggest that e-barriers are a promising option for treatment of energetic compounds in groundwater. Specifically, high fractional removal of TNT and RDX was observed with minimal generation of deleterious products at low power requirements. The batch reactor experiments conducted in Phase 2 suggest that the high fractional TNT removal found during the proof of concept experiments can be explained by heterogeneous cathodic reduction of TNT. The rate of TNT transformation is dependent on applied potential. Significant nitrite was formed and further reduced during the batch reactor experiments. At least one pathway has been identified involving formation of nitroso-substituted intermediates (MNX, DNx, and TNx) at low concentration. Other intermediates identified include nitramide. Based on the results of SERDP ER-1234, a proposal was accepted by ESTCP titled: Field Demonstration/ Validation of e-barrier technology for Treatment of Energetic Compounds in Groundwater: Pueblo Chemical Depot. The transition plan is to conduct a 2 year field demonstration under ESTCP funding followed by a full-scale e-barrier funded under Base Realignment and Closure (BRAC).

DTIC

Degradation; Electrolysis; Ground Water; Pollution Control; Water Pollution

20070035269 Naval Research Lab., Bay Saint Louis, MS USA

New Developments in Mitigation of Microbiologically Influenced Corrosion

Little, B; Lee, J; Ray, R; Jul 12, 2007; 8 pp.; In English; Original contains color illustrations

Report No.(s): AD-A470238; NRL/PP/7303-06-7017; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470238>

Two approaches to control of microbiologically influenced corrosion (MIC) have been developed that do not require the use of biocides. These strategies include the following: 1) use of biofilms to inhibitor prevent corrosion and 2) manipulation (removal or addition) of an electron acceptor, including oxygen, sulfate and nitrate, to influence the microbial population.

DTIC

Acceptor Materials; Corrosion; Electron Transfer

20070035326 Colorado State Univ., Fort Collins, CO USA

Decomposition of Energetic Materials from Excited Electronic States - RDX, HMX, Model Nitramines

Bernstein, Elliot R; Oct 1, 2006; 12 pp.; In English

Contract(s)/Grant(s): DAAD19-03-1-0222

Report No.(s): AD-B329047; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The energetic materials RDX, HMX, and CL-20 are studied in the gas phase by mass spectroscopy, optical wavelength

resolved and time resolved spectroscopic techniques. We learn that NO is the first product of the dissociation of these molecules excited to their first electronic excited singlet states. The NO appears at less than 100 fs following the excitation pulse. A number of cyclic and non cyclic nitramine model systems are studied in parallel with the energetic materials and, which NO is their first decomposition product from their excited electronic states, it appears with a very different internal energy distribution. We suggest a number of possible general ideas for improving the energy yield from energetic materials.
DTIC

Decomposition; Electron States; Excitation; Explosives; HMX; RDX; Vapor Phases

20070035458 Pennsylvania Univ., Philadelphia, PA USA

Structural Design and Photochemical Preparation of Ultrathin Molecular Film Materials

Dai, Hai-Lung; Dec 2006; 6 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): FA9550-05-1-0049

Report No.(s): AD-A470275; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Toward the goal of developing fundamental understanding of structural properties of molecular thin films to form a scientific basis for designing and preparation of molecular thin film materials, we have made important advances during the past three years. These advances were enabled through applying a combination of ultrahigh vacuum surface science and nonlinear optical techniques to the characterization of thin molecular films. Specifically we have demonstrated for the first time that the nonlinear optical technique Second Harmonic Generation can be used to determine the geometric structure of the interfacial layer of molecules buried in between the molecular film and the solid substrate, and that surface-state enhanced SHG can be used to probe the wetting-dewetting transition of monolayer molecular adsorbates on a metal. The nature of bonding between the layer of linear acenes, molecules such as tetracene and pentacene that have great potential as organic semiconducting materials, have been determined. Overall, we have gained to great extend a fundamental understanding of molecular film deposition, growth, and crystallization mechanisms. This research effort has resulted in a total of 13 referred publications since 2004 to date (listed at the end of the report). A more detailed description of research results are presented below.

DTIC

Monomolecular Films; Photochemical Reactions; Structural Design; Thin Films

20070035480 Aerojet-General Corp., Sacramento, CA USA

Ternary Phase Equilibria in Transition Metal-Boron-Carbon-Silicon Systems. Part 1. Related Binary Systems. Volume 1. Mo-C System

Rudy, Erwin; Chang, Austin Y; Windisch, Stefan; Mar 1965; 176 pp.; In English

Contract(s)/Grant(s): AF; 33(615)-1249

Report No.(s): AD-A470307; No Copyright; Avail.: Defense Technical Information Center (DTIC)

A complete phase diagram of the system molybdenum-carbon is presented. A thermodynamic model for the description of the phase separations of the Me₂C phases in transition metal-carbon systems has been developed and was semiquantitatively applied to Mo₂C. Literature data on thermodynamic properties of molybdenum carbides have been critically evaluated and data were selected. Apparative techniques for the precise study of phase reactions at high temperatures are described.

DTIC

Boron; Carbon; Carbon Compounds; Molybdenum; Phase Transformations; Silicon; Thermodynamics; Transition Metals

20070035502 Air Force Research Lab., Eglin AFB, FL USA

Simulating the Dynamics of Particles Interacting with Solidification Fronts (Preprint - Briefing Charts)

Garvin, Justin; Yang, Yi; Udaykumar, H S; Jul 2007; 48 pp.; In English

Contract(s)/Grant(s): Proj-2502

Report No.(s): AD-A470335; AFRL-MN-EG-TP-2007-7407; No Copyright; Avail.: Defense Technical Information Center (DTIC)

1) Developed a multiscale numerical approach to solve particle-solidification front problems in a general manner. 2) Model can be generalized to solve a variety of problems involving interacting interfaces. 3) First to look at the physics from a nonlinear dynamics point-of-view (i.e. phase-space point of view). 4) Model captures essential physics that past research has neglected.

DTIC

Charts; Simulation; Solidification

20070035504 Boston Coll., Chestnut Hill, MA USA

Kinetics of Sulfur Oxide, Sulfur Fluoride, and Sulfur Oxyfluoride Anions with Atomic Species at 298 and 500 K

Midey, Anthony J; Viggiano, A A; Feb 2007; 9 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): FA8718-04-C-0006; Proj-2303

Report No.(s): AD-A470337; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The rate constants and product-ion branching ratios for the reactions of sulfur dioxide {SO₂(-)}, sulfur fluoride {SF(n)-}, and sulfur oxyfluoride anions {SO(x)F(y)-} with H, H₂, N, N₂, NO, and O have been measured in a selected-ion flow tube (SIFT). H atoms were generated through a microwave discharge on a H₂/He mixture, whereas O atoms were created via N atoms titrated with NO, where the N had been created by a microwave discharge on N₂. None of the ions reacted with H₂, N₂ or NO; thus, the rate constants are <1 x 10(exp 12) cc/s. SO(x)F(y)- ions react with H by only fluorine-atom abstraction to form HF at 298 and 500 K. Successive F-atom removal does not occur at either temperature, and the rate constants show no temperature dependence over this limited range. SO₂(-) and F(-) undergo associative detachment with H to form a neutral molecule and an electron. Theoretical calculations of the structures and energetics of HSO₂ isomers were performed and showed that structural differences between the ionic and neutral HSO₂ species can account for at least part of the reactivity limitations in the SO₂(-) + H reaction. All of the SO(x)F(y)- ions react with O; however, only SO₂(-) reacts with both N and O. SO(x)F(y)- reactions with N {SO₂(-) excluded} have a rate constant limit of <1 x 10(exp 11) cc/s. The rate constants for the SO(x)F(y)- reactions with H and O are <1/25% of the collision rate constant, as seen previously in the reactions of these ions with O₃, consistent with a kinetic bottleneck limiting the reactivity. The only exceptions are the reactions of SO₂(-) with N and O, which are much more efficient. Three pathways were observed with O atoms: F-atom exchange in the reactant ion, F(-) exchange in the reactant ion, and charge transfer to the O atom. No associative detachment was observed in the N- and O-atom reactions.

DTIC

Anions; Atoms; Fluorides; Ion Atom Interactions; Oxyfluorides; Reaction Kinetics; Sulfur; Sulfur Fluorides; Sulfur Oxides

20070035522 Indiana Univ., Bloomington, IN USA

Boron Nitrogen Compounds

Schaeffer, Riley; Jan 1962; 4 pp.; In English

Report No.(s): AD-A470363; No Copyright; Avail.: Defense Technical Information Center (DTIC)

No abstract available

Boron Compounds; Nitrogen Compounds

20070035524 USA Borax Research Corp., Anaheim, CA USA

Research on Inorganic Polymer Systems Containing Boron and Aluminum

Brotherton, R J; McCloskey, A L; Steinberg, H; Boone, J L; Bower, J G; English, W D; Goldsmith, H; Iverson, M L; Kitasaki, K; Manasevit, H M; Newsom, H C; Jan 1962; 23 pp.; In English

Contract(s)/Grant(s): AF 33(616)-5931; AF 33(616)-7303

Report No.(s): AD-A470366; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The present investigation has been directed toward the preparation of thermally stable inorganic or semi-inorganic polymers. Initial work included investigations of polymers based on boron-boron and aluminum-oxygen bonding systems. Work was subsequently suspended in these areas in favor of more promising boron-nitrogen and boron-oxygen systems. Conversion of borazoles to linear boron-nitrogen systems or to polyborazoles has not given satisfactory materials, but more promising linear boron-nitrogen systems have been prepared by an alternative method. Recently a series of polymers with boron-oxygen or boron-nitrogen bonds and aromatic groups in the basic chains have been investigated.

DTIC

Aluminum; Boron

20070035526 Naval Research Lab., Bay Saint Louis, MS USA

A Modular Entrainment Model for Cohesive Sediment

Keen, Timothy; Furukawa, Yoko; May 23, 2007; 19 pp.; In English; Original contains color illustrations

Report No.(s): AD-A470371; NRL/PP/7320-03-110; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This paper describes an entrainment model for cohesive sediments that is based on a power-law expression for the excess shear stress and a total entrainment coefficient. Total entrainment includes terms for consolidation, bioturbation, and all other processes (base entrainment coefficient). The model is used to predict entrainment rates for cohesive sediments from Lake

Erie, the Tamar Estuary, Long Island Sound, and the Fox River, Wisconsin. The base entrainment coefficient, which is estimated using samples with the least post-depositional modification, is unique for each sediment suite because it includes environmentally sensitive processes like mineralogy, salinity, organic carbon content, etc. Based on available entrainment measurements, expressions are presented for the consolidation and bioturbation coefficients. The model is evaluated with entrainment data for identical sediment that has been either consolidated or bioturbated and the comparison is encouraging. A comparison of predicted and measured entrainment rates for undisturbed sediment is less favorable because of its unknown post-depositional history.

DTIC

Carbon; Cohesion; Entrainment; Models; Salinity; Sediments

20070035529 Air Force Materials Lab., Wright-Patterson AFB, OH USA

Ternary Phase Equilibria in Transition Metal-Boron-Carbon-Silicon Systems. Part 2. Ternary Systems. Volume 12. Ti-Zr-B System. Investigation of Pseudo-Binary Systems ZrB₂, -NbB₂, ZrB₂, TaB₂, and HfB₂-NbB₂

Eckert, T E; Oct 1966; 61 pp.; In English

Contract(s)/Grant(s): AF-33(615)-1249; Proj-7350

Report No.(s): AD-A470384; AFML-TR-65-2; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The ternary system titanium-zirconium-boron was investigated from 1000C to 3245C, the melting temperature of zirconium diboride. The equilibria which exist have been determined except for the boron-rich equilibria which have been estimated. The following notable features were found: minimum melting occurs in the titanium rich corner of the ternary; a four-phase reaction involving Beta-metal phase, monoboride, diboride, and liquid occurs at a temperature slightly higher than the minimum melting; zirconium exchanges with titanium in titanium monoboride to about 9 At. % zirconium; and the metal diborides form a continuous series of solid solutions. No ternary compounds were found. The techniques used in the investigation were X-ray analysis, melting point determination, and metallographic examination. Lattice parameter plots of the pseudo-binary systems ZrB₂-NbB₂, ZrB₂-TaB₂, and HfB₂-NbB₂ indicate that in each of these systems the diborides form a continuous series of solid solutions. Melting point temperatures for these systems have been determined.

DTIC

Borides; Boron; Carbon; Metallography; Metals; Phase Transformations; Silicon; Ternary Systems; Titanium; Transition Metals; Zirconium

20070035550 American Potash and Chemical Corp., Whittier, CA USA

Research on Borophane, Borazine, and Phosphorane Polymers

Wagner, Ross I; Washburn, Robert M; Eilar, Kendrick R; Jan 1962; 23 pp.; In English

Report No.(s): AD-A470430; No Copyright; Avail.: Defense Technical Information Center (DTIC)

No abstract available

Boron Compounds; Polymers

20070035552 Du Pont de Nemours (E. I.) and Co., Gibbstown, NJ USA

Thermally Stable Phosphonitrile Compositions

Nichols, George M; Jan 1962; 25 pp.; In English

Report No.(s): AD-A470432; No Copyright; Avail.: Defense Technical Information Center (DTIC)

No abstract available

Chlorides; Phosphonitriles; Thermal Stability

20070035553 Heidelberg Univ., Heidelberg, Germany

Preparation and Reactions of Isocyanates of Sulfuric and Phosphoric Acid

Appel, Rolf; Jan 1962; 5 pp.; In English

Report No.(s): AD-A470433; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Various syntheses of the diisocyanate of sulfuric acid will be described. Its properties and reactions with proton-active materials will be discussed. Reaction with glycols and with diamines leads to the formation of polymeric sulfourethanes and sulfo-ureas which, however, are only slightly stable towards hydrolysis. Further, a new synthesis of phosphorus oxytriisocyanate will be mentioned.

DTIC

Isocyanates; Phosphoric Acid; Sulfuric Acid

20070035557 University of Western Ontario, London, Ontario Canada

Metallo-Organic Compounds Containing Metal-Nitrogen Bonds

Bradley, D C; Thomas, I M; Torrible, E G; Jan 1962; 11 pp.; In English

Report No.(s): AD-A470437; No Copyright; Avail.: Defense Technical Information Center (DTIC)

By means of reactions involving transition metal chlorides MCl_x and lithium dialkylamides a number of new dialkylamino-derivatives of titanium, zirconium, vanadium, niobium, tantalum, chromium, molybdenum and tungsten have been prepared. Aminolysis of some of these compounds involved considerable steric effects due to shielding of the metal atom. In the case of quinquivalent niobium and tantalum the steric effect precluded the formation of pentakis-derivatives except with dimethylamino-, N-methyl-*n*-butylamino-, and piperidino-groups. With higher dialkylamines the products were $Nb(NR_2)_3$ and $RN=Ta(NR_2)_3$. Studies on the reactions of dialkylamino-titanium compounds with primary amines showed that polymeric compounds may be obtained.

DTIC

Bonding; Chlorides; Nitrogen; Organometallic Compounds; Transition Metals

20070035558 Iowa State Univ. of Science and Technology, Ames, IA USA

Cyclic Organosilicon Compounds

Gilman, Henry; Jan 1962; 9 pp.; In English

Report No.(s): AD-A470438; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The studies reported at this time are concerned primarily with cyclic compounds, particularly those containing one or more silicon atoms in the ring.

DTIC

Cyclic Compounds; Organic Silicon Compounds; Silicon Compounds

20070035559 Carnegie-Mellon Univ., Pittsburgh, PA USA

The Influence of Structure on the Molecular Mobility and Rheology of Amorphous Macromolecular Systems

Fox, T G; Allen, V; Jan 1962; 11 pp.; In English

Report No.(s): AD-A470440; No Copyright; Avail.: Defense Technical Information Center (DTIC)

A brief review with emphasis on the important open questions is presented of our knowledge of the factors influencing the chain mobility and mechanical properties of amorphous polymeric systems. It is necessary to give more precise meaning to the concepts of 'chain entanglements' and 'free volume' and to relate these to the structure of the repeating unit and to the gross chain structure of the macromolecules. From studies of the viscosity in bulk or in concentrated solution of model polymers and novel polymers we propose to determine the influence on the mobility of heterogeneity in chain length distribution of added diluent, and of the stereochemical chain structure. The initial data on polystyrenes of narrow distribution prepared in anionic synthesis and of mixtures of these are presented here.

DTIC

Amorphous Materials; Macromolecules; Mobility; Molecules; Polymers; Rheology

20070035560 Akron Univ., Akron, OH USA

Preparation and Properties of Monodisperse Branched Polystyrene

Morton, M; Helminiak, T E; Gardkary, S D; Bueche, F; Jan 1962; 11 pp.; In English

Report No.(s): AD-A470441; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Model branched polymers have been prepared by the reaction of relatively monodisperse polystyryl lithium with silicon tetrachloride. The branched molecules have been carefully characterized by light scattering and osmotic pressure measurements. A study of the dilute solution properties of the branched molecules has confirmed the theoretical development of the branching coefficient, g , by Zimm and Kilb. The second virial coefficient, A_2 , has been found to decrease with increased branching. In addition, the Huggins constant, k' , has been found to be a poor measure of branching in molecules.

DTIC

Molecules; Polystyrene

20070035576 Manchester Coll. of Science and Technology, UK

Bonding in Inorganic Systems

Barfield, P A; Lappert, M F; Lee, J; Jan 1962; 16 pp.; In English

Report No.(s): AD-A470475; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Evidence from nuclear magnetic resonance studies for π -bonding between boron and nitrogen in the borazens is

presented. Preliminary experiments, by infrared spectroscopy which indicate that a similar situation might exist between phosphorus (III) and nitrogen, in open chain compounds, are also reported. The energy barrier to rotation about the BN bond in dimethylaminophenylchloroborane is calculated (from four different observations on the N.M.R. spectra) as 18 plus or minus 2 kcals. Exploratory measurements on certain boron-oxygen compounds are also presented.

DTIC

Bonding; Nuclear Magnetic Resonance

20070035585 Massachusetts Inst. of Tech., Cambridge, MA USA

Organosilicon Derivatives of Inorganic 'Benzenoid' Compounds

Seyferth, Dietmar; Jan 1962; 7 pp.; In English

Report No.(s): AD-A470500; No Copyright; Avail.: Defense Technical Information Center (DTIC)

In a previous report the synthesis of thermally and oxidatively stable silicon-substituted borazines (I) was reported. The present report summarizes our $[R=(CH_3)_2R'SiCH_2-$, where $R'=CH_3, C_2H_5, n-C_4H_9$ and $(CH_3)_3SiO]$ further efforts in the borazine area and describes as well work devoted to the pre-preparation of silicon-substituted phosphazenes and to the synthesis and characterization of perfluorovinylolithiums. The latter reagent seemed of possible interest in connection with our studies of organofunctional borazines.

DTIC

Boron Compounds; Derivation; Inorganic Compounds; Organic Compounds; Silicon Compounds

20070035586 Heidelberg Univ., Heidelberg, Germany

Polymeric Phosphorus-Nitrogen Compounds

Becke-Goehring, Margot; Jan 1962; 11 pp.; In English

Report No.(s): AD-A470501; No Copyright; Avail.: Defense Technical Information Center (DTIC)

We were able to elucidate completely the mechanism of formation of polymeric phosphorus nitrile chlorides. Phosphorus pentachloride has a well known structure In the vapor state the molecule is in the form of a trigonal bipyramid Pure liquid PCl_5 exhibits a Raman spectrum which has been interpreted on the basis of a trigonal bipyramid structure In the crystal however phosphorus pentachloride has ionic structure corresponding to $[PCl_4]^+ + [PCl_6]^-$ when phosphorus pentachloride is dissolved in polar solvents, it acts as an electrolyte is present in ionic form Transference number experiments indicate at $[PCl_4]^+$ and $[PCl_6]^-$ are formed when phosphorus pentachloride is dissolved in nitrobenzene We suggested that with ammonia and derivatives of ammonia respectively phosphorus pentachloride may react as a salt $[PCl_4]^+ + [PCl_6]^-$. An ionic mechanism should be especially observed when a polar solvent is employed.

DTIC

Nitriles; Nitrogen Compounds; Phosphorus Compounds; Polymers; Raman Spectra

20070035589 Monsanto Research Corp., Dayton, OH USA

Phosphorus-Containing Inorganic and Semiorganic Polymers

Nielsen, M L; Greenley, R Z; Grisley, D W; Morrow, T J; Parts, Leo; Weesner, W E; Jan 1962; 28 pp.; In English

Report No.(s): AD-A470506; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The synthesis of new phosphorus-containing polymers expected to have high thermal stability was the object of this research. Accompanying this effort has been a study of model compounds and prototype reactions, to obtain information on bond formation and bond stability. Among phosphorus-containing compounds, those containing the P-C-P linkage have unusual thermal stability. For example, several methylene and phenylene bis diphenylphosphine oxides are stable to 425-450 C (797-842 F). For this reason, the preparation of p-c-p type polymers by addition and condensation reactions using a variety of monomers under widely varied conditions was attempted. Fundamental studies of the chemistry of P-C compounds are described. Reorganization studies indicated that the C-Hs-P bond is probably stable to at least 400 C. Polymers of the polyamide type with phosphorus in the backbone are described. Some prepared from a bibenzimidazole were stable to 425-450 C. (797-842 F), albeit of low molecular weight. Model compounds containing the phosphorus-imidazole bond showed stabilities as high as 500 C. (932 F).

DTIC

Phosphorus; Phosphorus Compounds; Polymers; Thermal Stability

20070035590 Aeronautical Systems Div., Wright-Patterson AFB, OH USA

Organometallic Compounds of Group III, IV, and V

Tamborski, C; Jan 1962; 9 pp.; In English

Report No.(s): AD-A470507; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The preparation and reactions of a number of organometallic compounds has been studied. The organolithium compounds under investigation are Ph_2CHLi , Ph_3CLi , Ph_3SnLi , Ph_3GeLi , Ph_3PbLi , Ph_2PU and Ph_2NLi . Also included in this serie 8 is Ph_2NNa . The reactions of these organometallics with various compounds as carbon dioxide, water, alkyl halides, aryl halides, aralkyl halides, metallic halides and esters has been studied.

DTIC

Carbon Dioxide; Lithium Compounds; Metals; Organometallic Compounds

20070035591 Aeronautical Systems Div., Wright-Patterson AFB, OH USA

A Study of the Friedel-Crafts Acylation of Ferrocene with Perfluorocarboxylic Acid Derivatives

Cottis, S G; Rosenberg, Harold; Jan 1962; 15 pp.; In English

Report No.(s): AD-A470508; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Since the discovery of bis(cyclopentadienyl)iron or ferrocene in 1950 numerous derivatives of this unique organometallic compound have been prepared and their properties studied connection with a program involving the synthesis of polymeric derivatives of ferrocene, it was of interest to investigate methods for the preparation of fluorine-containing ferrocene monomers and polymers Initially this involved the preparation and study of model compounds representative of new types of ferrocenes% such as the hitherto unknown perfluoroalkylferrocenyl ketones 1,1- dihydroperfluoroalkylferrocenes and perfluoroalkylferrocenes. In this paper are reported some of the preliminary results obtained in the investigation of synthetic approaches to the perfluoroalkylferrocenyl ketones $\text{C}_5\text{H}_5\text{FeC}_5\text{H}_4\text{CORf}$, as well as some observations and conclusions resulting from a study of the rather well-known Friedel-Crafts reaction with ferrocene.

DTIC

Acylation; Chemical Composition; Derivation; Ferrocenes; Friedel-Craft Reaction; Organometallic Compounds; Polymers

20070035592 Battelle Memorial Inst., Columbus, OH USA

Effects of Ultrahigh Pressures on the Formation and Properties of Organic Semiorganic and Inorganic Materials

Bradbury, E J; Schwartz, C M; Himes, R C; Sclar, C B; Carrison, L C; Krause, H H; Bigony, H E; Gray, C R; Leininger, R I; Jan 1962; 36 pp.; In English

Report No.(s): AD-A470509; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Studies on the effect of ultrahigh pressures 'up to 90,000 atmospheres' were carried out on organic polymers and a variety of semiorganic and inorganic materials. The experimental work was done in a Belt-type internally heated high pressure apparatus calibrated by means of electrical-resistance discontinuities in Bi, Tl, and Ba using the fixed pressure points of the 'new' post-1960 absolute pressure scale. With organic polymers results to date indicate that the effect of compression is influenced by: (1) The compression attained, (2) the compression rate, (3) the holding period, and (4) the polymer used. The most influential parameters within the target range of compression appear to be the polymer and the holding period. Results to date do not show any generalized pattern of behavior for polymers. Rather the limited data suggest that each material may well have its individual response to compression. Among the semiorganic compounds studied, dimethyldicyano silane apparently polymerized at 60,000 atmospheres through conversion of the nitrile groups to $> \text{C}=\text{N}-$. Other semiorganics, alumino-siloxanes, ethyldicyanophosphine arseno-siloxane, phosphonitrilic chloride trimer and diphenylphosphinoborine showed little effect of pressure or decomposed. In the work with inorganic materials, ultrahigh-pressure high-temperature studies of two heteropolynuclear acids (silicotungstic and phosphotungstic acid) and two heteropolynuclear salts (ammonium-arseno-vanado tungstate and ammonium-phospho-vanado tungstate) revealed what appear to be pressure dependent modifications over a broad pressure-temperature range to 75,000 atmospheres and 1300 C. The results of preliminary high-pressure experiments on a group of sulfides, including SbZS_3 and AsZS_3 , and on apatite $[\text{Ca}_5(\text{PO}_4)_3(\text{OH},\text{F})]$ were negative.

DTIC

Organic Compounds; Organic Materials; Silanes; Sulfides

20070035594 Manchester Coll. of Science and Technology, UK

Researches on Model Compounds Relevant to Linear Boron-Nitrogen Polymers

Cragg, R H; Lappert, M F; Tilley, B P; Jan 1962; 10 pp.; In English

Report No.(s): AD-A470511; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The following new organic boron-nitrogen compounds were synthesised NH-phenylene t-butylaminoboronate NH-

phenylene ethylaminoboronate NH-phenylene isopropylaminoboronate NH-phenylene phenylaminoboronate NH-phenylene dimethylaminoboronate The last four compounds were all obtained as hydrolytically stable dimers. The problem of monomer = dimer, equilibrium and the influence thereon of substituents on the nitrogen atom has been studied qualitatively. 2. A preliminary study of the sulphonylamino- boron compounds characterised are Bis(NH-phenylenedioxyboron) sulphamide.

DTIC

Boron; Boron Nitrides; Nitrogen; Nitrogen Polymers; Organic Compounds; Polymers

20070035597 Michigan State Univ., East Lansing, MI USA

Metal-Siloxy Condensation Reactions

Hammer, Robert N; Kinsinger, Jack B; Jan 1962; 28 pp.; In English

Report No.(s): AD-A470515; No Copyright; Avail.: Defense Technical Information Center (DTIC)

In search for a prototype inorganic condensation reaction that could be used later for study of inorganic polycondensation reactions, it was found that the reaction of NaOSiPhi3 with Phi3SnCl, (n-C4H9)2SnCl2, and (CH3)2SnCl2 in an aprotic solvent is consistent with the overall equations: $\text{Phi}_3\text{SnCl} + \text{NaOSiPhi}_3 + \text{Phi}_3\text{SiOSnPhi}_3 + \text{NaCl} \rightarrow (\text{n-C}_4\text{H}_9)_3\text{SnCl}_2 + 2\text{NaOSiChi}_3 + (\text{n-C}_4\text{H}_9)_2\text{Sn}(\text{OSiPhi}_3)_2 + 2\text{NaCl}$ $(\text{CH}_3)_2\text{SnCl}_2 + 2\text{NaOSiPhi}_3 + 2\text{NaCl}$ with no evidence that significant side reactions occur. These reactions appear to go to completion as shown by quantitative determination of NaCl and the stannosiloxane product. The sodium chloride by-product forms immediately, indicating that these reactions at room temperature in benzene are extremely rapid. Quantitative rate measurements could not be made but the stoichiometry of the reaction was established. In the course of the study, several new stannosiloxanes were prepared and characterized by infrared spectroscopy and elemental analysis. The preparation, characterization, and some properties are reported for siloxy derivatives of bis(cyclopentadienyl)titanium(IV). Monosiloxy derivatives were prepared by the reaction of the appropriate sodium silanolate with bis(cyclopentadienyl) titanium dichloride in toluene at 75-90C under anhydrous conditions. The compounds prepared and characterized were trimethylsiloxybis(cyclopentadienyl)titanium chloride, methyl-diphenylsiloxybis(cyclopentadienyl)titanium chloride, and triphenylsiloxybis(cyclopentadienyl)titanium chloride. These Ti-O-Si compounds are orange crystalline substances; the triphenylsiloxy derivative melts at 201-204 C. Replacement of C6H5 by CH3 groups markedly lowers the melting points and thermal stabilities. Bis(triphenylsiloxy)bis(cyclopentadienyl)titanium was prepared in toluene at 75-90 C from bis(cyclopentadienyl)titanium dihalide and sodium triphenylsilanolate or triphenylsilanol.

DTIC

Condensing; Siloxanes; Solvents; Thermal Stability

20070035810 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

Catalytic Partial Oxidation Reforming of JP8 and S8

Howell, Thomas G; Jun 2007; 83 pp.; In English; Original contains color illustrations

Report No.(s): AD-A470038; AFIT/GAE/ENY/07-J08; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470038>

Catalytic partial oxidation (CPOX) reforming experiments were performed using a 10 kW Aspen Products Group, Inc. fuel processing prototype utilizing military logistic fuels JP8 and S8. S8 is a sulfur-free Fisher-Tropsch fuel, while JP8 is a multi-fuel blend, which could impact reforming efficiency, product distribution and byproduct production. Sulfur contained within the JP8 will adversely affect the product distribution; therefore, desulfurization beds, capable of removing up to 1000 ppm sulfur, were incorporated into the system. The catalyst used in the prototype is noble metal dispersed on cordierite monolith. The goal of this experiment was to evaluate the efficiency and product distribution of the prototype fuel processor through application of several potential military fuels. These results are compared with computational models (Stanjan) to determine if CPOX reactions can be appropriately modeled. JP8 with 700 ppm of sulfur had the highest efficiency of 84.62% followed by JP8 with 400 ppm of sulfur at 84.37% and S8 at 84.37%.

DTIC

Desulfurizing; Fuels; Oxidation; Sulfur

20070035853 Naval Research Lab., Bay Saint Louis, MS USA

Diagnosing Microbiologically Influenced Corrosion: A State-of-the-Art Review

Little, B J; Lee, J S; Ray, R I; Nov 2006; 13 pp.; In English; Original contains color illustrations

Report No.(s): AD-A470200; NRL/MR/7330-07-8999; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470200>

Diagnosing microbiologically influenced corrosion (MIC) after it has occurred requires a combination of microbiological,

metallurgical, and chemical analyses. MIC investigations have typically attempted to 1) identify causative microorganisms in the bulk medium or associated with the corrosion products. 2) identify a pit morphology consistent with an MIC mechanism, and 3) identify a corrosion product chemistry that is consistent with the causative organisms. The following sections provides discussion of available techniques, their advantages and disadvantages, and most importantly, their limitations.

DTIC

Corrosion; Microbiology; Chemical Analysis

20070035994 NASA Glenn Research Center, Cleveland, OH, USA

Synthesis and Near IR Photoluminescence of Os(II) Bis(2,2'-bipyridine) (3,8-Diarylethynyl-1,10-phenanthroline) Complexes: Anomalous Behavior of the 3,8-Dinitrophenylethynyl-substituted Homologue

Yang, Jinhua; Dass, Amala; Sotiriou-Leventis, Chariklia; Tyson, Daniel S.; Leventis, Nicholas; *Inorganica Chimica Acta*; [2005]; Volume 358, Issue 2, pp. 389-395; In English

Contract(s)/Grant(s): NNC3-1064; NCC3-1064; Copyright; Avail.: Other Sources; Abstract Only

ONLINE: <http://dx.doi.org/10.1016/j.ica.2004.08.012>

A large bathochromic shift (50 nm) and emission in the near infrared is observed by attaching arylethynyl groups at the 3,8-positions of the 1,10-phenanthroline ligand (phen) of $[\text{Os}(\text{bipy})_2(\text{phen})]^{2+}$ (where bipy = 2,2'-bipyridine). Thus $[\text{Os}(\text{bipy})_2(3,8\text{-di-4-methoxyphenylethynyl-1,10-phenanthroline})]^{2+}$ emits at 795 nm, while $[\text{Os}(\text{bipy})_2(3,8\text{-diphenylethynyl-1,10-phenanthroline})]^{2+}$ emits at 815 nm. According to this trend it would have been expected that $[\text{Os}(\text{bipy})_2(3,8\text{-di-4-nitrophenylethynyl-1,10-phenanthroline})]^{2+}$ emits farther in the near infrared. Nevertheless, this complex is not photoluminescent because of intramolecular electron transfer quenching of the MLCT excited state by the nitroaromatic group. These results set structural and redox potential standards in the design of near infrared emitters based on $[\text{Os}(\text{bipy})_2(\text{phen})]^{2+}$ type complexes.

Author

Synthesis (Chemistry); Near Infrared Radiation; Photoluminescence; Pyridines; Substitutes

20070036081 Mississippi State Univ., Mississippi State, MS USA

Scalable SiC Power Switches for Applications in More Electric Vehicles (Preprint)

Mazzola, Michael S; Seale, Douglas; Bondarenko, Volodymyr; Cheng, Lin; Casady, Janna; Kelley, Robin; Casady, Jeffrey B; Jun 2007; 9 pp.; In English

Contract(s)/Grant(s): F33615-01-D-2103-0006; Proj-1168

Report No.(s): AD-A470598; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470598>

SiC JFETs can be manufactured in three different conduction types; fully normally off (capable of blocking BVDS(max) at VGS = 0V), quasi-off (previously referred to as bias-enhanced capable of blocking half BVDS(max) at VGS = 0V), and ?hard? normally on (unable to block any amount of voltage at VGS = 0V). There exists trade-offs between each of the three conduction types mostly evident in the forward current ratings and specific on resistance. Due to the structure of the device the normally on device yields the greatest forward current ratings and lowest on resistance. The quasi-off device that is design to block up to half of the maximum blocking capabilities at VGS = 0, typically results in 1.5x reduction in forward current with the normally off device demonstrating greater than 2x reduction in forward current ratings. Because of the large reduction in conduction current capabilities of the normally off device, the normally on and quasi-off devices are more strongly promoted.

DTIC

Electric Motor Vehicles; JFET; Silicon Carbides; Switches; Switching Circuits

20070036139 Massachusetts Univ., Amherst, MA USA

Advanced, Non-Toxic, Anti-Corrosion, Anti-Fouling and Foul-Release Coatings Based on Covalently Attached Monolayers, Multilayers and Polymers

McCarthy, Thomas J; Aug 8, 2007; 6 pp.; In English

Contract(s)/Grant(s): N00014-02-1-0835

Report No.(s): AD-A470718; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470718>

This report describes 7 publications that led from this grant: Buried Interface Modification Using Supercritical Carbon Dioxide, Controlled Growth of Silicon Dioxide from 'Nanoholes' in Silicon-Supported Tris(trimethylsiloxy)silyl Monolayers,

Adsorption of Poly(vinyl alcohol) onto Hydrophobic Substrates (2 papers), A General Approach for Hydrophilizing and Chemically Activating Surfaces, Chemical Surface Modification of Poly(p-xylylene) Thin-Films, Nylon Surface Modification (2 papers).

DTIC

Adsorption; Antifouling; Corrosion; Hydrophobicity; Polymers; Thin Films; Toxicity

20070036289 Naval Research Lab., Bay Saint Louis, MS USA

Comparison of Key West and Persian Gulf Seawaters

Lee, Jason S; Ray, Richard I; Little, Brenda J; Jul 18, 2007; 16 pp.; In English

Report No.(s): AD-A470732; NRL/PP/7303-06-7024; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The experiments described in this paper demonstrate changes in the chemistries and microflora of two natural coastal seawaters collected from Key West, Florida, and the Persian Gulf as a result of storage and environmental conditions. Exposure to an anaerobic atmosphere containing a mixed gas of nitrogen, carbon dioxide, and hydrogen generated the highest microflora concentration, especially sulfate-reducing bacteria (SRB). Biotic dissolved sulfide levels were also highest in the mixed gas atmosphere. In contrast, sulfides were not detected in seawater maintained anaerobic with bubbled nitrogen. Separate introductions of carbon steel and agitation also affected chemistries and microflora. Key West seawater consistently had equal or greater bacterial numbers in all conditions when compared with Persian Gulf seawater. Bubbling nitrogen into natural seawater to achieve an anaerobic condition is not conducive to the growth of SRB and the resulting biotic sulfide. Laboratory experiments that mimic anaerobic conditions by bubbling nitrogen may not produce conditions found in the field due to pH changes. Therefore, removal of oxygen is not the only consideration when attempting to reproduce anaerobic conditions. A followup paper is planned to address the influences of chemistry and microflora on corrosivity.

DTIC

Aerobes; Anaerobes; Bacteria; Carbon Steels; Exposure; Persian Gulf; Sea Water; Water

20070036300 Cincinnati Univ., OH USA

Robust Visible and Infrared Light Emitting Devices Using Rare-Earth-Doped GaN

Steckl, Andrew; May 31, 2006; 18 pp.; In English

Contract(s)/Grant(s): DAAD19-03-1-0101

Report No.(s): AD-A470750; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Rare earth (RE) dopants (such as Er, Eu, Tm) in the wide bandgap semiconductor (WBGs) GaN are investigated for the fabrication of robust visible and infrared light emitting devices at a variety of wavelengths. GaN:RE devices are extremely versatile emitters which emit light at very specific wavelengths and with very narrow spectral linewidth (due to inner shell transitions of the selected RE dopants). We have fabricated singly doped GaN: RE devices emitting pure light at the three primary visible colors (red, green and blue) and at important IR wavelengths (1.0, 1.3 and 1.5 μ m). We have also shown that co-doping with multiple REs produces mixed colors adjustable throughout the color spectrum. These multi-color light emitters have the potential to revolutionize many Army applications, such as vehicle and personal displays, secure communications, short-range illuminators, etc. The GaN:RE light emitters are very robust in terms of exposure to high and low temperatures, corrosives, radiation, shock, vibration, etc.

DTIC

Doped Crystals; Gallium Nitrides; Infrared Radiation; Light Emitting Diodes; Rare Earth Elements; Visibility

20070036310 Oregon Univ., Eugene, OR USA

Molecular Investigations of Interfacial Processes in Tribology

Richmond, Geraldine L; Mar 2007; 4 pp.; In English

Report No.(s): AD-A470776; N00014-01-1-0785; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The support from the Office of Naval Research over the past 3 years has enabled us to make significant contributions to interest important to the Navy. Our research has focused in three areas. In the first area we have been advancing our understanding of aqueous surfaces as they pertain to understanding how water interacts with other media. We have been able to obtain detailed pictures of how water surfaces behave in the presence of high acid concentrations and adjacent to halocarbon surfaces. In the second area we have been examining the structure of molecular films that have important relevance to tribology. In these studies we have been working to understand how films assemble at surfaces and how to construct robust surfaces that can withstand chemical and physical pressures. The third thrust has been in developing molecular modeling capabilities to augment our experimental studies. These modeling capabilities have been extremely successful in giving us

insights into how molecules behave at buried interfaces, particularly when in contact with other fluid media. As we move towards topics in environmental mediation in the coming funding period, the results of these current efforts will be invaluable.
DTIC

Aqueous Solutions; Molecular Dynamics; Tribology

20070036317 Rensselaer Polytechnic Inst., Troy, NY USA

Multifunctional Carbon Nanotube Damping Films

Koratkar, Nikhil; Hajela, Prabhat; Ajayan, Pulickel; Jun 6, 2006; 49 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAAD19-03-1-0036

Report No.(s): AD-A470805; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The objective of this project was to quantify the energy dissipation that occurs when the interfacial slip of nanoscale fillers is activated in a host matrix material. We consider both polymer (such as polycarbonate, PEO, PEG) and epoxy matrices. The nanoscale fillers considered are carbon nanotubes (both singlewalled as well as multi-walled) as well as fullerenes. The nano-composites are fabricated by using a solution mixing technique with tetra-hydro-furan as the solvent. The interfacial friction damping is quantified by performing uniaxial dynamic load tests and measuring the material storage and loss modulus. We study various effects such as impact of nanotube weight fraction, nanotube surface treatment (oxidation, epoxidation etc.), test frequency, strain amplitude, operating temperature as well as effect of pre-strain or biased strain. The effect of geometry (i.e. aspect ratio) is also considered by comparing the damping response of fullerene-composites with that of nanotube-composites.

DTIC

Carbon Nanotubes; Damping

20070036332 California Univ., San Diego, La Jolla, CA USA

Autoignition and Combustion of Diesel and JP-8

Seshadri, Kalyanasundaram; Jul 19, 2007; 51 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W911NF-04-1-0139

Report No.(s): AD-A470858; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The Department of Defense directive 4140.25 dated April 12, 2004 mandates that 'primary fuel support for land-based air and ground forces in all theaters shall be accomplished using a single kerosene-based fuel, in order of precedence: JP-8, commercial jet fuel (with additive package), or commercial jet fuel (without additives).' The objective of the proposed research is to understand those key aspects of combustion of JP-8 that are required to facilitate this conversion. It has been established that a useful approach to understanding combustion of JP-8 is to first develop surrogates that reproduce selected aspects of combustion of JP-8. Experimental, numerical and analytical studies have been carried out. The Aachen surrogate made up of n-decane (80%) and trimethylbenzene (20%) by liquid volume, and the UCSD surrogate made up of n-dodecane (60%), methylcyclohexane (20%), and o-xylene (20%) by liquid volume were found to best reproduce autoignition and extinction characteristics of JP-8.

DTIC

Combustion; Diesel Fuels; Ignition; JP-8 Jet Fuel; Spontaneous Combustion

20070036333 Pennsylvania State Univ., University Park, PA USA

High Performance Damping with Carbon Nanotube-Polymer Composites

Wang, Kon-Well; Bakis, Charles; Jul 20, 2007; 28 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W911NF-04-1-0111

Report No.(s): AD-A470859; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The overall goal of this research project is to investigate the characteristics of carbon nanotube (CNT) filler-based polymers and provide guidelines to advance the state of the art of structural damping enhancement utilizing CNT fillers. Our major efforts have been focused on: (1) To perform tests to observe the damping effect of composites with CNT fillers; (2) To develop a micromechanical constitutive model to analyze the effects of the stick-slip motion of the filler-filler and filler-resin interactions on the total loss factor of composite with aligned and randomly oriented, dilute nanoropes; (3) To simultaneously analyze the effects of the viscoelastic resin together with the stick-slip motion of the filler-filler and filler-resin interactions on the total loss factor of composite with dilute nanoropes; (4) To utilize molecular dynamics (MD) simulations

to analyze the interfacial strength at the filler-filler and filler-resin interface; and (5) To develop methods for nanofiller alignment in composites.

DTIC

Carbon Nanotubes; Composite Materials; Damping; Fillers; Polymers

20070036340 Wisconsin Univ., Madison, WI USA

Dilute-Nitride Type-II Quantum Well Lasers Grown by MOCVD

Mawst, Luke J; Feb 25, 2007; 31 pp.; In English

Contract(s)/Grant(s): DAAD19-03-1-0367

Report No.(s): AD-A470869; No Copyright; Avail.: Defense Technical Information Center (DTIC)

One challenging goal remaining for GaAs-based InGaAsN QW lasers is to extend the emission wavelength beyond 1.3 μm , while maintaining optical material quality for the realization of longer wavelength and high performance. Higher N-content leads to increased nonradiative monomolecular recombination, thus high performance at 1.55 μm has not been achieved to date. Recently, we proposed a novel approach for realizing GaAs-based diode lasers with emission wavelengths beyond ≈ 1500 nm. This approach utilizes the type-II band alignment between InGaAsN and GaAsSb. The PL emission wavelengths of previous InGaAs-GaAsSb type-II QW lasers, were generally limited to 1200-1400 nm, mainly due to strain limitations and the larger bandgap of InGaAs. We have performed design studies using the 10-band k.p method to determine the compositional dependences of the optical matrix element and emission wavelength corresponding to the type-II transition. Increasing the In and Sb contents both extend the emission wavelength, due to reduced bandgap for the corresponding layers. The dilute-nitride type-II laser structures reported here were grown by metalorganic chemical vapor deposition (MOCVD), at an active region growth temperature of 530 deg. C and reactor pressure of 100 mbar. 3-stage $\text{In}_{0.37}\text{Ga}_{0.62}\text{As}_{0.98}\text{N}_{0.02}\text{-GaAs}_{0.7}\text{Sb}_{0.3}$ 'W' QW laser were fabricated and characterized.

DTIC

Metalorganic Chemical Vapor Deposition; Nitrides; Quantum Well Lasers; Quantum Wells; Semiconductor Lasers

20070036372 Army Cold Regions Research and Engineering Lab., Hanover, NH USA

Development of Environmental Data for Navy, Air Force, and Marine Munitions

Clausen, Jay L; Scott, Constance; Cramer, Randall J; Jun 2007; 60 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): Proj-ER-1480

Report No.(s): AD-A470912; ERDC/CRREL-TR-07-7; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Use of conventional weapons and explosives in live-fire military training can lead to release of munitions constituent residues, which can migrate to groundwater and drinking water sources. The extent to which major energetic constituents (RDX, HMX, TNT, and perchlorate) are present at military installations is being analyzed and assessed. Studies of the presence of energetic materials on US Army live-fire training sites have increased our understanding of the environmental fate and transport of energetic constituent residues. This study is intended to expand existing information concerning Army installations to Navy, Marine Corps, and Air Force facilities by relating munitions constituent database information with training allocations and recorded range munitions usage. Munition usage projections from training allocations and range records help identify probable presence of energetic residues and allow for prioritization of sites for further analysis and investigation. Data from this study suggest Air Force, Navy, and Marine training in the continental USA involves use of munitions containing quantities of RDX, HMX, TNT, and perchlorate comparable to Army usage on an annual basis. Based on field studies of numerous Army ranges, there is a high probability of introduction of RDX, HMX, TNT, and perchlorate residues into the environment at Air Force, Navy, and Marine ranges as well.

DTIC

Ammunition; Explosives; Ground Water; Navy; Perchlorates

20070036378 Kansas Univ., Lawrence, KS USA

Issues Involving Infrared Detector Material Systems

Wu, Judy; Sep 28, 2006; 8 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAAD19-02-1-0395

Report No.(s): AD-A470919; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The original objectives of this project are two-fold. One objective is to develop textured templates for growth of epitaxial thin film ferroelectric (TFFE) IR detectors on polyimide coated Si. The commercial TFFE has a polycrystalline structure since

it is directly grown on non-textured polyimide coating. This results in degraded device performance. The same problem also occurs widely to many other device applications. To achieve epitaxial growth of the devices on non-textured surface, an ultra-thin textured template, with high transparency to infrared photons in the infrared detector applications, must be developed on non-textured surface. To resolve this issue, we have developed a unique approach in this project to generate ultra-thin textured MgO buffers on amorphous substrates using ITEX technique (stand for ion beam texturing). This topic has been the main focus of this project and many exciting results have been obtained. The other topic is to improve the performance of Hg-Cd-Te by engineering substrate surface at nano-scales aiming at reducing the defect densities such as dislocations in the device. The main approach is to prepare surfaces that have alternating areas of perfect lattice match area 1 or no match (amorphous, for example) area 2 to Hg-Cd-Te. Each area has a dimension on the order of few tens of nanometers. It is anticipated that Hg-Cd-Te will only nucleate in area 1, not area 2. If the Hg-Cd-Te domains grown in area 1 can overlay on the area 2, the strain induced from lattice mismatch between substrate and Hg-Cd-Te layer may be minimized. We have successfully achieved the surface nanoengineering using electron-beam lithography (EBL). The dimension of the engineered surface area is, however, small typically on the order of few hundred micrometers. This topic was not pursued after one year experiment, due to limitation of characterization capability on small sample spot on our ARL collaborator side.

DTIC

Epitaxy; Ferroelectricity; Infrared Detectors; Mercury Cadmium Tellurides; Silicon; Thin Films

20070036401 Army Engineer Research and Development Center, Vicksburg, MS USA

Engineering Considerations for Hydroxide Treatment of Training Ranges

Davis, Jeffrey L; Larson, Steven L; Felt, Deborah R; Nestler, Catherine C; Martin, W A; Riggs, LeeAnn; Valente, Edward J; Bishop, G R; Jun 2007; 99 pp.; In English; Original contains color illustrations

Report No.(s): AD-A470974; ERDC/EL-TR-07-3; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The use of hydrated lime has the potential to be an effective in situ technology for the destruction and containment of explosives contamination. This was proven with the results from the SERDP project CU-1230, where it was shown to rapidly degrade RDX and TNT. However, prior to field deployment of this technology additional experimental work was required to address concerns regarding the mechanism of the alkaline hydrolysis reaction, the character of the final products of the reaction, the potential for biodegradation of the reaction products, and the amount of lime required for alkaline hydrolysis in different soils. The results can be summarized as follows. First, spectroscopic studies of the TNT alkaline hydrolysis reaction identified two well-resolved and spectrally distinct reaction intermediates. A single radical species was formed during the TNT hydroxide reaction that correlated with the second reaction intermediate. Second, TNT and RDX degraded rapidly through alkaline hydrolysis at pH 12.5. The end products of the reaction were low water-soluble molecular weight compounds that included nitrate and formate. No polymer formation was observed under these reaction conditions. Third, anaerobic and aerobic incubation of neutralized hydrolysis reaction mixtures with range soil showed that there is a high potential for biodegradation. This was evidenced by mineralization of reaction end products (production of [14C]-labeled carbon dioxide) and a decrease in nitrite and nitrate concentrations. Fourth, a simple method to predict the lime required by different soils under different environmental and contamination conditions was developed based on current ASTM methods for raising soil pH. A guidance document was prepared to provide site managers a means to easily and inexpensively determine the lime dosage required to raise pH to levels required for munitions and metals remediation.

DTIC

Alkalinity; Biodegradation; Education; Explosives; Hydroxides

20070036427 Engineering Research and Consulting, Inc., Edwards AFB, CA USA

Supercritical Fluids: Nanotechnology and Select Emerging Applications

Chehroudi, B; Jan 2006; 69 pp.; In English

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

Report No.(s): AD-A471004; AFRL-PR-ED-TP-2004-223; No Copyright; Avail.: Defense Technical Information Center (DTIC)

In this paper, a selected list of emerging applications of supercritical fluids (SCFs) is presented. In particular, demonstrated facts for the promise of the nanoscale science and technology and its overlap or interface with the SCFs technology are presented. It is argued that nanoengineered materials at the nanoscale have mechanical, optical, chemical, and electrical properties quite different from the bulk material. Examples of enhanced performance of many such materials when they are used in practical applications are given. SCFs, in particular carbon dioxide, on account of their special properties such as zero surface tension, low viscosity, and high solubility, enable them to play a critical role in many advanced technology applications. For example, as miniaturization efforts approach the nanoscale, surface tension forces become an important

factor in many nanotechnology processes such as lithography in the electronic industry. In particular, the zero-surface-tension property of the SCFs presents them as a natural choice for nanotechnology.

DTIC

Forecasting; Nanotechnology; Self Consistent Fields; Supercritical Fluids; Thermophysical Properties

20070036444 Clark Univ., Worcester, MA USA

NMR Studies of Micro-Structured and Nano-Structured Polymeric Membrane Systems

Lin, Guoxing; Feb 27, 2007; 8 pp.; In English

Contract(s)/Grant(s): DAAD19-03-1-0087

Report No.(s): AD-A471029; CLARK-40403-CH; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This report describes our achievement in the investigation of the influence of structure on diffusion in styrene-ethylene/butylene-styrene triblock copolymers (SEBS) during the period of June 1, 2006 to November 30, 2006. This type of triblock copolymers has the potential for chemical protection and fuel cell application. Our progress is made in the following fields: (I) Pulse-field- gradient (PFG) Nuclear Magnetic Resonance (NMR) study of the translational diffusion; (II) lattice model simulation of diffusion. From the study, it shows that the copolymer structure and the extent of sulfonation of SEBS have significant influence on penetrant diffusion and sulfonated SEBS (sSEBS) may have a good selectivity for water over DMMP depending on the SEBS structure.

DTIC

Block Copolymers; Diffusion; Membranes; Nuclear Magnetic Resonance

20070036458 Army Cold Regions Research and Engineering Lab., Hanover, NH USA

Characterization and Fate of Gun and Rocket Propellant Residues on Testing and Training Ranges: Interim Report 1

Jenkins, Thomas F; Pennington, Judith C; Ampleman, Guy; Thiboutot, Sonia; Walsh, Michael R; Diaz, Emmanuela; Dontsova, Katerina M; Hewitt, Alan D; Walsh, Marianne E; Bigl, Susan R; Taylor, Susan; MacMillan, Denise K; Clausen, Jay L; Lambert, Dennis; Perron, Nancy M; Lapointe, Marie C; Brochu, Sylvie; Brassard, Marc; Stowe, Rob; Farinaccio, Roccio; Jan 2007; 221 pp.; In English; Original contains color illustrations

Report No.(s): AD-A471046; ERDC/CRREL-TR-07-1; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The objectives of the research described in this report are to characterize the deposition and accumulation of propellant residues at the various types of firing points at military firing ranges, develop process descriptors to allow estimation of environmental transport rates of individual energetic chemicals from these residues, and collect lysimeter and groundwater monitoring well samples to experimentally assess off-site transport of residues. Estimates of residue deposition are presented for the firing of 60- and 81-mm mortars and 105-mm howitzers. Experimental results are provided for propellant residue accumulation at antitank rocket, mortar, artillery, and small arms ranges at several installations. Results from soil column experiments on the transport of nitroglycerin, nitroguanidine, and diphenylamine also are presented with resulting transport property estimates. Also, an experiment to assess the deposition of ammonium perchlorate from Mk58 rocket motors is described.

DTIC

Ammonium Perchlorates; Artillery; Education; Gun Propellants; Nitroguanidine; Residues; Rocket Propellants

20070036461 Queens Univ., Kingston, Ontario Canada

Ln³⁺-Catalyzed Alcoholysis of Organophosphates: New Methodology for the Catalytic Transformation of Phosphorus Pesticides and CW Agents

Brown, Robert S; Mar 14, 2007; 13 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W911NF-04-1-0057

Report No.(s): AD-A471054; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The title project involved investigation of the metal ion catalyzed alcoholysis (e.g. methanolysis) of neutral organophosphorus (OP)ester compounds. These included several members of the phosphate [(ArO)(RO)₂P=O] and phosphorothioate [(ArS)(RO)₂P=O] classes, as well as phosphonate [(ArO)CH₃(OR)P=O] and phosphonothioate [(ArS)CH₃(RO)P=O] classes. Some work was conducted on the P=S phosphorothionate esters which are common pesticides. In general it was found that La³⁺ ion, in the presence of one equivalent of alkoxide, provided an efficient catalyst capable of decomposing all P=O classes of the above neutral OP agents (except P=S derivatives) at rates between 7 to 9 orders of

magnitude larger than the background reactions at the same pH. The Zn(II) and Cu(II) complexes of 1,5,9-triazacyclododecane, as their monoalkoxy forms, are also powerful catalysts for decomposing these OP materials, including the P=S examples. Considerable study was devoted to determining the mechanism of the reactions which is suggested to involve a dual role for the catalyst as both a Lewis acid and deliverer of a metal bound alkoxide to the OP substrate. The metal catalyzed alcoholysis procedures are simple, proceed rapidly at room temperature and essentially neutral pH conditions, give essentially non-toxic ester products from decomposition of the OP simulants investigated.

DTIC

Catalysis; Catalysts; Chemical Warfare; Continuous Radiation; Pesticides; Phosphorus

20070036623 Naval Undersea Warfare Center, Newport, RI USA

Cathodic Delamination Accelerated Life Test Method

Ramotowski, Thomas S, Inventor; Jul 30, 2007; 21 pp.; In English; Original contains color illustrations

Report No.(s): AD-D020304; No Copyright; Avail.: Other Sources

A method for conducting an accelerated life test of a polymer coated metallic sample includes placing the sample below the water surface in a test tank containing water and an oxygen containing gas. Cathodic polarization of the metallic portion of the sample is increased. This can be by using a voltage source or a sacrificial anode. Dissolved oxygen in the test tank water is also increased. Dissolved oxygen can be increased by providing oxygen under pressure to the tank or through an aerator under the water surface. Temperature can also be regulated to accelerate the test speed. Delamination of the sample is periodically tested through a peel test or by other means. The invention also provides a reaction model independent method for calculating activation energy.

DTIC

Accelerated Life Tests; Bonding; Coatings; Delaminating; Metals; Polymers

20070036672 Army Construction Engineering Research Lab., Champaign, IL USA

Fort Ord Groundwater Remediation Studies, 2002 - 2005

Flegal, A R; Mantey, Patrick; Oldenburg, Curt; Daley, Paul; Aug 2006; 149 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DACA42-02-2-0056

Report No.(s): AD-A470908; ERDC/CERL-CR-06-2; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This report presents the results of collaborative studies of groundwater contamination, remediation, and monitoring at the former Fort Ord Army Base in northern Monterey County, California. These complementary, integrated studies were conducted at the site by principal investigators from three different institutions: the Lawrence Livermore National Laboratory; Environmental Restoration Division, Physical and Biological Sciences Division at the University of California Santa Cruz; and Earth Sciences Division, Lawrence Berkeley National Laboratory. These collaborative studies resulted in assessments of groundwater flow monitoring technologies; analyses of aquifer response, groundwater flow, and plume evolution; simulation of in-situ permeable flow sensors for measuring groundwater velocity; and remote sampling and analyses of inorganic contaminants in the groundwater. The first three assessments addressed concerns with organic contaminants previously detected at the site, while the fourth was designed to determine the applicability of the remote sampling system developed to monitor organic contaminants to the monitoring of inorganic contaminants that had also been detected at elevated levels in the general study area. Four separate reports were developed from this project and the results are combined in this integrated summary report.

DTIC

Contamination; Environment Management; Ground Water

20070036786 NASA Glenn Research Center, Cleveland, OH, USA

Arylethynyl Substituted 9,10-Anthraquinones: Tunable Stokes Shifts by Substitution and Solvent Polarity

Yang, Jinhua; Dass, Amala; Rawashdeh, Abdel-Monem M.; Sotiriou-Leventis, Chariklia; Panzner, Matthew J.; Tyson, Daniel S.; Kinder, James D.; Leventis, Nicholas; Chemistry of Materials; 2004; Volume 16, No. 18, pp. 3457-3468; In English; Coordinated in part by the University of Missouri-Rolla; University of Akron; and the Ohio Aerospace Institute

Contract(s)/Grant(s): NNC3-1064; NNC3-1064; Copyright; Avail.: Other Sources

ONLINE: <http://dx.doi.org/10.1021/cm049590g>

2-Arylethynyl- and 2,6- and 2,7-diarylethynyl-substituted 9,10-anthraquinones were synthesized via Sonogashira coupling reactions of 2-bromo-, 2,6-dibromo-, and 2,7-dibromo-9,10-anthraquinone with para-substituted phenylacetylenes.

While the redox properties of those compounds are almost insensitive to substitution, their absorption maxima are linearly related to the Hammett constants with different slopes for electron donors and electron acceptors. ABI compounds are photoluminescent both in solution (quantum yields of emission $\leq 6\%$), and as solids. The emission spectra have the characteristics of charge-transfer bands with large Stokes shifts (100-250 nm). The charge-transfer character of the emitting state is supported by large dipole moment differences between the ground and the excited state as concluded on the basis of molecular modeling and Lippert-Mataga correlations of the Stokes shifts with solvent polarity. Maximum Stokes shifts are attained by both electron-donating and -withdrawing groups. This is explained by a destabilization of the HOMO by electron donors and a stabilization of the LUMO by electron acceptors. X-ray crystallographic analysis of, for example, 2,7-bisphenylethyne-9,10-anthraquinone reveals a monoclinic P2₁ space group and no indication for pi-overlap that would promote quenching, thus explaining emission from the solid state. Representative reduced forms of the title compounds were isolated as stable acetates of the corresponding dihydro-9,10-anthraquinones. The emission of these compounds is blue-shifted relative to the parent oxidized forms and is attributed to internal transitions in the dihydro-9,10-anthraquinone core.

Author

Acceptor Materials; Acetates; Anthraquinones; Electron Transfer; Polarity; Solvents

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METALS AND METALLIC MATERIALS

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

20070035268 Naval Research Lab., Bay Saint Louis, MS USA

How Marine Conditions Affect Severity of MIC of Steels

Little, B; Lee, J; Ray, R; Jul 11, 2007; 7 pp.; In English; Original contains color illustrations

Report No.(s): AD-A470237; NRL/PP/7303-06-7038; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470237>

Both microfouling (biofilms) and macrofouling can influence corrosion in marine environments. Biofilms force an increase in open circuit potential (ennoblement) for passive alloys and an increase in cathodic kinetics. The result is a decrease in initiation time for crevice corrosion for some stainless steels and increase propagation rate for galvanic corrosion for some couple metals. A specific type of carbon sheet piling corrosion, accelerated low water corrosion, has been attributed to a microbiologically generated sulfur cycle in the presence of heavy macrofouling in tidal zones. Ennoblement and carbon steel sheet piling corrosion have been observed in fresh water, but the mechanisms producing these two phenomena are specific to the environments.

DTIC

Corrosion; Electrochemical Corrosion; Fouling; Marine Environments; Stainless Steels; Steels; Water

20070036137 Naval Research Lab., Bay Saint Louis, MS USA

Microbiologically Influenced Corrosion in Military Environments

Lee, Jason S; Ray, Richard I; Little, Brenda J; Jan 2006; 11 pp.; In English

Report No.(s): AD-A470709; NRL/BC/7303-04-1; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470709>

MICROBIOLOGICALLY INFLUENCED CORROSION (MIC) designates corrosion due to the presence and activities of microorganisms. Microorganisms can accelerate rates of partial reactions in corrosion processes and/or shift the mechanism for corrosion processes and/or shift the mechanism for corrosion (Ref 1). Most laboratory and field MIC studies have focused on bacterial involvement; however, other single-celled organisms, including fungi, can influence corrosion. This article focuses on MIC of military assets and is divided into atmospheric, hydrocarbon and water immersed, and buried environments. Individual mechanisms for MIC are discussed for specific examples. More general discussions of MIC are found in the articles 'Microbiologically Influenced Corrosion' and 'Microbiologically Influenced Corrosion Testing' in ASM Handbook, Volume 13A, 2003.

DTIC

Corrosion; Metals; Microorganisms; Submerging

20070036313 Montana Tech of the Univ. of Montana, Butte, MT USA

Free Form Low Cost Fabrication Using Titanium

Anderson, Corby G; Krstulich, John J; Jun 29, 2007; 52 pp.; In English; Original contains color illustrations

Report No.(s): AD-A470788; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The Army weapons systems of the future will require improvements in transportability, maneuverability, and durability. These improvements can be realized through changes in materials of construction. Titanium-based alloys exhibit the exceptionally favorable strength-to-weight ratio, low density, as well as, superior resistance to erosion and impingement attack. It also displays outstanding resistance to a broad range of acids, alkalis, industrial chemicals, natural waters, and marine atmospheres. The current high costs associated with titanium-based alloys remain the main obstacle for widespread use as a material of construction. Although relatively high costs originate in the extraction and refining for the titanium based metal, the highest expenditures can be found in the fabrication of components. Free form fabrication is a growing technology that can be applied to weapons systems manufacturing. This technology utilizes digital information derived from 3D CAD data or data from 3D digitizing systems. Specialized software converts the 3D data into layered 2D data. This layered data is used by a variety of processes that join liquid, powder, or sheet materials to form parts comprised of plastic, metal, ceramic, or composite parts, in a layer upon layer manner. CAMP/Montana Tech has acquired a ProMetal R2, a three-dimensional printing machine, from The Ex One Company of Irwin, Pennsylvania. Titanium-based component fabrication with a three-dimensional printing machine, using of metals powders, and the layer-by-layer methodology, will result in a near-net shape component. For titanium components, the parts will then be subjected to a low-temperature binder removal followed by a high-temperature vacuum furnace sintering and completed by a hot isostatically press furnace stage. The process holds promise to reduce the fabrication costs for titanium components. This method is a more economical titanium fabrication technique when compared to current casting methods.

DTIC

Computer Aided Manufacturing; Fabrication; Low Cost; Titanium; Titanium Alloys

20070036446 General Dynamics Corp., Groton, CT USA

Development of an Ultralight Pulse Gas Metal ARC Welding System for Shipyard Applications

Fichtelberg, Neil D; Jul 27, 2007; 40 pp.; In English

Report No.(s): AD-A471032; PDE-301; No Copyright; Avail.: Defense Technical Information Center (DTIC)

A significant cost in shipbuilding is setup during unit erection and outfitting to support welding operations. For small welding jobs such as hanger and tack welding, the labor associated with equipment relocation and setup can be a large part of the total cost of welding. This is primarily due to the need to move large and cumbersome welding equipment and cables through confined structures. As a result, many hangers and other light-duty welding tasks are carried out aboard ship using the shielded metal arc welding (SMAW) process (stick welding). This manual process is relatively slow, discharges considerable fume, requires removal of welding slag and electrode stubs, and may have lower welder appeal compared to the semi-automatic pulse gas metal arc welding (PGMAW) process. During certain phases of construction, it has not been economical to weld all hangers with PGMAW because of the high amount of labor required to move the cumbersome welding equipment around the boat. Additionally, shipboard space restrictions frequently interfere with power supply placement and accessibility for the PGMAW wire feeder, wire conduit, and welding torch.

DTIC

Arc Welding; Marine Technology; Ships; Shipyards; Supplying

27

NONMETALLIC MATERIALS

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

20070035152 Chungbuk National Univ., Korea, Republic of

Self-Controlled Synthesis of Hyperbranched Polyetherketones From A3 + B2 Approach Via Different Solubilities of Monomers in the Reaction Medium (Preprint)

Choi, Ja-Young; Baek, Jong-Beom; Tan, Loon-Seng; Oct 2006; 38 pp.; In English; Original contains color illustrations

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

Report No.(s): AD-A470044; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470044>

Hyperbranched polyetherketones (PEKs) were synthesized via A3 + B2 polymerization approach without forming

cross-linked networks, because the polymer-forming process based on Friedel-Crafts reaction was kinetically controlled by the solubility difference of monomers in the viscous hydrophilic reaction medium, polyphosphoric acid (PPA)/phosphorous pentoxide (P₂O₅). The hydrophilic trimesic acid as an A3 monomer is soluble in the reaction medium, while hydrophobic diphenyl ether and 1,4-diphenoxybenzene as B2 monomers are marginally soluble. It is hypothesized that the gelation was avoided because of the following two factors: (i) self-regulated feeding of the arylether monomers into the system driven by their poor solubility and phase separation from PPA/ P₂O₅ medium; (ii) reaction-medium-induced isolation of growing macromolecules promoted by the high bulk viscosity. Both polymerization experiments based on equimolar or equifunctional stoichiometry A3 + B2 resulted in completely soluble hyperbranched PEKs in polar aprotic solvents when these polymers contained a little amount of solvent residues and only in strong acids if they were rigorously dried. The structural analysis by using MALDI-TOF mass spectroscopy in the low molar mass region provided further confirmation that there was no trace of networks; various sizes of cyclics were detected instead.

DTIC

Monomers; Polymerization; Solubility

20070035229 Universal Energy Systems, Inc., Dayton, OH USA

A Model for the Oxidation of Refractory Diborides (Preprint)

Parthasarathy, T A; Kerans, Ronald J; Opeka, M; May 2007; 25 pp.; In English

Contract(s)/Grant(s): FA8650-04-D-5233; Proj-2311

Report No.(s): AD-A470166; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470166>

Hypersonic applications require materials that can withstand very high temperatures. Refractory diborides appear to be the most promising candidates for these applications, from the standpoint of resistance to oxidation and evaporative loss. In this work, a mechanistic model is presented that predicts the oxidation behavior of diborides of Zr, Hf and Ti. Using available thermodynamic data and literature data on vapor pressures, good correspondence is obtained between theory and experiments for weight gain, recession and scale thickness as a function of temperature and oxygen partial pressure.

DTIC

Borides; High Temperature; Hypersonics; Oxidation; Refractories

20070035233 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

The Effects of Environment on the Interlaminar Shear Performance of an Oxide/Oxide Ceramic Matrix Composite at Elevated Temperature

Laffey, Patrick D; Jun 2007; 184 pp.; In English; Original contains color illustrations

Report No.(s): AD-A470171; AFIT/GAE/ENY/07-J11; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470171>

This research investigated the interlaminar shear performance of an oxide/oxide ceramic matrix composite consisting of Nextel (trademark) 720 fibers in a high purity, porous alumina (Al₂O₃) matrix. The interlaminar shear performance was observed in both tension and compression of double notched specimens (DNS) at 1200 C. Interlaminar shear creep behavior was examined in both laboratory air and in steam environment at 1200 C. In air, the creep stress was -6.5 MPa. In steam creep stresses included -4.0, -5.0, and -6.5 MPa. Primary and secondary creep regimes were observed in all air creep tests and the creep test in steam at -4.0 MPa. Tertiary creep was also observed in the creep tests in steam at -5.0 and -6.5 MPa. The specimens tested in creep at -6.5 MPa in air achieved run-out, defined as 100 hours at creep stress. The residual strength increased after 100 h of creep in air at 1200 C. In the presence of steam, creep performance deteriorated rapidly and run-out was achieved only at ~50% the interlaminar shear strength. The fracture surfaces and the matrix of all samples were examined in order to determine the failure and environmental degradation mechanisms behind the reduced creep performance of the matrix in steam.

DTIC

Aluminum Oxides; Ceramic Matrix Composites; Creep Properties; Environmental Tests; High Temperature; Oxides; Shear Strength

20070035250 California Univ., Los Angeles, CA USA

Modeling the Deformation of Engineered Nano-Layered Structures by Computer Simulations

Ghoniem, Nasr M; Kioussis, Nick; Dec 2006; 16 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): F49620-03-1-0031

Report No.(s): AD-A470206; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470206>

We developed here fundamental models of plasticity, based on dislocation dynamics and atomistic computer simulation methods for the prediction of the strength and plastic deformation at the nano-to-micro-length scales. The models are applied to the simulation of plastic flow in ultra-strong nano-laminates. The developed methods are: (1) An ab-initio based hybrid approach based on an extension of the parametric dislocation dynamics (DD) to bi-materials where the dislocation spreading over the interface is explicitly accounted; (2) a hybrid ab initio-discrete dislocation dynamics model to study the core structure in straight and curved dislocations, with application to single layers and across material interfaces; (3) Molecular dynamics (MD) modeling of dislocation motion and deformation in nano-layered composite materials and twins; and (4) Dislocation Dynamics (DD) modeling of dislocation motion and deformation modes of anisotropic, nano-layered composite materials.

DTIC

Computerized Simulation; Deformation; Molecular Dynamics; Plastic Deformation

20070035500 Air Force Research Lab., Eglin AFB, FL USA

Compressive Properties of Extruded Polytetrafluoroethylene

Jordan, Jennifer L; Foley, Jason R; Siviour, Clive R; Brown, Eric N; Jul 2007; 14 pp.; In English

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

Report No.(s): AD-A470333; AFRL-MN-EG-TP-2007-7408; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Polymers are becoming increasingly used in aerospace structural applications, where they experience complex, non-static loads. Correspondingly, the mechanical properties at high strain rates are of increasing importance in these applications. This paper presents an investigation of the properties of Dupont 9B polytetrafluoroethylene (PTFE) across strain rates from 10-3 to 10⁵ s⁻¹ (see paper). The samples were tested using an Instron mechanical testing machine for static loading, traditional split Hopkinson pressure bars (SHPBs) for high strain rates, and a miniaturized SHPB for ultra-high strain rates. Additionally, the material was tested using dynamic mechanical analysis to determine the effects of time-temperature superposition on the strain rate behavior of the samples. The results of the experiments are analyzed using the Zerillie-Armstrong model for polymers, which shows good agreement with other PTFE studies.

DTIC

Compressibility; Extruding; Polytetrafluoroethylene; Resins

20070035521 Carnegie-Mellon Univ., Pittsburgh, PA USA

Specific Diluent Effects on the Elastic Properties of Polymeric Networks

Hoeve, C A; O'Brien, M; Jan 1962; 7 pp.; In English

Report No.(s): AD-A470362; No Copyright; Avail.: Defense Technical Information Center (DTIC)

No abstract available

Diluents; Elastic Properties; Polymers

20070035525 University of Southern California, Los Angeles, CA USA

Polymer Components Involving Phosphorus (III)

Burg, Anton B; Griffiths, James E; Joshi, Kamalakant K; Grant, Jr, Louis R; Peterson, Louis K; Nixon, John F; Jan 1962; 10 pp.; In English

Report No.(s): AD-A470368; No Copyright; Avail.: Defense Technical Information Center (DTIC)

No abstract available

Phosphorus; Polymers

20070035806 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

High Temperature Degradation of 5250-4 Polymer Resin

Link, Patrick E; Jun 2007; 99 pp.; In English; Original contains color illustrations

Report No.(s): AD-A470135; AFIT/GAE/ENY/07-J12; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470135>

5250-4 bismaleimide resin is used in high performance polymer matrix composites with high temperature aeronautical applications. This thesis investigated the thermal and oxidative degradation of 5250-4 neat resin powder in argon, air, and oxygen environments. The powder was aged at 163 deg. C, 177 deg. C, and 190 deg. C in all environments for at least 250 hours. Isothermal thermo-gravimetric analysis demonstrated that weight loss was negligible for aging in the argon environment, indicating weight loss is the result of an oxidative process at these temperatures. The 5250-4 powder exhibited an initial period of weight gain before eventually losing weight in both air and oxygen. The applicability of a closed loop oxidation scheme to 5250-4 gravimetric behavior was investigated. Kinetic parameters for the scheme were determined for the Air Force Research Laboratory's polymer matrix composite lifetime prediction modeling efforts.

DTIC

Degradation; High Temperature; Resins; Thermoplasticity

20070035851 General Electric Co., Schenectady, NY USA

Evaluation Techniques for Small Polymer Samples

Doyle, C D; Jan 1962; 16 pp.; In English

Report No.(s): AD-A470370; No Copyright; Avail.: Defense Technical Information Center (DTIC)

No abstract available

Polymers; Sampling; Thermal Analysis

20070036058 Arizona State Univ., Tempe, AZ USA

High Temperature Liquid and Glass Precursors for Oxyphosphate Ceramic Composites

Petuskey, William T; Jul 2007; 27 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): FA9550-04-1-0153

Report No.(s): AD-A470566; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470566>

The overall objective of this project has been explore the structure, dynamics and physical chemistry of rare earth aluminophosphosilicates (REAPS) glasses for the purpose of designing low temperature synthetic routes for fabricating high temperature, high fracture toughness ceramic-matrix-composites. The concept is based on a glass-ceramic approach that combines the densification of glass powders via viscous sintering followed by independent crystallization anneals. The challenge with REAPS glasses is to balance the design criteria for effective synthesis with the criteria of the composite applications. One objective was to find appropriate compositions that allowed sufficient range of temperatures to sinter glass powders above their glass transition temperatures to separately densify glass powders in their supercooled state with the hindrance of premature crystallization. In subsequent step, the densified glasses would be crystallized in a manner to produce microstructures of appropriate utility. The work undertaken has been to evaluate and understand the pertinent physical and chemical properties that are necessary for optimizing the chemistry that best meets both demands. Fortunately, we identified compositions that satisfy both sets of criteria with almost no compromise and the feasibility of the glass-ceramic approach for producing ceramic matrix nanocomposites was proven.

DTIC

Ceramic Matrix Composites; Chemical Properties; Glass; High Temperature; Metals; Powder (Particles)

20070036075 Colorado State Univ., Fort Collins, CO USA

Extending the Performance of Net Shape Molded Fiber Reinforced Polymer Composite Valves for Use in Internal Combustion Engines

Buckley, Richard T; Jun 2007; 367 pp.; In English; Original contains color illustrations

Report No.(s): AD-A470590; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470590>

Fiber Reinforced Composite (FRC) materials offer the possibility of reduced mass and increased performance over metals. Used in internal combustion engines, this may enable increased power and mechanical efficiency. Previous work has both

shown structural and thermal limitations. A net-shape resin transfer molded intake valve has been developed, using a single-piece carbon fiber preform and the high temperature polymer PETI-RFI. Performance has been validated through testing. High engine load conditions resulted in thermal failure of FRC valves. Thermal modeling was conducted to simulate the effect of fiber orientation and coating combinations on transient thermal performance of FRCs. One dimensional modeling has predicted FRC valve surface temperatures to be 120 deg. C higher than that of a steel valve. Simply re-orienting conductive fiber along the heat path may reduce the temperature rise to below that of steel. Two dimensional analysis has resulted in a novel method of evaluating thermal performance. Using the unitless ratio of thermal resistance at the coating surface and at the interface boundary, designated Bb, an accurate prediction of the interface temperature can be obtained. Relative temperature gradients in both coating and core materials can also be estimated. Using this methodology a fiber and coating structure is proposed that reduces FRC core temperature by 80%. It has been shown that careful selection of fiber orientation and coating materials can enable a polymer matrix composite material to withstand the structural and thermal environment of an IC engine combustion chamber.

DTIC

Fiber Composites; Internal Combustion Engines; Shapes; Valves

20070036393 Army Engineer Research and Development Center, Vicksburg, MS USA

Evaluation Criteria for Aged Asphalt Concrete Surfaces

Bell, Haley P; Freeman, Reed B; Jun 2007; 73 pp.; In English; Original contains color illustrations

Report No.(s): AD-A470955; ERDC/GSL-TR-07-18; No Copyright; Avail.: Defense Technical Information Center (DTIC)

An evaluation of aged asphalt concrete (AC) was performed during the period February to December 2006 at the Vicksburg Airport (Vicksburg, MS), Hood Army Airfield and Robert Gray Army Airfield (Fort Hood, TX), Lawson Army Airfield (Fort Benning, GA), Cairns Army Airfield (Fort Rucker, AL), Butts Army Airfield (Fort Carson, CO), and Kandahar Airfield (Kandahar, Afghanistan) to develop a method for predicting the performance of aged AC surfaces in situ. A portable seismic pavement analyzer (PSPA) was used on the in situ AC pavements to determine the pavement modulus. The aged AC samples obtained from the military airfields were brought to the U.S. Army Engineer Research and Development Center for further laboratory testing. Various asphalt mixture and binder properties were determined from the samples, indirect tensile strength tests were run on core samples, and beam fatigue tests were performed on beam samples. The results from this study were used to develop adjustments to the current Department of Defense (DoD) fatigue criterion for the purpose of improving fatigue life predictions for aged AC surfaces. Aged AC surfaces are considered to be 10 years old or older. The most accurate adjustment to the current DoD criterion required both asphalt modulus (from PSPA) and binder stiffness (from dynamic shear rheometer) as input.

DTIC

Asphalt; Concretes; Pavements

20070036449 Dayton Univ. Research Inst., OH USA

Nanocomposites Derived from Carbon Nanofibers and a Hyperbranched Poly(Ether-Ketone): In Situ Polymerization, Chain-End Modification, and Properties (Preprint)

Wang, David H; Mirau, Peter; Tan, Loon-Seng; Li, Bing; Li, Christopher Y; Baek, Jong-Beom; May 2007; 41 pp.; In English
Contract(s)/Grant(s): F33615-00-D-5008; Proj-4347

Report No.(s): AD-A471035; No Copyright; Avail.: Defense Technical Information Center (DTIC)

5-Phenoxyisophthalic acid, an A2B monomer, was easily polymerized via a Friedel-Crafts acylation in poly(phosphoric acid)/phosphorus pentoxide (PPA/P2O5; 1:4 w/w) medium to form a CO2H-terminated hyperbranched poly(ether-ketone), HPB-PEK. Thus, the polymerization of 5-phenoxyisophthalic acid, in the presence of various amounts (1, 2, 5, 10, 20, 30 and 40 wt%) of vapor-grown carbon nanofibers (VGCNF) was performed under similar reaction conditions. The resulting (HPB-PEK)-g-VGCNF nanocomposites were insoluble in dichlorobenzene or toluene, but showed greatly improved solubility in polar solvents such as NMP, DMF, DMAc, ethanol, and even higher solubility in ethanol/triethylamine mixture or in aqueous ammonia solution, apparently stemming from the ionization of the numerous peripheral CO2H groups. This is in contrast to our previous result that the nanocomposites derived from VGCNF similarly grafted with a linear meta-poly(ether-ketone), mPEK, with 1-30 wt% VGCNF content had much lower solubility in these polar solvents but are more soluble in methanesulfonic acid. As a way to determine both the ease in performing chemical transformation on the periphery of the hyperbranched component of the resulting (HPB-PEK)-g-VGCNF nanocomposites and the endgroup effect on some of their physical properties, the 10wt% (HPB-PEK)-g-VGCNF bearing carboxylic-acid endgroups were converted to benzothiazole, dodecyl ester and amine endgroups. For example, the dodecyl-terminated nanocomposite displayed an excellent solubility in chloroform and a much lower Tg than the CO2H-terminated analog. The overall evidence was based on the data from

elemental analysis, thermogravimetric analysis (TGA), Fourier-transform infrared spectroscopy (FT-IR), nuclear magnetic resonance (NMR), scanning electron microscopy (SEM) as well as transmission electron microscopy (TEM).

DTIC

Carbon; Carbon Fibers; Composite Materials; Ketones; Nanocomposites; Polyether Resins; Polymerization

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*.

20070035081 NASA Marshall Space Flight Center, Huntsville, AL, USA

Liquid Bismuth Propellant Management System for the Very High Specific Impulse Thruster with Anode Layer

Polzin, K. A.; Markusic, T. E.; Stanojev, B. J.; May 2007; 40 pp.; In English; Original contains color and black and white illustrations

Contract(s)/Grant(s): NAS7-03001

Report No.(s): NASA/TM-2007-214958; M-1187; No Copyright; Avail.: CASI: [A03](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20070035081>

Two prototype bismuth propellant feed systems were constructed and operated in conjunction with a propellant vaporizer. One system provided bismuth to a vaporizer using gas pressurization but did not include a means to measure the flow rate. The second system incorporated an electromagnetic pump to provide fine control of the hydrostatic pressure and a new type of in-line flow sensor that was developed for accurate, real-time measurement of the mass flow rate. High-temperature material compatibility was a driving design requirement for the pump and flow sensor, leading to the selection of Macor for the main body of both components. Posttest inspections of both components revealed no degradation of the material. The gas pressurization system demonstrated continuous pressure control over a range from zero to 200 torr. In separate proof-of-concept experiments, the electromagnetic pump produced a linear pressure rise as a function of current that compared favorably with theoretical pump pressure predictions, producing a pressure rise of 10 kPa at 30 A. Preliminary flow sensor operation indicated a bismuth flow rate of 6 mg/s with an uncertainty of plus or minus 6%. An electronics suite containing a real-time controller was successfully used to control the entire system, simultaneously monitoring all power supplies and performing data acquisition duties.

Author

Anodes; Bismuth; Liquid Rocket Propellants; Specific Impulse; Feed Systems; Prototypes

20070035274 Library of Congress, Washington, DC USA

The Department of Defense: Reducing Its Reliance on Fossil-Based Aviation Fuel - Issues for Congress

Blackwell, Kristine E; Jun 15, 2007; 47 pp.; In English

Report No.(s): AD-A470250; CRS-RL34062; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470250>

As the largest single consumer of fuel in the USA, the Department of Defense (DOD) has the potential to make important contributions to the national effort to reduce the use of and reliance on fossil fuel. Aviation fuel makes up the largest portion of fossil fuel consumed by DOD and therefore represents the area of greatest potential energy savings. This report examines DOD's use of aviation fuel and possibilities to reduce that use by examining related issues and presenting options Congress may choose to consider. DOD has publicly expressed its intention to devote resources to this issue; Air Force leadership has stated a goal of using domestically produced synthetic fuel for half of its domestic aviation fuel by 2016. At the present time, however, DOD does not seem to have a comprehensive long-term energy strategy or centralized leadership focused on energy issues for the department. This may affect the department's ability to achieve its long-term energy goals. This report will not be updated.

DTIC

Aircraft Fuels; Conservation; Fossil Fuels

20070035555 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

Investigation of Non-Conventional Bio-Derived Fuels for Hybrid Rocket Motors

Putnam, Scott G; Aug 2007; 144 pp.; In English; Original contains color illustrations

Report No.(s): AD-A470435; AFIT-CI07-0058; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Non-conventional bio-derived fuels have been evaluated for use in hybrid rocket motors. Tests were conducted at

combustion pressures in the range of 100 - 220 psig and thrust levels of 40 - 170 newtons. Beeswax was tested with oxygen as the oxidizer and showed a regression rate at least three times as high as traditional hybrid propellant combinations such as hydroxyl-terminated polybutadiene (HTPB) and liquid oxygen (LOX). This provides the promise of a high thrust hybrid rocket motor using a simple, single port geometry and overcomes the main weakness of traditional hybrid rocket motor propellants, which are low regression rates. Beeswax was also tested with nitrous oxide as an oxidizer, but further testing is needed to attain high enough combustion chamber pressures to achieve stable combustion. Experimental evaluation of the specific impulse for beeswax and oxygen was moderately successful for lab scale testing, but needs further refinement. Analytical studies were performed to evaluate the theoretical performance of non-conventional hybrid rocket motors. This analysis indicates beeswax, lard, a mixture of paraffin and lard, and combinations of beeswax and aluminum should all perform better than traditional hybrid rocket propellants considered when burned with oxygen.

DTIC

Ducted Rocket Engines; Fuels

20070035759 Organisatie voor Toegepast Natuurwetenschappelijk Onderzoek, Rijswijk, Netherlands

Response of Munitions Items due to Heating or a Fire

Scholtes, J. H. G.; Verboom, V.; September 2007; 2 pp.; In Dutch

Contract(s)/Grant(s): TNO Proj. 014.16225

Report No.(s): TD2007-0149; TNO-DV 2007 A315; Copyright; Avail.: Other Sources

Safety of munitions for personnel and ordnance in all kinds of situations is important. One of the major threats for munitions is heating of munitions (cook-off), direct (fire) as well as indirect heating (fire in adjacent room). In this study the time to cook-off for several munitions items has been investigated by means of simple 1-dimensional calculations. These calculations have been performed on in-service munitions items, from 35 mm up to 155 mm. with fillings as HMX, RDX and TNT or a combination of this. Also research has been carried out on gun propellants in general. From these results, guidelines have been given to improve the regulations for fire fighting as written in MP 40-21 'Voorschrift voor opslag van gevaarlijke stoffen' or the 'Brandweeropleiding Brandmeester'.

Author

Firing (Igniting); Explosives; Propellants; Incendiary Ammunition; Combustion; Heat of Combustion; Computerized Simulation; Mathematical Models

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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*.

20070035282 Library of Congress, Washington, DC USA

Nuclear Warheads: The Reliable Replacement Warhead Program and the Life Extension Program

Medalia, Jonathan; Jul 16, 2007; 50 pp.; In English

Report No.(s): AD-A470267; CRS-RL33748; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470267>

Current U.S. nuclear warheads were deployed during the Cold War. The National Nuclear Security Administration (NNSA) maintains them with a Life Extension Program (LEP). NNSA questions if LEP can maintain them indefinitely. Congress mandated the Reliable Replacement Warhead (RRW) program in 2004 to improve the reliability, longevity, and certifiability of existing weapons and their components. Since then, Congress has specified more goals for the program. RRW has become the principal program for designing new warheads to replace current ones. The program's first step was a design competition. The winning design was selected in March 2007. If the program continues, NNSA would advance the design of the first RRW, assess its technical feasibility, and estimate cost and schedule in FY2008; start engineering development by FY2010; and produce the first deployable RRW between FY2012 and FY2016. Congressional actions on the FY2008 national defense authorization bills (H.R. 1585, S. 1547) and energy and water appropriations bills (H.R. 2641, S. 1751) have called this schedule into question. For details, see CRS Report RL32929, The Reliable Replacement Warhead Program: Background and Current Developments. Each year, Congress would decide whether to fund the program as requested, modify it, or cancel it, and whether to continue or halt LEP. RRW's supporters argue that the competing designs meet all goals set by Congress. Some critics respond that LEP should work indefinitely and meets almost all goals set by Congress. Others maintain that the scientific tools used to create RRW designs have not been directly validated by nuclear tests, and that the accretion of changes

resulting from LEP makes the link of current warheads to the original tested designs increasingly tenuous. In this view, nuclear testing offers the only way to maintain confidence in the stockpile. This report is intended for Members and staff interested in U.S. nuclear weapon programs.

DTIC

Maintenance; Nuclear Warheads; Reliability; Replacing; Safety; Warheads

20070035447 Naval Undersea Warfare Center, Newport, RI USA

Test Apparatus to Determine the Shear Strength of a Composite Sandwich Beam Under a High Hydrostatic Load

Doleski, Robert F, Inventor; Jul 17, 2007; 33 pp.; In English; Original contains color illustrations

Report No.(s): AD-D020298; No Copyright; Avail.: Other Sources

ONLINE: <http://hdl.handle.net/100.2/ADD020298>

An apparatus for determining the strength of composite sandwich beam in which an enclosure and insertable bladder is provided. The apparatus comprises positioning a bladder within the enclosure. The beam to be tested is slid through a cutout or aperture of the enclosure with support feet holding the beam in place within the enclosure. The enclosure supports the bladder sides with one face of the bladder pressuring the composite sandwich beam. For testing, water is pumped under pressure through a fitting into the bladder. The tolerances between the beam, enclosure and an extrusion seal do not allow the bladder to squeeze outward with the result being measurable testing pressure on the face of the composite beam.

DTIC

Composite Structures; Hydrostatic Pressure; Hydrostatics; Loads (Forces); Sandwich Structures; Shear Strength; Test Equipment

20070035503 Naval Research Lab., Bay Saint Louis, MS USA

The HYCOM (HYbrid Coordinate Ocean Model) Data Assimilative System

Chassignet, Eric P; Hulburt, Harley E; Smedstad, Ole M; Halliwell, George R; Hogan, Patrick J; Wallcraft, Alan J; Baraille, Remy; Bleck, Rainer; Jun 2007; 25 pp.; In English; Original contains color illustrations

Report No.(s): AD-A470336; NRL/JA/7304-05-5098; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This article provides an overview of the effort centered on the HYbrid Coordinate Ocean Model (HYCOM) to develop an eddy-resolving, real-time global and basin-scale ocean hindcast, nowcast, and prediction system in the context of the Global Ocean Data Assimilation Experiment (GODAE). The main characteristics of HYCOM are first presented, followed by a description and assessment of the present near real-time Atlantic forecasting system. Regional/coastal applications are also discussed since an important attribute of the data assimilative HYCOM simulations is the capability to provide boundary conditions to regional and coastal models. The final section describes the steps taken toward the establishment of the fully global eddy-resolving HYCOM data assimilative system and discusses some of the difficulties associated with advanced data assimilation given the size of the problem.

DTIC

Assimilation; Data Systems; Ocean Models; Oceans

20070035518 Naval Research Lab., Washington, DC USA

Magnetometer Transect Survey of AOI 6 -- Dalecarlia Impact Area American University Experiment Station

Andrews, A M; Steinhurst, D A; Nelson, H H; Jul 11, 2007; 50 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W74RDV-10-0-93316

Report No.(s): AD-A470357; NRL/MR/6110--07-9063; No Copyright; Avail.: Defense Technical Information Center (DTIC)

In December 2006, the Environmental Security Technology Certification Program (ESTCP) Program Office and the Chemistry Division of the Naval Research Laboratory conducted a transect magnetometer survey of the Federal Property on the western edge of the Spring Valley, DC Formerly Used Defense Site (FUDS). The purpose of this demonstration was to evaluate the use of statistically-guided ground transect methods, previously validated for wide area assessment (WAA), to locate and bound an artillery fan and suspected disposal site associated with the former American University Experiment Station in the Spring Valley neighborhood of Washington, DC. Survey results, however, show that the background density on

the site is substantially higher than estimated during the planning process. We conclude that it is not reasonable to expect to find a lightly used target on a site with this background density using statistical methods. The high-quality geophysical data collected have been transmitted to the site team for use in planning future investigations on this site.

DTIC

Ammunition; Magnetometers; Surveys

20070035531 Air Force Research Lab., Wright-Patterson AFB, OH USA

Head Tracker Evaluation Utilizing the Dynamic Tracker Test Fixture

Shattuck, Judson L; Parisi, Vincent M; Smerdon, Arryn J; Mar 2007; 27 pp.; In English

Contract(s)/Grant(s): Proj-2830

Report No.(s): AD-A470391; AFRL-HE-WP-TR-2007-0063; No Copyright; Avail.: Defense Technical Information Center (DTIC)

In military aviation, head tracker technologies have become increasingly important to track the pilot's head position and orientation, allowing the user to quickly interact with the operational environment. This technology allows the pilot to quickly acquire items of interest and see Fighter Data Link type information. Acquiring the target on a helmet-mounted tracker/display which can automatically slew a weapon's seeker is far more efficient than having to point at the target with the nose of the aircraft as previously required for the heads-up display type of target acquisition. The USA Air Force has used and evaluated a variety of helmet-mounted trackers for incorporation into their high performance aircrafts. The Dynamic Tracker Test Fixture (DTTF) was designed by the Helmet-Mounted Sensory Technology laboratory to accurately measure rotation in one plane both static and dynamic conditions for the purpose of evaluating the accuracy of head trackers, including magnetic, inertial, and optical trackers. This paper describes the design, construction, capabilities, limitations, and performance of the DTTF.

DTIC

Azimuth; Dynamic Tests; Fixtures; Helmet Mounted Displays

20070035891 NASA Marshall Space Flight Center, Huntsville, AL, USA

Application of Simulated Reactivity Feedback in Nonnuclear Testing of a Direct-Drive Gas-Cooled Reactor

Bragg-Sitton, S. M.; Webster, K. L.; June 2007; 44 pp.; In English; Original contains color and black and white illustrations

Report No.(s): NASA/TM-2007-214959; M-1188; No Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: <http://hdl.handle.net/2060/20070035891>

Nonnuclear testing can be a valuable tool in the development of an in-space nuclear power or propulsion system. In a nonnuclear test facility, electric heaters are used to simulate heat from nuclear fuel. Standard testing allows one to fully assess thermal, heat transfer, and stress related attributes of a given system but fails to demonstrate the dynamic response that would be present in an integrated, fueled reactor system. The integration of thermal hydraulic hardware tests with simulated neutronic response provides a bridge between electrically heated testing and full nuclear testing. By implementing a neutronic response model to simulate the dynamic response that would be expected in a fueled reactor system, one can better understand system integration issues, characterize integrated system response times and response and response characteristics, and assess potential design improvements with a relatively small fiscal investment. Initial system dynamic response testing was demonstrated on the integrated SAFE 100a heat pipe cooled, electrically heated reactor and heat exchanger hardware. This Technical Memorandum discusses the status of the planned dynamic test methodology for implementation in the direct-drive gas-cooled reactor testing and assesses the additional instrumentation needed to implement high-fidelity dynamic testing.

Author

Feedback; Gas Cooled Reactors; Reactivity; Simulation; Mathematical Models; Test Facilities; Electric Propulsion

20070036056 Army Materiel Systems Analysis Activity, Aberdeen Proving Ground, MD USA

Physics-of-Failure Design Analysis and Condition Based Maintenance Applications to Improve the Reliability and Supportability of Army Systems

Page, Matthew; Shepler, Marguerite; Jul 2007; 18 pp.; In English

Report No.(s): AD-A470564; TR-2007-21; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470564>

Army Physics of Failure (PoF) design analyses and condition based maintenance applications have and will continue to improve the reliability and supportability of multiple systems. The PoF examples will show how dynamic modeling, fatigue modeling, finite element analyses, vibrations analysis, and thermal modeling have addressed potential reliability shortfalls and provided better products for our Warfighters. Such PoF analyses are most beneficial when performed during the early design

and low-level testing process. However applications to systems already in the hands of our soldiers can provide significant returns. The condition based maintenance portion will show emerging results from multiple operational and logistics parameters that are being collected from different types of vehicles. The data are being captured from the vehicle data bus, external accelerometers, a six degree of freedom motion pack, and GPS. The paper will explain how templates are being developed to provide soldiers and life-cycle management center staff an easy way to assess vehicle utilization, environment, and other key parameters and conditions. The condition based maintenance results have great potential to improve Army vehicle fleet management capabilities, improve reliability, and address specific component failures. Both the PoF reliability improvement and condition based maintenance efforts are greatly helping our Warfighters.

DTIC

Design Analysis; Failure Analysis; Life (Durability); Maintenance; Reliability

20070036405 Rochester Univ., NY USA

Enhanced Ultrasound Visualization of Brachytherapy Seeds by a Novel Magnetically Induced Motion Imaging Method

McAleavey, Stephen; Apr 1, 2007; 15 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-04-1-0034

Report No.(s): AD-A470978; No Copyright; Avail.: Defense Technical Information Center (DTIC)

We report our progress in developing Magnetically Induced Motion Imaging (MIMI) for unambiguous identification and localization brachytherapy seeds in ultrasound images. In this period we have used finite-element models to determine a torque maximizing seed core shape to generate the greatest possible seed vibration for a given core volume. We present two new signal-processing methods. The first is a compounding method for suppression of 'comet-tail' artifacts in segmented seed images. The second is a method for joining ends of seeds in segmented seed images based on the phase of the detected vibration signal. Both methods are demonstrated in vitro using a commercial ultrasound scanner and tissue-mimicking phantoms.

DTIC

Images; Imaging Techniques; Magnetic Effects; Seeds; Ultrasonics

20070036430 Army Engineer Research and Development Center, Vicksburg, MS USA

Template for Conceptual Model Construction: Model Review and Corps Applications

Henderson, Jim E; O'Neil, L J; Aug 2007; 22 pp.; In English

Report No.(s): AD-A471008; ERDC-TN-SWWRP-07-4; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This technical note reports on a review of conceptual model construction and use, and identifies how conceptual model use can be facilitated to better serve the Corps of Engineers (CE). Previously, Henderson and O'Neil (2004) described a six-step process for conceptual model development and discussed uses and applications of conceptual models in CE Planning and Operations activities. Observations that many Corps conceptual model applications had similar objectives and involved similar resources and disciplines led to a proposal for a template for conceptual model construction. The template will expedite conceptual model construction by providing users with model parameters and potential model components, building on a study team's knowledge and experience, and promoting thought and discussion on how this system works. The template will be developed from work on previous models and documentation on the resources, objectives, and impacts encountered in system wide studies. As a preliminary step for a conceptual model template, conceptual models and current Corps applications were reviewed and categorized. The findings of those reviews are presented here and are used to identify initial descriptor categories for the template. The response to water resources problems flooding, water supply, pollution has historically been with site-specific solutions in the form of structures, water system development, pollutant loading or water quality standards for river or stream reaches. The current scientific, technical, and political approach for water resources management requires a broader approach rather than the site-specific approach. Problems may be manifested at a particular location, but the source of the problem may be at numerous sites in upper or lower watershed locations, or be diffusely distributed over a wide area, only concentrating in the problem site location.

DTIC

Ecology; Models; Templates; Water Resources; Watersheds

20070036455 Army Cold Regions Research and Engineering Lab., Hanover, NH USA

Energetic Residues on Alaskan Ranges: Studies for US Army Garrison Alaska 2005 and 2006

Walsh, Marianne E; Collins, Charles M; Ramsey, Charles A; Douglas, Thomas A; Bailey, Ronald N; Walsh, Michael R; Hewitt, Alan D; Clausen, Jay L; Aug 2007; 86 pp.; In English; Original contains color illustrations
Report No.(s): AD-A471042; ERDC/CRREL-TR-07-9; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Soil was collected from Alaskan firing points and impact areas to assess accumulation of 2,4-DNT, NG, RDX, TNT, and/or HMX resulting from live-fire training activities. At each sampling site, the energetic compound was known from previous sampling or from specific training events. Surface soils at firing points for 105-mm howitzers had part-per-million concentrations of 2,4-DNT resulting from deposition of slivers of propellant from multi-perforated single-base propellant grains. 2,4-DNT was not detectable at a 155-mm howitzer firing point where the propellant formulation was the same, but the propellant grain was single-perforated. Nitroglycerin was detected from tens to hundreds of parts per million at mortar firing points, some of which may have been due to burning of excess propellant. Consistent soil sampling depth to monitor propellant residues is important because 2,4-DNT and NG concentrations decrease sharply with depth. At vegetated firing points, propellant was detectable in mosses and dry, matted grasses, but not in recently emergent leafy vegetation. To estimate the concentration of high-explosives residues, more mass and increments are needed to overcome the greater spatial and compositional heterogeneity. Particulate HE can persist for many years at upland impact areas, but degradation processes are apparent in a salt marsh impact area.

DTIC

Education; Fires; Residues; Soils

20070036457 Army Cold Regions Research and Engineering Lab., Hanover, NH USA

Protocols for Collection of Surface Soil Samples at Military Training and Testing Ranges for the Characterization of Energetic Munitions Constituents

Hewitt, Alan D; Jenkins, Thomas F; Walsh, Marianne E; Walsh, Michael R; Bigl, Susan R; Ramsey, Charles A; Jul 2007; 55 pp.; In English; Original contains color illustrations
Report No.(s): AD-A471045; ERDC/CRREL-TR-07-10; No Copyright; Avail.: Defense Technical Information Center (DTIC)

In the past, very little guidance has been available for site characterization activities addressing the concentration and mass of energetic residues in military training range soils. Energetic residues are heterogeneously distributed over military training ranges as particles of various sizes, shapes, and compositions. Most energetic residues are deposited on the surface, and the highest concentrations exist at firing positions, near targets, and where demolition activities are performed. In the case of impact and demolition ranges the greatest quantities of residues are from rounds that fail to detonate as designed. To address the compositional and distributional heterogeneity associated with the distribution of particles and to obtain representative mean energetic residue soil concentrations, the sampling strategy must strive for the acquisition of samples that contain the constituents of concern in the same proportion to the bulk matrix as exists within the decision unit (sampled area, population, or exposure unit). This report summarizes the sampling strategies and designs that have been implemented for various types of military ranges, including hand grenade, antitank rocket, artillery, bombing, and demolition ranges. These protocols were developed during investigations on active ranges and primarily addressed potential surface source zones from which energetic residues could be migrating into surface and groundwater systems. A multi-increment sampling strategy was selected to accomplish this task after exposing the inadequacies of discrete sampling.

DTIC

Education; Protocol (Computers); Residues; Soil Sampling

20070036702 Condition Monitoring and Diagnostic Engineering Management International, Birmingham, UK

International Journal of COMADEM: Volume 9 Number 4

Rao, B. K. N., Editor; October 2006; ISSN 1363-7681; 47 pp.; In English; See also 20070036703 - 20070036712; Original contains black and white illustrations; Copyright; Avail.: Other Sources

The contents include: 1) On-line Detection of Cracks using Surface Wave Propagation Techniques; 2) ANN based Evaluation of Wire - EDM Process; 3) Guidelines & Rules for CBM Software GUI Design; 4) An Experimental Method for Measuring the Thickness of Mineral Wool Fibres; 5) Maintenance performance measurement system: Application of ICT and e-Maintenance Concepts; 6) An Evaluation of the Potential Offered by a Relevance Vector Classifier in Machinery Fault Diagnosis; 7) Integrating Technical Change with Human Resource; 8) Ideas, View, and Experiences on How to Implement a

Condition Based Maintenance Strategy; 9) A Simple But Effective Approach to Control the Performance of Maintenance Processes; and 10) Equipment Criticality Ranking Case Study.

CASI

Engineering Management; Technologies; Artificial Intelligence; Software Engineering; Neural Nets

20070036703 Ljubljana Univ., Ljubljana, Slovenia

An Experimental Method for Measuring the Thickness of Mineral Wool Fibres

Blagojevic, B.; Sirok, B.; Primozic, U.; International Journal of COMADEM: Volume 9 Number 4; October 2006, pp. 23-29; In English; See also [20070036702](#)

Contract(s)/Grant(s): ERBIC15CT960700; Copyright; Avail.: Other Sources

The quality of mineral-wool products is affected by the thickness of the wool's fibers. The thickness of the fibers depends on the kinematic and thermodynamic parameters of the production process, and on the chemical composition of the raw materials used for the production of the mineral wool. A novel method for measuring the thickness of mineral-wool fibers based on capturing and processing digital images of mineral-wool fibers is presented. The method uses a computer algorithm to detect the mineral-wool fibers in digital images and to process the statistical data. The advantages of this method in comparison with classic measuring methods are its simplicity and the quickly verified repeatability. The method also makes it possible to analyze large numbers of experimental samples, ensuring results that are statistically significant. In our study we used the method to measure the mineral-wool fiber from a variety of samples. The results of the average thickness of the mineral-wool fiber using our new method were compared with results obtained using a classic measuring method. We observed good agreement between the two methods, suggesting that the new measurement method could be used in the real-time industrial production of mineral-wool, where it would increase the quality of the final product.

Author

Wool; Minerals; Thickness; Chemical Composition; Digital Data; Measurement; Real Time Operation; Kinematics

20070036704 Manchester Univ., MacClesfield, UK

An Evaluation of the Potential Offered by a Relevance Vector Classifier in Machinery Fault Diagnosis

Zhang, Kui; Li, Yuhua; Fan, Yibo; Gu, Fengshou; Ball, Andrew; International Journal of COMADEM: Volume 9 Number 4; October 2006, pp. 35-40; In English; See also [20070036702](#); Copyright; Avail.: Other Sources

The increasing complexity of modern inery systems d fault diagnosis strategy with low cost, high efficiency and reliability. This paper reports work which attempts to explore the potential offered by a Relevance Vector Machine (RVM) in machinery fault diagnosis. This work starts with a full investigation into the demands of modern fault diagnosis of the RVM method, and then provides an insight into the model of a relevance vector machine for classification. Finally, a case study of the multi-class classification of bearing faults further demonstrates the application potential of the method. Besides, it is proved that the proposed method is most suitable for real-time applications due to its high computational speed, low memory requirement and high accuracy.

Author

Vectors (Mathematics); Classifiers; Machinery; Mathematical Models; Mechanical Engineering

20070036705 Condition Monitoring and Diagnostic Engineering Management International, Birmingham, UK

A Simple But Effective Approach to Control the Performance of Maintenance Processes

Castro, D. E.; Pinheiro, M. A.; International Journal of COMADEM: Volume 9 Number 4; October 2006, pp. 42; In English; See also [20070036702](#); Copyright; Avail.: Other Sources

Much effort has been realized in the last decades in order to improve maintenance performance in industrial plants. The Brazilian Society of Maintenance (ABRAMAN) is a national organization of Brazil that joins maintenance professionals of different industrial branches (steel industry, mining industry, oil industry, etc) and realizes periodically a survey of the Brazilian maintenance situation. The last results of this survey were shown in the Annual National Meeting of ABRAMAN realized in the city of Belo Horizonte in August 2005. One important result observed in the survey was the expressive number of companies using well known maintenance tools like TPM, RCM, and other management tools like 6-Sigma, 5S, etc. in order to improve the performance of maintenance activities. On the other side, the survey of ABRAMAN showed that the corrective/ preventive rate of maintenance activities remains unchanged. Over the last ten years the corrective rate of maintenance activities in Brazil remains in ca. 30% and other types of maintenance activities (preventive maintenance, condition monitoring, programmed corrective activities, etc) achieve values of ca. 70%. A significant part of this second type of maintenance activities is still corrective (programmed corrective activities or the so called 'preventive activities', but not

programmed!). Considering this unclear classification it can be considered that in Brazil 40% to 50% of all realized maintenance activities are of corrective nature. In spite of this elevated rate of corrective maintenance the survey realized by ABRAMAN showed that time loss due to machine breakdown is 6%. It means that the machines are working in the plants 94% of the available time. The problem is that during this 'productive time' the overall functional efficiency of the assets (measured by OEE) does not surpass values of 40%, this means that approximately 60% of the 'productive time' is lost due to functional failures like reduced velocity, uncontrolled set-up, quality loss, etc. It is necessary to ask why machine performance in industrial plants is so low in spite of increasing use of better management practices in maintenance activities. Observing this behavior, a relatively simple approach was developed and tested by the Maintenance and Reliability Engineering Group (NEC&MS) of the Technical Federal Center (CEFET-MG) in Belo Horizonte (Minas Gerais - Brazil). This approach was denominated RRMS (Reliability and Risk Management System) and consists of continuous monitoring of reliability and risk rates of all plant machines comparing the trend of these variables with pro-active (preventive and condition monitoring) maintenance activities realized in the plant. This approach was initially applied to a vehicle (a bus) of a transportation company and then it was applied to a telecommunication plant. This paper will show the results obtained with this approach and the possibilities offered by this concept to control the performance of the whole maintenance process,

Author

Maintenance; Reliability Engineering; Approach Control; Preventive Maintenance; Telecommunication; Classifications; Management Systems

20070036706 Fluor Corp. Ltd., Los Angeles, CA, USA

Integrating Technical Change with Human Resource

Barker, John; International Journal of COMADEM: Volume 9 Number 4; October 2006, pp. 41; In English; See also [20070036702](#); Copyright; Avail.: Other Sources

Forward thinking maintenance managers and supervisors constantly seek to improve their operation, either on their own or with the assistance of outside consultants. These improvement efforts may focus on maintenance planning, management of subcontractors, material procurement, or any one of the many other functional areas within the purview of the maintenance organization. Some of these improvement projects succeed. However, many of these efforts do not deliver 100% of the expected outcomes while others fail to deliver any results whatsoever. While there are a variety of causes behind this suboptimal level of achievement, one cause stands out above all others: Ignoring the critical and necessary culture change component. All improvement efforts have at their core a fundamental fact - people involved in the improvement must change their behavior. This paper explains that when change is imposed on people, it will not be sustainable over the long term, and why behaviors will drift back to the way things were before the improvement program. Further, it outlines a set of tools and processes that can be used to execute an improvement program that delivers longterm sustainable results.

Author

Human Resources; Planning; Procurement

20070036707 Condition Monitoring and Diagnostic Engineering Management International, Birmingham, UK

Ideas, View, and Experiences on How to Implement a Condition Based Maintenance Strategy

Castro, D. E.; Pinheiro, M. A.; International Journal of COMADEM: Volume 9 Number 4; October 2006, pp. 41-42; In English; See also [20070036702](#); Copyright; Avail.: Other Sources

The preventive maintenance strategy condition based maintenance has been reported to hold many advantages compared to predetermined and corrective maintenance. Although, investigation shows that the condition based maintenance strategy is not utilized in the Swedish industry to the extent one might expect. This paper sets out that the issue can be inherent from an organizational point of view and that general guidelines and implementation models of condition based maintenance thus far has been absent. The objective with this paper is to present ideas, views, and experiences to form general guidelines for a condition based maintenance implementation model. Empirics on the topic have been gathered through E-mail questions to a group of professionals within the Swedish maintenance field. Four groups of professionals; they who have implemented condition monitoring on their production process, they who have implemented condition monitoring into their products, they who develop condition monitoring tools, and they who teach within the area of maintenance, give their views on some open questions. Ideas, views, and personal experiences of the respondents are presented.

Author

Preventive Maintenance; Strategy

20070036708 Shaw Stone and Webster, Baton Rouge, LA, USA

Equipment Criticality Ranking Case Study

Davis, Dwayne M.; International Journal of COMADEM: Volume 9 Number 4; October 2006, pp. 43; In English; See also [20070036702](#); Copyright; Avail.: Other Sources

Prioritizing efforts to utilize resources effectively is a vital component in today's maintenance operations. Critical assets must be managed to ensure continuity of operations. What makes an asset 'critical'? Defining 'critical' is oftentimes left to the experienced based knowledge of maintenance personnel and is the result of a very informal, subjective process. Developing a formal, objective system for ranking the criticality of assets is an important early step in establishing a reliability culture. Shaw Stone & Webster's Reliability Group (Shaw) has developed an equipment criticality ranking process that provides an objective evaluation of assets by identifying and quantifying risk categories such as safety, quality, production, maintenance, etc. Through facilitation and a collaborative effort of various client disciplines such as engineering, maintenance, and operations, a quantitative criticality is derived for each asset. This criticality serves as a corner stone for subsequent improvement initiatives such as preventative maintenance (PM) optimization, work order prioritization, root cause analyses, and spare parts inventory optimization. The criticality ranking process follows a structured approach, and uses a Microsoft Access database tool to document the results.

Author

Maintenance; Inventories; Reliability; Spare Parts; Ranking; Risk

20070036709 Vidya Vikas Inst. of Engineering and Technology, India

Artificial Neural Network based Evaluation of Wire-EDM Process

Ranganath, B. J.; Sudhakar, K. G.; Srikantappa, A. S.; International Journal of COMADEM: Volume 9 Number 4; October 2006, pp. 8-13; In English; See also [20070036702](#); Copyright; Avail.: Other Sources

Wire-EDM process is gaining a significant importance in modern manufacturing activity when a complicated shape is to be made on difficult to machine materials. This paper highlights the relevance of selection of machining parameters like discharge current and discharge time for better machining in wire-EDM. Machining has been carried out on different work materials of varying hardness like Mild steel, OHN steel and HCHCr steel with two types of tool wires, bare brass wire and zinc coated brass wire. An artificial neural network model has been developed to the process parameters such as surface finish, material removal rate, wire wear rate and cutting speed. Experimental results and ANN computed values are observed to be compatible. SEM and EDXA results are discussed to study the characteristics of machined surface and worn out wire.

Author

Neural Nets; Wire; Machining; Surface Finishing; Wear; Steels; Brasses

20070036710 Loughborough Univ., Leicestershire, UK

Guidelines and Rules for CBM Software GUI Design

Higgs, P. A.; Parkin, R.; Jackson, M.; International Journal of COMADEM: Volume 9 Number 4; October 2006, pp. 14-22; In English; See also [20070036702](#)

Contract(s)/Grant(s): GR/P03537/01; Copyright; Avail.: Other Sources

Condition Based Maintenance (CBM) systems are used for monitoring and determining the health of machinery predictively. Graphic user interfaces (GUIs) are the preferred method of Human Computer Interaction (HCI) used by CBM systems. Guidelines and rules aimed at assisting the CBM software GUI design and development process are not presently standardised. It is the intension of this research to initiate the creation of a standard set of rules and guidelines, firstly via survey. Results from seventy seven participating survey respondents are presented in this paper. The results identify values and the level of importance associated with various GUI design factors, CBM software design considerations, and issues anticipated to affect the saleability of CBM software. Survey results represent a direct continuation from two previously published surveys conducted by the authors: Higgs et al. [2004] and Higgs et al. [2006]. Survey results are presented in descending percentage majority vote, highest to lowest for each set of questions. Towards the end of the paper, each result is grouped into a hierarchial list. The list represents a proposal for an initial set of CBM software GUI design and development guidelines and rules.

Author

Graphical User Interface; Human-Computer Interface; Software Engineering; Systems Health Monitoring

20070036711 Lulea Univ., Sweden

Maintenance Performance Measurement System: Application of ICT and e-Maintenance Concepts

Parida, Aditya; International Journal of COMADEM: Volume 9 Number 4; October 2006, pp. 30-34; In English; See also [20070036702](#); Copyright; Avail.: Other Sources

With emergence of intelligent sensors to measure and monitor the health state of the components and implementation of information and communication technologies (ICT), conceptualization and implementation of e-Maintenance is becoming a reality. e-Maintenance facilitates decision making in real time by monitoring plant and systems health and its behaviour in real time, benchmarking the status against the specified standards and by evaluating the associated business risks with various alternatives at hand by using embedded intelligent sensors internet and technology. To benchmark the health state and the performance characteristics invariably different types of performance trend charts and indicators are envisioned to be generated and implemented for use by the experts while making decisions in maintenance. Though, e-Maintenance shows a lot of promise, seamless integration of ICT into the industrial environment and setting, remains a challenge. In this paper, the author argues that understanding the requirements and constraints from maintenance performance and ICT perspective is essential for effective implementation of such concepts. The related issues are needed to be addressed for successful use of ICT and e-Maintenance for measuring maintenance performance. The paper discusses the concepts of e-Maintenance and is based on experiences gained through an ongoing project in this area and examines its applicability generating on-line indicators suitable for various hierarchies in management.

Author

Communication; Technologies; Internets; Electronic Commerce; Maintenance

20070036712 Vrije Univ., Brussels, Belgium

On-line Detection of Cracks using Surface Wave Propagation Techniques

Vanlanduit, Steve; Longo, Roberto; Harri, Kristof; Guillaume, Patrick; International Journal of COMADEM: Volume 9 Number 4; October 2006, pp. 2-7; In English; See also [20070036702](#); Copyright; Avail.: Other Sources

Surface acoustic waves (SAW) can be used to detect a crack in a component by monitoring the transmitted energy between a sending and a receiving transducer. In this paper it will be shown that the success of the technique largely depends on the stress in the vicinity of the crack (when the crack is closed the SAW energy is almost completely transmitted and consequently the crack cannot be detected). This means that the use of the SAW method is not possible during a fatigue test (i.e. on-line), because in that case the stress, and consequently the transmitted SAW energy, typically varies in cycles. In this paper, a novel approach will be proposed to circumvent this problem. During one cycle of a fatigue test several pulses will be transmitted and received. Then a parameter that describes the statistical distribution of this set of transmission ratios is calculated. It will be shown that this parameter is a good indicator of the crack length that is not sensitive to the stress state of the structure. Therefore, the method can be used on-line during the fatigue test. The proposed method will be validated on a steel beam with a propagating crack.

Author

Crack Propagation; On-Line Systems; Wave Propagation; Detection; Surface Waves; Acoustics; Transducers

20070036779 Army Research Inst., Alexandria, VA USA

Fiscal Year 2006 Program

Jan 2006; 19 pp.; In English; Original contains color illustrations

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ONLINE: <http://hdl.handle.net/100.2/ADA470700>

The mission of the U.S. Army Research Institute for the Behavioral and Social Sciences (ARI) is to maximize individual and unit performance and readiness to meet Army operational requirements through advances in the behavioral and social sciences. This document describes ARI's Fiscal Year 2006 program to accomplish this mission.

DTIC

Military Personnel; Education; Human Behavior

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*.

20070035058 Naval Postgraduate School, Monterey, CA USA

Counterterrorism Tactics: A Model of Cell Dynamics

Giebel, Kathleen A; Jun 2007; 83 pp.; In English; Original contains color illustrations

Report No.(s): AD-A470031; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470031>

The modus operandi of various terrorist organizations have been studied extensively, and databases such as ITERATE collate details about terrorist attacks, to include the types of technology used by the terrorist organization and the number of resultant casualties. Surprisingly, however, a generalized model of how terrorist organizations plan their attacks is unavailable in the extant literature. Drawing from organizational theory, particularly the command and control literature and case study methods, this paper posits a generalized model of terrorist attack planning. By extending this model into the counterterrorism domain, the author considers how to more optimally detect terrorist attacks. One thing this model must take into consideration is the assertion that terror cell origins today have changed from the origin of terror cells like the 9-11 attackers. "[There] was a shift from an Al Qaeda operational model based on an 'all-star' team of operatives that was selected, trained and dispatched by the central leadership to the target, to an operational model that encourages independent 'grassroots' Jihadists to conduct attacks, or to a model in which Al Qaeda provides operational commanders who organize grassroots cells.' This work conducts research into the following three thwarted terrorist attacks: (1) the Brooklyn Bridge attack by Iyman Faris; (2) the Millennial Bombings at the Los Angeles Airport by Ahmad Ressaam; and (3) Operation Bojinka, a plan in the mid-1990s to attack airliners over the Pacific Ocean along with a series of simultaneous attacks around the world, masterminded by Ramzi Ahmed Yousef. Occasionally, the author makes reference to other terrorist attacks to better illustrate a specific point. However, primary emphasis is placed on the terrorist plots outlined above.

DTIC

Group Dynamics; Organizations; Planning; Terrorism

20070035065 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

Preferred Frequency Range, Technical Characteristics, and Interference Assessment for a Microwave Observatory of Subsurface and Subcanopy (MOSS) for 1 MHz Bandwidth in the Frequency Range of 100-150 MHz

Honeycutt, Bryan L.; October 12, 2005; 10 pp.; In English; Space Frequency Coordination Group (SFCG), 12-15 Oct. 2005, Beijing, China; Original contains black and white illustrations

Report No.(s): SF25 15/D; Copyright; Avail.: Other Sources

ONLINE: <http://hdl.handle.net/2014/40501>

This document presents rationale for the frequency band selection, technical and operational characteristics of active spaceborne sensors in the Earth Exploration-Satellite Service (active), and interference assessment for a 1 MHz bandwidth sensor in the 100-150 MHz frequency range. The active spaceborne sensors expected to be operating in the frequency range of 100-150 MHz is the synthetic aperture radar (SAR) such as the MOSS. The technical characteristics, mission objectives, orbital parameters, design parameters, antenna characteristics, and preliminary interference assessment are given for MOSS. The purpose of the document is to provide rationale for the frequency band selection, technical characteristics of the active spaceborne sensor Microwave Observatory of Subsurface and Subcanopy (MOSS) that can be used to analyze the compatibility of active spaceborne sensors and other systems of 1 MHz bandwidth in the 100-150 MHz frequency band.

Author

Frequency Ranges; Bandwidth; Spacecraft Instruments; Design Analysis; Synthetic Aperture Radar; Microwaves

20070035086 NASA Dryden Flight Research Center, Edwards, CA, USA

A Low Cost TDRSS Compatible Transmitter Option

Whiteman, Don; October 25, 2005; 8 pp.; In English; 2005 International Telemetry Conference, 25-27 Oct. 2005, Las Vegas, N, USA; Original contains color and black and white illustrations; No Copyright; Avail.: CASI: A02, Hardcopy

ONLINE: <http://hdl.handle.net/2060/20070035086>

The NASA Space-based Telemetry and Range Safety (STARS) program has developed and tested a low cost Ku-Band transmitter alternative for TDRSS applications based on an existing IRIG shaped offset quaternary phase shift keying

(SOQPSK) transmitter. This paper presents information related to the implementation of this low cost system, as well as performance measurements of the alternative TDRSS transmitter system compared with an existing QPSK TDRSS transmitter.
Author

Low Cost; TDR Satellites; Telemetry; Quadrature Phase Shift Keying; Systems Engineering; Transmitter Receivers; Compatibility

20070035103 NASA Goddard Space Flight Center, Greenbelt, MD, USA

A Comparison of Near Concurrent Measurements from the SSMIS and CoSMIR for Some Selected Channels over the Frequency Range of 50-183 GHz

Wang, J. R.; Racette, P. E.; Piepmeier, J. R.; [2007]; 38 pp.; In English; Original contains color illustrations; No Copyright; Avail.: Other Sources

Ten under-flights of the SSMIS (Special Sensor Microwave/Imager/Sounder) with CoSMIR (Conical Scanning Millimeter-wave Imaging Radiometer) on board the NASA ER-2 aircraft were conducted over the coastal region of California between March 2004 and March 2005. The measured brightness temperatures (T_b) from both sensors are collocated and compared at the frequencies of 50.3, 52.8, 53.6, 91.665, 150, 183.3+1, 183.3k3, and 183.3k6.6 GHz. The more transparent channels at 50.3, 91.665, and 150 GHz are strongly affected by changes in surface emission and low-level liquid clouds. Thus, the average differences in $T(\text{sub } b)\text{'s}(\Delta T(\text{sub } b))$ measured by the two sensors and their changes from flight to flight are difficult to assess. For the remaining opaque channels, using the CoSMIR measurements as reference, the lowest SSMIS $T(\text{sub } b)\text{'s}$ occur when the SSMIS is completely under the earth's shadow. As the satellite moves out of the earth's shadow in the ascending passes, the SSMIS $T(\text{sub } b)\text{'s}$ are found to gradually increase with more exposure to the sun. The magnitudes of these T_b changes are about 4-5 K for the three 183.3 GHz channels, and about 2 K for the 52.8 and 53.6 GHz channels.

Author

Frequency Ranges; Millimeter Waves; Radiometers; Microwave Imagery; Exposure; Conical Scanning

20070035113 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

Development of Laser Beam Transmission Strategies for Future Ground-to-Space Optical Communications

Wilson, Keith E.; Kovalik, Joseph M.; Biswas, Abhijit; Roberts, William T.; April 9, 2007; 21 pp.; In English; SPIE Defense and Security Symposium, 9-13 Aprl. 2007, Orlando, FL, USA; Original contains color illustrations; Copyright; Avail.:

Other Sources

ONLINE: <http://hdl.handle.net/2014/40345>

Optical communications is a key technology to meet the bandwidth expansion required in the global information grid. High bandwidth bi-directional links between sub-orbital platforms and ground and space terminals can provide a seamless interconnectivity for rapid return of critical data to analysts. The JPL Optical Communications Telescope Laboratory (OCTL) is located in Wrightwood California at an altitude of 2.2.km. This 200 sq-m facility houses a state-of- the-art 1-m telescope and is used to develop operational strategies for ground-to-space laser beam propagation that include safe beam transmission through navigable air space, adaptive optics correction and multi-beam scintillation mitigation, and line of sight optical attenuation monitoring. JPL has received authorization from international satellite owners to transmit laser beams to more than twenty retro-reflecting satellites. This paper presents recent progress in the development of these operational strategies tested by narrow laser beam transmissions from the OCTL to retro-reflecting satellites. We present experimental results and compare our measurements with predicted performance for a variety of atmospheric conditions.

Author

Laser Beams; Optical Communication; Space Communication; Spaceborne Lasers; Wireless Communication

20070035145 Naval Postgraduate School, Monterey, CA USA

Counterterrorism Tactics: A Model of Cell Dynamics

Giebel, Kathleen A; Jun 2007; 83 pp.; In English; Original contains color illustrations

Report No.(s): AD-A470031; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470031>

The modus operandi of various terrorist organizations have been studied extensively, and databases such as ITERATE collate details about terrorist attacks, to include the types of technology used by the terrorist organization and the number of resultant casualties. Surprisingly, however, a generalized model of how terrorist organizations plan their attacks is unavailable in the extant literature. Drawing from organizational theory, particularly the command and control literature and case study methods, this paper posits a generalized model of terrorist attack planning. By extending this model into the counterterrorism

domain, the author considers how to more optimally detect terrorist attacks. One thing this model must take into consideration is the assertion that terror cell origins today have changed from the origin of terror cells like the 9-11 attackers. "[There] was a shift from an Al Qaeda operational model based on an ‘all-star’ team of operatives that was selected, trained and dispatched by the central leadership to the target, to an operational model that encourages independent ‘grassroots’ Jihadists to conduct attacks, or to a model in which Al Qaeda provides operational commanders who organize grassroots cells.’ This work conducts research into the following three thwarted terrorist attacks: (1) the Brooklyn Bridge attack by Iyman Faris; (2) the Millennial Bombings at the Los Angeles Airport by Ahmad Ressay; and (3) Operation Bojinka, a plan in the mid-1990s to attack airliners over the Pacific Ocean along with a series of simultaneous attacks around the world, masterminded by Ramzi Ahmed Yousef. Occasionally, the author makes reference to other terrorist attacks to better illustrate a specific point. However, primary emphasis is placed on the terrorist plots outlined above.

DTIC

Group Dynamics; Organizations; Planning; Terrorism

20070035172 Defence Science and Technology Organisation, Edinburgh, Australia

Interpolation of Head-Related Transfer Functions

Martin, Russell; McAnally, Ken; Feb 2007; 26 pp.; In English; Original contains color illustrations

Report No.(s): AD-A470084; DSTO-RR-0323; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470084>

Using current techniques it is usually impractical to measure head-related transfer functions (HRTFs) at a spatial resolution that does not exceed the minimum audible angle, i.e. 1-2 degrees for a source directly in front, by a considerable amount. As a result, measured HRTFs must be interpolated to generate a display in which auditory space is rendered smoothly. The spatial resolution at which it is necessary to measure HRTFs for the display to be of high spatial fidelity will depend on the quality of the interpolation technique. This report describes an interpolation technique that involves the application of a novel, inverse-distance-weighted averaging algorithm to HRTFs represented in the frequency domain. The quality of this technique was evaluated by comparing four listeners’ abilities to localize virtual sound sources generated using measured or interpolated HRTFs. The measured HRTFs were shown to be of sufficiently high fidelity to allow virtual sources to be localized as accurately as real sources. Localization error measures, i.e. lateral errors, polar errors and proportions of front/back confusions, for HRTFs interpolated across up to 30 degrees of either lateral or polar angle, or 20 degrees of both lateral and polar angle, did not differ noticeably from those for measured HRTFs. On the basis of this finding we recommend that HRTFs be measured at a 20 degrees lateral- and polar-angle resolution.

DTIC

Display Devices; Interpolation; Transfer Functions

20070035204 Naval Postgraduate School, Monterey, CA USA

Command and Control for Distributed Operations: An Analysis of Possible Technologies, Structure and Employment

Craig, Clayton A; Tsirlis, Christopher S; Jun 2007; 175 pp.; In English; Original contains color illustrations

Report No.(s): AD-A470128; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470128>

In order for information to move efficiently in asymmetric combat environments the military has had to flatten its organization and find ways to network those decision makers who impact the ebb and flow of events on the ground day to day. This thesis further develops the concept of Marine Corps distributed operations (DO) under the current Marine Air Ground Task Force (MAGTF) structure. Analysis will focus on the integration of traditional RF nets into a networked based architecture using emerging Commercial off the Shelf (COTS) Radio Frequency to Internet-Protocol (RF to IP) technologies that would further advance the Marine Corps MAGTF capabilities. Evaluations include traditional Marine Corps ground radio assets along with COTS equipment. Tests include laboratory and field settings. Key performance measures include interoperability, bandwidth measurements, range and power consumption. Additional measures include interoperability with current internet protocol networks and methods of execution. Findings support the bridging of military tactical ground radios into IP networks or into other IP enabled communication devices. Radio interoperability is investigated over various network mediums such as IEEE 802.16, IEEE 802.11A and Mesh links.

DTIC

Command and Control; Communication Networks

20070035277 Library of Congress, Washington, DC USA

Digital Surveillance: The Communications Assistance for Law Enforcement Act

Figliola, Patricia M; Jun 8, 2007; 18 pp.; In English

Report No.(s): AD-A470258; CRS-RL30677; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470258>

The Communications Assistance for Law Enforcement Act (CALEA, P.L. 103- 414, 47 U.S.C. 1001-1010), enacted October 25, 1994, is intended to preserve the ability of law enforcement officials to conduct electronic surveillance effectively and efficiently despite the deployment of new digital technologies and wireless services that have altered the character of electronic surveillance. CALEA requires telecommunications carriers to modify their equipment, facilities, and services, wherever reasonably achievable, to ensure that they are able to comply with authorized electronic surveillance actions. Since 2004, the Federal Communications Commission (FCC) has been considering a number of questions as to how to apply CALEA to new technologies, such as Voice over Internet Protocol (VoIP). In August 2005, in response to a March 2004 petition by a group of law enforcement agencies, the FCC released a Notice of Proposed Rulemaking and Declaratory Ruling which required providers of certain broadband and interconnected VoIP services to accommodate law enforcement wiretaps. The FCC found that these services could be considered replacements for conventional telecommunications services already subject to wiretap rules, including circuit-switched voice service and dial-up Internet access. The Order is limited to facilities-based broadband Internet access service providers and VoIP providers that offer services that use the public switched telephone network (interconnected VoIP providers).

DTIC

Law (Jurisprudence); Pulse Communication; Voice Communication

20070035570 Army Command and General Staff Coll., Fort Leavenworth, KS USA

New Military Strategic Communications System

Baldwin, Robert F; May 2007; 64 pp.; In English; Original contains color illustrations

Report No.(s): AD-A470460; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The USA government and the US military are struggling with strategic communications. To succeed the USG must improve its ability to understand the social context and cultural characteristics of the population, identify target audiences from a population, and engage the target audience through unified action. The Quadrennial Defense Review Roadmap for Strategic Communications and the Department of Defense, Report of the Defense Science Board Task Force on Strategic Communication both concluded that the US military must organize supporting communications capabilities better to provide a coherent message through unified action synchronized with operations. The current Department of Defense solutions to military strategic communications do not address the entire scope of the strategic communications problem. Consequently, the messages are still ineffective and not synchronized with other military actions to mass effects on the battlefield. To remedy this situation, the US military needs a more effective planning process and organizational structure to help commanders focus their military strategic communications planning efforts at the operational and tactical level. Achieving success in strategic communications requires an agile, adaptable, and scalable planning process that provides a commander a framework to synchronize message and action in their area of operations. Political campaigning was one resource identified by the Department of Defense Science Board. Applying the political campaign planning process to military strategic communications suggests such a framework. The framework presented at the conclusion of this paper was derived from an assessment of the current shortfalls in the strategic communications system and a comparison of that system with political campaign processes. The framework provides a foundation from which to alter current military doctrine.

DTIC

Message Processing; Military Operations; Strategy; Telecommunication

20070035770 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

Interference Mitigation Technique Using Active Spaceborne Sensor Antenna in EESS (Active) and Space Research Service (Active) for Use in 500 MHz Bandwidth Near 9.6 GHz

Huneycutt, Bryan L.; October 12, 2005; 15 pp.; In English; Space Frequency Coordination Group (SFCG), 12-20 Oct. 2005, Beijing, China; Original contains black and white illustrations

Report No.(s): SF24-14/D; Copyright; Avail.: Other Sources

ONLINE: <http://hdl.handle.net/2014/40502>

This document presents an interference mitigation technique using the active spaceborne sensor SAR3 antenna in the Earth Exploration-Satellite Service (active) and Space Research Service (active) for use in a 500 MHz bandwidth near 9.6

GHz. The purpose of the document is present antenna designs which offer lower sidelobes and faster rolloff in the sidelobes which in turn mitigates the interference to other services from the EESS (active) and SRS (active) sensors.

Author

Antenna Design; Bandwidth; Synthetic Aperture Radar

20070035782 Naval Research Lab., Washington, DC USA

FM-MRR Analog Audio System

Murphy, J L; Gilbreath, G C; Rabinovich, W S; Sepantaie, M M; Goetz, P G; Jan 2005; 9 pp.; In English
Report No.(s): AD-A470520; No Copyright; Avail.: Defense Technical Information Center (DTIC)

In this work, we describe a hybrid free-space infrared communications link that supports audio transmission. The technique combines conventional frequency modulation 'FM' techniques with optical amplitude modulation 'AM' with a Multiple Quantum Well 'MQW' Modulating Retroreflector 'MRR' technology. The method has produced a robust, low power system capable of transmitting high quality audio information over a free space infrared link extending to multiple kilometers, depending on the characteristics of the Transmit/Receiver 'interrogator' and the sensor/ MRR unit at the data source.

DTIC

Analog Data; Frequency Modulation; Optical Communication; Systems Engineering

20070035996 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

Processing of High Resolution, Multiparametric Radar Data for the Airborne Dual-Frequency Precipitation Radar APR-2

Tanelli, Simone; Meagher, Jonathan P; Durden, Stephen L.; Im, Eastwood; November 12, 2004; 8 pp.; In English; SPIE Remote Sensing of the Atmosphere, Environment, and Space, 8-12 Nov. 2004, Honolulu, HI, USA; Original contains black and white illustrations; Copyright; Avail.: Other Sources

ONLINE: <http://hdl.handle.net/2014/40519>

Following the successful Precipitation Radar (PR) of the Tropical Rainfall Measuring Mission, a new airborne, 14/35 GHz rain profiling radar, known as Airborne Precipitation Radar - 2 (APR-2), has been developed as a prototype for an advanced, dual-frequency spaceborne radar for a future spaceborne precipitation measurement mission. . This airborne instrument is capable of making simultaneous measurements of rainfall parameters, including co-pol and cross-pol rain reflectivities and vertical Doppler velocities, at 14 and 35 GHz. furthermore, it also features several advanced technologies for performance improvement, including real-time data processing, low-sidelobe dual-frequency pulse compression, and dual-frequency scanning antenna. Since August 2001, APR-2 has been deployed on the NASA P3 and DC8 aircrafts in four experiments including CAMEX-4 and the Wakasa Bay Experiment. Raw radar data are first processed to obtain reflectivity, LDR (linear depolarization ratio), and Doppler velocity measurements. The dataset is then processed iteratively to accurately estimate the true aircraft navigation parameters and to classify the surface return. These intermediate products are then used to refine reflectivity and LDR calibrations (by analyzing clear air ocean surface returns), and to correct Doppler measurements for the aircraft motion. Finally, the the melting layer of precipitation is detected and its boundaries and characteristics are identified at the APR-2 range resolution of 30m. The resulting 3D dataset will be used for validation of other airborne and spaceborne instruments, development of multiparametric rain/snow retrieval algorithms and melting layer characterization and statistics.

Author

Airborne Radar; High Resolution; Precipitation Measurement; Satellite Instruments; Velocity Measurement; Multispectral Radar; Meteorological Radar; Radar Data

20070036006 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

Out-of-Band 40 DB Bandwidth of EESS (Active) Spaceborne SARs

Huneycutt, Bryan L.; October 12, 2005; 7 pp.; In English; Space Frequency Coordination Group (SFCG), 12-20 Oct. 2005, Beijing, China; Original contains black and white illustrations; Copyright; Avail.: Other Sources

ONLINE: <http://hdl.handle.net/2014/40562>

This document presents a study of out of band (OOB) 40 dB bandwidth requirements of spaceborne SARs in the Earth Exploration-Satellite Service (active) and Space Research Service (active). The purpose of the document is to study the OOB 40 dB bandwidth requirements and compare the 40 dB bandwidth B-40 as measured in simulations with that calculated using the ITU-R Rec SM.1541 equations. The spectra roll-off and resulting OOB 40 dB bandwidth of the linear FM signal is affected

by the time-bandwidth product and the rise/fall times. Typical values of these waveform characteristics are given for existing EESS (active) sensors.

Author

Bandwidth; Simulation; Synthetic Aperture Radar; Antenna Arrays

20070036021 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

Concepts and Technologies for Synthetic Aperture Radar from MEO and Geosynchronous orbits

Edelstein, Wendy N.; Madsen, Soren; Moussessian, Alina; Chen, Curtis; November 8, 2004; 9 pp.; In English; SPIE Remote Sensing Symposium, 8-12 Nov. 2004, Honolulu, HI, USA; Original contains black and white illustrations; Copyright;

Avail.: Other Sources

ONLINE: <http://hdl.handle.net/2014/40547>

The area accessible from a spaceborne imaging radar, e.g. a synthetic aperture radar (SAR), generally increases with the elevation of the satellite while the map coverage rate is a more complicated function of platform velocity and beam agility. The coverage of a low Earth orbit (LEO) satellite is basically given by the fast ground velocity times the relatively narrow swath width. The instantaneously accessible area will be limited to some hundreds of kilometers away from the sub-satellite point. In the other extreme, the sub-satellite point of a SAR in geosynchronous orbit will move relatively slowly, while the area which can be accessed at any given time is very large, reaching thousands of kilometers from the subsatellite point. To effectively use the accessibility provided by a high vantage point, very large antennas with electronically steered beams are required.

Author

Synthetic Aperture Radar; Geosynchronous Orbits; Low Earth Orbits; Space Based Radar; Imaging Radar; Antennas

20070036042 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

GeoSTAR - A Synthetic Aperture Microwave Sounder for Geostationary Missions

Lambrigtsen, Bjorn; Wilson, William; Tanner, Alan; Kangaslahti, Pekka; November 8, 2004; 10 pp.; In English; SPIE 4th International Asia-Pacific Environmental Remote Sensing Symposium, Honolulu, 8-11 Nov. 2004, Honolulu, HI, USA; Original contains black and white illustrations; Copyright; Avail.: Other Sources

ONLINE: <http://hdl.handle.net/2014/40556>

The Geostationary Synthetic Thinned Aperture Radiometer (GeoSTAR) is a new microwave atmospheric sounder under development. It will bring capabilities similar to those now available on low-earth orbiting environmental satellites to geostationary orbit - where such capabilities have not been available. GeoSTAR will synthesize the multimeter aperture needed to achieve the required spatial resolution, which will overcome the obstacle that has prevented a GEO microwave sounder from being implemented until now. The synthetic aperture approach has until recently not been feasible, due to the high power needed to operate the on-board high-speed massively parallel processing system required for 2D-synthesis, as well as a number of system and calibration obstacles. The development effort under way at JPL, with important contributions from the Goddard Space Flight Center and the University of Michigan, is intended to demonstrate the measurement concept and retire much of the technology risk.

Author

Geosynchronous Orbits; Synthetic Apertures; Onboard Data Processing; Microwave Sounding; Earth Orbits; Calibrating

20070036308 Naval War Coll., Newport, RI USA

On a Hot Roof in New Orleans: Can DOD Airborne Assets Efficiently Deploy and Effectively Conduct Time-Critical Search and Rescue within the Bounds of Current Federal Processes and Construct of an Ad Hoc Joint Task Force?

Elias, James J; May 10, 2007; 32 pp.; In English

Report No.(s): AD-A470773; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Immediate response is one of the most fundamental and critically important principles of search and rescue (SAR) doctrine. The window of time that offers victims the best chance of survival after an accident or disaster is generally measured in hours and not days. Although the U.S. National Guard (NG), U.S. Coast Guard (USCG)/Department of Homeland Security (DHS), Department of the Interior (DOI), and Department of Defense (DoD) air assets successfully rescued and evacuated more than 34,000 residents within the first 10 days after Hurricane Katrina made landfall on August 29th, 2005, there is compelling evidence that the government did not efficiently and effectively bring the full potential of America's domestic SAR capability to bear. This paper analyzes federal plans and processes that directly impact the swiftness of the DoD's domestic SAR response to a natural disaster. Moreover, it explains some potential limitations and interoperability shortcomings of

DoD's current domestic disaster response structure that could adversely impact the effectiveness of immediate SAR efforts. In short, can Title 10 airborne SAR assets be on-scene quicker and conduct SAR better within the construct of an ad hoc joint task force? Since the scope of the Katrina catastrophe was unprecedented, this disaster will represent an illustrative example from which lessons can be gleaned and applied to future large-scale tragedies or national emergencies where DoD support would be anticipated. The focus of the paper is on the DoD's ability to rapidly deploy airborne assets and adequately execute SAR, and does not specifically address the additional complexities of effectively integrating adjacent SAR mission sets led by other governmental agencies. Finally, the paper will recommend the creation of an additional standing joint task force to provide the attention, comprehension, and solutions to the complexities that accompany time-critical search and rescue operations of similar scope.

DTIC

Air Transportation; Command and Control; Defense Program; Disasters; Evacuating (Transportation); Hurricanes; Medical Services; Rescue Operations; Roofs; System Effectiveness; Time Dependence

20070036328 Naval War Coll., Newport, RI USA

Interagency: Command and Control Across the Agencies

Nelson, III, Thomas P; May 10, 2007; 21 pp.; In English

Report No.(s): AD-A470846; No Copyright; Avail.: Defense Technical Information Center (DTIC)

As long as the Department of Defense and other agencies continue to talk about interagency solutions as a problem of coordination than it will be a long time before we see a unified effort among the USA government to solve a complex national strategic objective. The crossing, intersecting, and converging lines of operation that the various agencies of the U.S. government apply to a problem will ultimately lead our efforts to failure unless we can begin to dramatically transform our organizations. Combating Al Qaeda and its associated movements (AQAM) requires the USA provide operational leaders with the flexibility to apply all instruments of national power to resolve crisis or combat terrorism. Fighting this adaptive and elusive enemy and idea will require that Ambassadors and Operational Commanders be give the power to make dramatic decisions in their own unique areas of operation. In order to apply parallel, converging, and mutually supporting lines of operation and instruments of national power it is essential to give these operational leaders total authority.

DTIC

Command and Control; Organizations

20070036362 Army Command and General Staff Coll., Fort Leavenworth, KS USA

Your Turn to Run Your Country Just Ended: Global-Reach Regime Replacement

Scott, Paul J; Jun 4, 2007; 57 pp.; In English; Original contains color illustrations

Report No.(s): AD-A470900; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Global-Reach Regime Replacement, alternately referred to as GR3, is a proposed method to forcibly remove an existing regime from power, replace it with a new government, and conduct appropriate levels of stability and reconstruction operations in the aftermath. Within the context of the contemporary operating environment (COE), this monograph examines the hypothesis that the Joint Strategic Capabilities Plan (JSCP) should assign responsibility for GR3 to the USA Strategic Command (USSTRATCOM). Drawing upon analyses of regime replacement operations in Panama, Haiti, Afghanistan, and Iraq, the monograph evaluates the GR3 concept against the criteria of feasibility, acceptability, and suitability. In each case, GR3 meets the criteria and frequently provides comparative advantages over military methods that require the build-up of conventional forces before the commencement of operations. The resulting primary recommendation is that the JSCP should task USSTRATCOM to develop GR3 into a supporting plan ready for implementation by the regional Combatant Commanders. No plan for GR3 currently exists. Yet in an environment of uncertainty, where threats from far-flung regimes may quickly surface, it is a capability invaluable to the security of the USA. The flexibility and agility of GR3 provides a method for swift action against regimes that threaten the vital interests of the USA. Additionally, it also brings the capability to expand legitimate governance should regime replacement become necessary.

DTIC

Command and Control; Foreign Policy; Military Operations; Replacing; United States

20070036381 Naval War Coll., Newport, RI USA

Strategic Communication and the Geographic Combatant Commander: Using Principles of War to Win Peace

Bohlen, Heath D; May 10, 2007; 24 pp.; In English

Report No.(s): AD-A470924; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Though the importance of strategic communication (SC) has been identified and often conceptualized at the

National/Strategic level, it is at the Theater level and below that much of the interaction with adversaries and potential adversaries takes place. As such, the ability of the U.S. to win the long war will rely heavily on the ability of geographic combatant commanders (GCCs) to effectively plan for and employ the instruments of soft power, including SC. Through these efforts, the GCCs will wage the battle of ideas and, in doing so, aim to prevent the creation of new generations of enemies. To achieve success, GCCs will need to treat SC as they would any other mission area by applying selected principles of war. Through the proper planning and employment of SC, utilizing the principles of objective, unity of command/effort, offensive and mass, GCCs can defeat potential enemies before they reach the battlefield. This paper provides the current definition of SC, discusses the organizational framework supporting SC, analyzes the validity and necessity of SC as a GCC mission and examines SC efforts from the perspective of selected principles of war with a focus on how GCCs have used these principles to effectively employ SC. This paper concludes by providing recommendations for future employment of SC by the GCCs.

DTIC

Warfare

20070036403 Air Force Packaging Technology and Engineering Facility, Wright-Patterson AFB, OH USA
Development of the C-17 Heads-Up Display (HUD) Container, CNU-676/E

Miller, Robbin L; Evans, Susan J; Jan 27, 2006; 47 pp.; In English

Contract(s)/Grant(s): Proj-04-P-106

Report No.(s): AD-A470976; AFPTEF-06-R-05; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The Air Force Packaging Technology and Engineering Facility (AFPTEF) was tasked with the design of a new shipping and storage container for the C-17 Heads-Up Display (HUD) unit in March of 2004. The new container is designed to replace the wood/fiberboard combination package presently used. The current containers lack of mechanical and environmental protection as well as handling issues prompted AFPTEF's design of a new container. The new container will protect the HUD both mechanically and environmentally and make it easier to maneuver during worldwide shipment and storage. The CNU-676/E, designed to SAE ARP1967A, is an aluminum, long- life, controlled breathing, reusable shipping and storage container. The new container passed all qualification tests per ASTM D4169. The CNU-676/E container will not only meet the users requirements but will also provide an economic saving for the Air Force. The savings will be thousands of dollars over the twenty-year life span of the container.

DTIC

Display Devices; Engineering; Head-Up Displays

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*.

20070035101 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Wiring Damage Analyses for STS OV-103

Thomas, Walter, III; May 2006; 40 pp.; In English; Original contains color and black and white illustrations

Report No.(s): NASA/TP-2006-214156; 2006-00678-1; No Copyright; Avail.: CASI: [A03](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20070035101>

This study investigated the Shuttle Program's belief that Space Transportation System (STS) wiring damage occurrences are random, that is, a constant occurrence rate. Using Problem Reporting and Corrective Action (PRACA)-derived data for STS Space Shuttle OV-103, wiring damage was observed to increase over the vehicle's life. Causal factors could include wiring physical deterioration, maintenance and inspection induced damage, and inspection process changes resulting in more damage events being reported. Induced damage effects cannot be resolved with existent data. Growth analysis (using Crow-AMSAA, or CA) resolved maintenance/inspection effects (e.g., heightened awareness) on all wire damages and indicated an overall increase since Challenger Return-to-Flight (RTF). An increasing failure or occurrence rate per flight cycle was seen for each wire damage mode; these (individual) rates were not affected by inspection process effects, within statistical error.

Author

Space Transportation System; Wiring; Inspection; Maintenance; Damage Assessment; Deterioration; Space Shuttles

20070035135 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Design and Fabrication Highlights Enabling a 2 mm, 128 Element Bolometer Array for GISMO

Allen, Christine; Benford, Dominic; Miller, Timothy; Staguhn, Johannes; Wollack, Edward; Moseley, Harvey; [2007]; 1 pp.; In English; 12th International Workshop on Low Temperature Detectors, 22-27 Jul. 2007, Paris, France; Copyright; Avail.: Other Sources; Abstract Only

The Backshort-Under-Grid (BUG) superconducting bolometer array architecture is intended to be highly versatile, operating in a large range of wavelengths and background conditions. We have undertaken a three-year program to develop key technologies and processes required to build kilopixel arrays. To validate the basic array design and to demonstrate its applicability for future kilopixel arrays, we have chosen to demonstrate a 128 element bolometer array optimized for 2 mm wavelength using a newly built Goddard instrument, GISMO (Goddard /RAM Superconducting 2-millimeter Observer). The arrays are fabricated using batch wafer processing developed and optimized for high pixel yield, low noise, and high uniformity. The molybdenum-gold superconducting transition edge sensors are fabricated using batch sputter deposition and are patterned using dry etch techniques developed at Goddard. With a detector pitch of 2 mm 8x16 array for GISMO occupies nearly one half of the processing area of a 100 mm silicon-on-insulator starting wafer. Two such arrays are produced from a single wafer along with witness samples for process characterization. To provide thermal isolation for the detector elements, at the end of the process over 90% of the silicon must be removed using deep reactive ion etching techniques. The electrical connections for each bolometer element are patterned on the top edge of the square grid supporting the array. The design considerations unique to GISMO, key fabrication challenges, and laboratory experimental results will be presented.

Author

Bolometers; Superconductivity; Molybdenum; Millimeter Waves; SOI (Semiconductors)

20070035139 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Radiation Test Results for a MEMS Microshutter Operating at 60 K

Rapchun, David A.; Buchner, Stephen; Moseley, Harvey; Meyer, Stephen E.; Ray, Knute; Tuttle, Jim; Quinn, Ed; Buchanan, Ernie; Bloom, Dave; Hait, Tom; Pearce, Mike; Beamer, A.; [2007]; 4 pp.; In English; IEEE 207 Nuclear and Space Radiation Effects Conference, 23-27 Jul. 2007, Honolulu, HI, USA; Original contains black and white illustrations; Copyright; Avail.: CASI: [A01](#), Hardcopy

The James Webb Space Telescope (JWST), the successor to the Hubble Space Telescope, is due to be launched in 2013 with the goal of searching the very distant Universe for stars that formed shortly after the Big Bang. Because this occurred so far back in time, the available light is strongly red-shifted, requiring the use of detectors sensitive to the infrared portion of the electromagnetic spectrum. HgCdTe infrared focal plane arrays, cooled to below 30 K to minimize noise, will be used to detect the faint signals. One of the instruments on JWST is the Near Infrared Spectrometer (NIRSPEC) designed to measure the infrared spectra of up to 100 separate galaxies simultaneously. A key component in NIRSPEC is a Micro-Electromechanical System (MEMS), a two-dimensional micro-shutter array (MSA) developed by NASA/GSFC. The MSA is inserted in front of the detector to allow only the light from the galaxies of interest to reach the detector and to block the light from all other sources. The MSA will have to operate at 30 K to minimize the amount of thermal radiation emitted by the optical components from reaching the detector array. It will also have to operate in the space radiation environment that is dominated by the MSA will be exposed to a large total ionizing dose of approximately 200 krad(Si). Following exposure to ionizing radiation, a variety of MEMS have exhibited performance degradation. MEMS contain moving parts that are either controlled or sensed by changes in electric fields. Radiation degradation can be expected for those devices where there is an electric field applied across an insulating layer that is part of the sensing or controlling structure. Ionizing radiation will liberate charge (electrons and holes) in the insulating layers, some of which may be trapped within the insulating layer. Trapped charge will partially cancel the externally applied electric field and lead to changes in the operation of the MEMS. This appears to be a general principle for MEMS. Knowledge of the above principle has raised the concern at NASA that the MSA might also exhibit degraded performance because, i) each shutter flap is a multilayer structure consisting of metallic and insulating layers and ii) the movement of the shutter flaps is partially controlled by the application of an electric field between the shutter flap and the substrate (vertical support grid). The whole mission would be compromised if radiation exposure were to prevent the shutters from opening and closing properly. energetic ionizing particles. Because it is located A unique feature of the MSA is that, as outside the spacecraft and has very little shielding, previously mentioned, it will have to operate at temperatures near 30 K. To date, there are no published reports on how very low temperatures (- 30K) affect the response of MEMS devices to total ionizing dose. Experiments on SiO₂ structures at low temperatures (80 K) indicate that the electrons generated by the ionizing radiation are mobile and will move rapidly under the application of an external electric field. Holes, on the other hand, that would normally move in the opposite direction through the SiO₂ via a 'thermal hopping' process, are effectively immobile at low electric fields as they are trapped close to their generation sites. However, for sufficiently large

electric fields (greater than 3 MV/cm) holes are able to move through the SiO₂. The larger the field, the more rapidly the holes move. The separation of the electrons and holes leads to a reduced electric field within the insulating layer. To overcome this reduction in electric field, a greater external voltage will have to be applied that alters the normal operation of the device. This report presents the results of radiation testing of the MSA at 60 K. The temperature was higher than the targeted temperature because of a faulty electrical interconnect on the test board. Specifically, our goal was to determine whether the MSA would function properly after a TID of 200 krad(Si).

Author

Microelectromechanical Systems; Radiation Dosage; Shutters; Ionizing Radiation; Low Temperature

20070035154 Massachusetts Inst. of Tech., Cambridge, MA USA

New Lattice-Mismatched Materials and Services

Fitzgerald, Jr, Eugene; Jan 23, 2007; 19 pp.; In English

Contract(s)/Grant(s): DAAD19-01-1-0588

Report No.(s): AD-A470047; MIT-OSP-6892067; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470047>

In this program, we have been able to advance materials and device work in the area of lattice-mismatched semiconductor materials. In the silicon-germanium materials system, we have explored the use of strained layers together hydrogen implanted into the layers for an exfoliation process. This layer transfer technique was used to demonstrate germanium on insulator (GOI) substrate formation using virtual Ge/Si wafers. In III-V materials systems, we have investigated the formation of cracks during GaAs growth on virtual GeAs/Si, GaAs/Ge/SiGe/Si, GaAs and GaAs/Ge, and show that the integrated intensity of the InGaAs QW on GaAs/Ge/SiGe/Si and GaAs are nearly equivalent. We have demonstrated continuous-wave room temperature lasing of GaAs lasers on silicon.

DTIC

Germanium; Semiconductors (Materials); Silicon; Substrates

20070035180 Binghamton Univ., Binghamton, NY USA

Cooperative Communications for Wireless Information Assurance: Secure Cooperative Communications and Testbed Development

Li, Xiaohua; Jun 2007; 33 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): FA8750-06-2-0167; Proj-231G

Report No.(s): AD-A470095; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470095>

This report summarizes our progress and accomplishments for the project Secure Cooperative Communications and Testbed Development. We have worked on physical-layer security and cooperative communications, and have been developing a wireless cooperative transmission testbed to demonstrate our theoretic results. In this project, we have obtained some major achievements. We have developed an innovative secure transmission scheme, have studied the limit of cooperative transmissions, and have invented a new cooperative OFDM transmission scheme to combat transmission asynchronism. They are helpful to the development of future physical-layer wireless information assurance techniques as well as the cooperative communication techniques. We have successfully implemented the wireless cooperative transmission testbed, implemented array transmissions, and estimated channels which partially verified the validity of our theories.

DTIC

Antenna Arrays; Frequency Division Multiplexing; Test Stands; Wireless Communication

20070035221 Army Research Lab., Adelphi, MD USA

Flip Chip Hybridization Using Indium Bump Technology at ARL

Olver, Kimberley A; Jul 2007; 14 pp.; In English; Original contains color illustrations

Report No.(s): AD-A470149; ARL-TN-283; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470149>

Flip chip hybridization bonding is a microelectronics packaging technique which directly connects an active device to a substrate face down, eliminating the need for peripheral wirebonds. Solder material is used as the conductive link between the two parts. Solder bumps are directly deposited onto the active regions of the device and substrate. The main type of solder bump used at the Army Research Laboratory is the indium solder bump. Indium bump technology has been a part of the

electronic interconnect process field for many years. This report discusses the techniques of flip chip hybrid bonding using indium bumps.

DTIC

Chips; Hybrid Circuits; Indium

20070035243 Dayton Univ. Research Inst., OH USA

E-Beam-Cured Layered-Silicate and Spherical Silica Epoxy Nanocomposites (Preprint)

Chen, Chenggang; Anderson, David P; Mar 2007; 26 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): FA8650-05-D-5052; Proj-4347

Report No.(s): AD-A470185; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470185>

This research demonstrates that an epoxy nanocomposite can be made through electron beam (e-beam) curing. The nanofillers can be two dimensional (layered-silicate) and zero dimensional (spherical silica). Both the spherical silica epoxy nanocomposite and the layered-silicate epoxy nanocomposite can be cured to a high degree of curing. The transmission electron microscopy (TEM) and small-angle x-ray scattering (SAXS) of the e-beam-cured layered-silicate epoxy nanocomposites demonstrate the intercalated nanostructure or combination of exfoliated and intercalated nanostructure. The TEM images show that the spherical silica epoxy nanocomposite has the morphology of homogeneous dispersion of aggregates of silica nanoparticles. The aggregate size is ~100nm. The dynamic mechanical analysis shows that the storage modulus of the spherical silica nanocomposite has been improved, and the glass transition temperature can be very high (~175 degrees C).

DTIC

Electron Beams; Epoxy Resins; Nanocomposites; Nanostructures (Devices); Silicates; Silicon Dioxide; X Ray Scattering

20070035270 California Univ., Irvine, CA USA

Atomic and Molecular Manipulation of Chemical Interactions

Ho, Wilson; Jul 2007; 7 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): FA9550-04-1-0181

Report No.(s): AD-A470240; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470240>

To understand chemistry is to be able to control it. The fulfillment of this long sought after goal ultimately hinges on a detailed knowledge at the atomic and molecular level. Control of chemistry not only provides insights into known materials and phenomena but also leads to chemicals with novel compositions, structures, and functions. The primary objective of this project is to use a homemade, variable low temperature scanning tunneling microscope (STM) to carry out atomic and molecular manipulation of chemical interactions for the discovery of novel nanostructures and properties. In effect, the goal is to carry out chemical changes by manipulating individual atoms and molecules to induce different bonding geometry and to create new interactions with their environment. These studies provide the scientific basis for the advancement of technology in catalysis, molecular electronics, optics, chemical and biological sensing, and magnetic storage.

DTIC

Atomic Energy Levels; Atoms; Field Effect Transistors; Molecular Interactions; Nanostructures (Devices); Spatial Resolution

20070035271 Naval Research Lab., Bay Saint Louis, MS USA

Estimating the Underwater Light Field from Remote Sensing of Ocean Color

Liu, Cheng-Chien; Miller, Richard L; Carder, Kendall L; Lee, Zhongping; D'Sa, Eurico J; Ivey, James E; Jan 2006; 15 pp.; In English; Original contains color illustrations

Report No.(s): AD-A470241; NRL/JA/7330-06-6145; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470241>

We present a new approach that incorporates two models to estimate the underwater light field from remote sensing of ocean color. The first employs a set of analytical, semi-analytical, and empirical algorithms to retrieve the spectrum of inherent optical properties (IOPs), including the absorption and backscatter coefficients, from the spectrum of remote sensing reflectance. The second model computes the profile of photosynthetically available radiation (PAR(z)) for a vertically homogeneous water column using the information of the retrieved IOPs and the ambient optical environment. This computation is based on an improved look-up table technology that possesses high accuracy, comparable with the full solution of the radiative transfer equations, and meets the computational requirement of remote sensing application. This new approach

was validated by in situ measurements and an extensive model-to-model comparison with a wide range of IOPs. We successfully mapped the compensation depth by applying this new approach to process the SeaWiFS imagery. This research suggests that E0, PAR(z) can be obtained routinely from ocean-color data and may have significant implications for the estimation of global heat and carbon budget.

DTIC

Electro-Optics; Estimating; Oceans; Optical Properties; Radiative Transfer; Remote Sensing; Remote Sensors; Water Color

20070035276 Boston Univ., Brookline, MA USA

Residual Stress and Fracture of PECVD Thick Oxide Films for Power MEMS Structures and Devices

Zhang, Xin; Jun 2007; 164 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): F49620-03-1-0078

Report No.(s): AD-A470256; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470256>

Plasma enhanced chemical vapor deposited (PECVD) silicon oxide (SiO_x) is the most commonly used interlayer dielectric (ILD) in MEMS devices and structures. In this project, PECVD SiO_x is chosen as an example for the systematic study of mechanical behavior and underlying casual mechanisms of amorphous thin films for MEMS applications, which are generally less well understood because of the complex interplay among the deformation mechanisms.

DTIC

Fracturing; Microelectromechanical Systems; Oxide Films; Residual Stress; Thick Films; Vapor Deposition

20070035324 Harvard Univ., Cambridge, MA USA

Quantum Information Processing Using Local Control of Exchange in 1D Nanotubes

Marcus, Charles M; Altshuler, Boris L; Lieber, Charles M; Park, Hongkun; Dec 31, 2006; 20 pp.; In English

Contract(s)/Grant(s): DAAD19-02-1-0039

Report No.(s): AD-B329045; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The overall project aimed to develop gated nanotubes and nanowires to be used in the development of spin qubits arranged in a 1D array. Nanotube circuits with gate-confined single and double dots were realized, shell-core nanowire growth methods were developed, gated nanowire circuits were fabricated, and double quantum dots, appropriate for singlet-triplet qubits, were investigated experimentally. We also investigated light emission from nanowires, to be of potential use in electron-photon coupled qubits. Theoretical work spanned the range from investigations of charge dephasing due to 1/f noise, quantum versus classical coupling to nuclear spins, and band mixing in graphene. Dozens of papers were published, several patents were filed, and several students received PhD degrees as a result of this funding.

DTIC

Data Processing; Microelectronics; Nanotechnology; Nanotubes

20070035479 Department of the Navy, Washington, DC USA

Electrical Filter System Using Multi-Stage Photonic Bandgap Resonator

Hughes, Derke R, Inventor; Jul 18, 2007; 9 pp.; In English; Original contains color illustrations

Report No.(s): AD-A470303; No Copyright; Avail.: Other Sources

An electrical filter system includes a transmission line and three or more separated photonic bandgap (PBG) structures positioned successively therealong.

DTIC

Electric Equipment; Energy Gaps (Solid State); Patent Applications; Resonators

20070035569 Boston Univ., Boston, MA USA

Small Depth Quantum Circuits

Bera, Debajyoti; Green, Frederic; Homer, Steven; Jan 2007; 15 pp.; In English

Contract(s)/Grant(s): DAAD19-02-1-0058

Report No.(s): AD-A470452; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Small depth quantum circuits have proved to be unexpectedly powerful in comparison to their classical counterparts. We survey some of the recent work on this and present some open problems.

DTIC

Circuits; Depth

20070035578 Notre Dame Univ., IN USA

Design and Simulation of a Programmable Memory/Multiplier Array Using G4-FET Technology

Brockman, Jay B; Kogge, Peter M; Jul 2007; 21 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): FA8750-06-1-0234; Proj-AD52

Report No.(s): AD-A470480; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Field-programmable and mask-programmable gate arrays can greatly reduce the non-recurring costs of ASIC development by reusing both masks and physical design effort across many designs. The downside of gate arrays is that they result in suboptimal implementations in terms of area, speed, and power. In addition, there is very little flexibility in converting logic to memory or vice versa, a problem of increasing importance as memory-intensive applications gain in importance. To address these issues, we have investigated the design of a novel gate array structure based on G4-FET devices, which combine SOI CMOS and JFET technologies, and that can be biased to function as either a not-majority logic gate, a router/multiplexer, or as a DRAM cell. To demonstrate the potential of G4-FETs for gate arrays, we have designed a memory/multiplexer array that consists of an array of configurable cells built from G4-FETs and a mask-configurable interconnect that may serve as either a multiply-accumulate circuit or as a memory array.

DTIC

Field Effect Transistors; Memory (Computers); Multipliers; Simulation

20070035579 Microsystems and Nanotechnologies, Webster, NY USA

Three-Dimensional Nanobiocomputing Architectures With Neuronal Hypercells

Lyshevski, Sergey; Shmerko, Vlad; Yanushkevich, Svetlana; Lyshevski, Marina; Jun 2007; 51 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): FA8750-06-C-0058; Proj-NBGQ

Report No.(s): AD-A470485; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Microsystems and Nanotechnologies investigated a novel 3D3 (Hardware Software Nanotechnology) technology to design super-high performance computing and processing platforms utilizing molecular hardware within an enabling organization and architecture. The design technology is based on utilizing a three-fold solution: (1) Innovative hardware - 3D-topology molecular hardware (device module- system) within enabling organization/architecture solutions utilizing molecular integrated circuits (MICs); (2) Novel software - computer-aided-design (CAD) tools supported by new synthesis and design methods; (3) Nanotechnology - molecular fabrication technology. The technology departs from conventional planar ICs design (VLSI, ULSI and post ULSI), von Neumann architectures, and CMOS fabrication. Novel solutions of massive parallel distributed computing and processing (pipelined due to systolic processing) were utilized using devised 3D hypercubes (data structure assemblies) and neuronal hypercells (N hypercells) to implement designed MICs as molecular electronics hardware. Novel highly-efficient synthesis taxonomy and design concepts were developed and demonstrated. The design was accomplished utilizing linear decision diagrams and linear systolic arrays. Fundamental and applied research were integrated within innovative computing and molecular electronics technologies developing representative CAD tools and proof-of-concept software.

DTIC

Architecture (Computers); Computer Programming; Molecular Electronics; Nanotechnology; Neurophysiology; Software Engineering

20070035595 Texas Univ., Austin, TX USA

Nonlinear Polarization Conversion using Microring Resonators

Fietz, Chris; Shvets, Gennady; Jun 8, 2007; 4 pp.; In English

Contract(s)/Grant(s): W911NF-04-01-0203

Report No.(s): AD-A470512; No Copyright; Avail.: Defense Technical Information Center (DTIC)

We present a design of a polarization converter between linear, circular, and elliptic accomplished with an on-chip high-Q dielectric microring resonator. Nonlinear polarization switching can be accomplished at modest input intensities because of the high-intensity compression in the ring. We predict an optical bistability effect making the polarization of the transmitted light dependent on its spectral or intensity history.

DTIC

Linear Polarization; Nonlinear Systems; Nonlinearity; Partial Differential Equations; Resonators

20070035602 Johns Hopkins Univ., Baltimore, MD USA

Receiver Performance Characterization for Modulating Retro-Reflector Atmospheric Optical Links With Pulsed Lasers and Optical Pre-Amplifiers

Davidson, F M; Nigon, P; Gilbreath, G C; Rabinovich, W S; Jan 2005; 12 pp.; In English

Report No.(s): AD-A470521; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Receiver performance is calculated for two types of free-space atmospheric optical communications systems - a direct detection system using a p-i-n photodiode preceded by an optical amplifier, and an ideal coherent receiver operated in its shot-noise limited regime without an optical pre-amplifier. The signal format for both is amplitude shift keying 'onoff modulation' with an assumed rectangular light pulse of duration T seconds. The more accurate Beckman probability density function 'pdf' is used to describe the intensity fading rather than the more commonly used log-normal PDF which overestimates receiver performance. A coherent receiver using asynchronous detection is shown to outperform the direct detection system with an optical pre-amplifier gain of 30 dB by anywhere from 7 to about 10 dB depending on Rytov variance intensity fading levels. In addition, the effect of inner scale turbulence parameter, l_0 , on system bit error rate is demonstrated.

DTIC

Characterization; Modulation; Preamplifiers; Pulsed Lasers; Receivers; Reflectors; Retroreflectors

20070035734 Naval Undersea Warfare Center, Newport, RI USA

Axial Field Electric Motor and Method

Cho, Chahee P, Inventor; Jun 26, 2007; 29 pp.; In English; Original contains color illustrations

Report No.(s): AD-D020302; No Copyright; Avail.: Other Sources

It is therefore a general purpose and primary object of the present invention to provide an improved axial field electric motor. It is a further object of the present invention is to provide an improved electric motor for high power density applications. A hybrid field, brushless, permanent magnet electric motor utilizing a rotor with two sets of permanent magnets oriented such that the flux produced by the two sets of magnets is perpendicular to each other. A plurality of axial flux permanent magnets are positioned radially interiorly of a plurality of radial flux permanent magnets. Axial stators interact with the axial flux permanent magnets. A radially positioned stator interacts with radial flux permanent magnets. In one configuration, an electronic feedback system is created that magnetically clamps and holds the hybrid rotor in its axially centrally aligned position, thereby reducing axial vibrations.

DTIC

Electric Motors; Patent Applications; Permanent Magnets

20070035836 Michigan Univ., Ann Arbor, MI USA

Design Technologies for Energy-Efficient VLSI Systems

Papaefthymiou, Marios C; Jan 20, 2007; 19 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAAD19-03-1-0122

Report No.(s): AD-A470045; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470045>

This project has investigated novel design technologies for energy-efficient VLSI systems. Its primary focus has been on charge-recovery circuits. These circuits achieve higher energy efficiency than their conventional counterparts by steering currents to flow across devices with low voltage drops, while recycling undissipated energy in parasitic capacitors. Previous investigations into charge recovery have resulted in complex circuits and architectures that are impractical for high-speed design. This project has led to the discovery of practical low-complexity charge-recovery circuits which achieve high energy efficiency and achieve clock frequencies in excess of 1GHz. The results of this research have been validated through silicon prototyping and experimentation. For four of the inventions resulting from this project, the University of Michigan has filed utility and provisional patent applications with the US Patent and Trademark Office.

DTIC

Very Large Scale Integration; Energy Conservation

20070035982 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

Initial Single Event Effects Testing of the Xilinx Virtex-4 Field Programmable Gate Array

Allen, Gregory R.; Swift, Gary M.; Carmichael, C.; Tseng, C.; April 9, 2007; 17 pp.; In English; Single Event Effects

Symposium, 9-12 Apr. 2007, Long Beach, CA, USA; Original contains color and black and white illustrations; Copyright; Avail.: Other Sources

ONLINE: <http://hdl.handle.net/2014/40350>

We present initial results for the thin epitaxial Xilinx Virtex-4 Field Programmable Gate Array (FPGA), and compare to previous results obtained for the Virtex-II and Virtex-II Pro. The data presented was acquired through a consortium based effort with the common goal of providing the space community with data and mitigation methods for the use of Xilinx FPGAs in space.

Author

Field-Programmable Gate Arrays; Single Event Upsets; Performance Tests; Spacecraft Electronic Equipment

20070035987 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

Simulations of Resonant Intraband and Interband Tunneling Spin Filters

Ting, David; Cartoixa-Soler, Xavier; McGill, T. C.; Smith, Darryl L.; Schulman, Joel N.; September 4, 2001; 20 pp.; In English; Defense Advanced Research Projects Agency (DARPA) Spins/Spintronics Workshop and Review, Long Beach, California, September 4-7, 2001, 4-7 Sep. 2001, Long Beach, CA, USA; Original contains color illustrations; Copyright; Avail.: Other Sources

ONLINE: <http://hdl.handle.net/2014/40404>

This viewgraph presentation reviews resonant intraband and interband tunneling spin filters. It explores the possibility of building a zero-magnetic-field spin polarizer using nonmagnetic III-V semiconductor heterostructures. It reviews the extensive simulations of quantum transport in asymmetric InAs/GaSb/AlSb resonant tunneling structures with Rashba spin splitting and proposes a new device concept: side-gated asymmetric Resonant Interband Tunneling Diode (a-RITD).

Derived from text

Resonant Tunneling; Simulation; Electron Spin

20070035997 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

Operation of FPGAs at Extremely Low Temperatures

Burke, Gary R.; Cozy, Scott; Lacayo, Veronica; Bakhshi, Alireza; Stern, Ryan; Mojarradi, Mohammad; Johnson, Travis; Kolawa, Elizabeth; Bolotin, Gary; Gregoire, Tim; Ramesham, Rajeshuni; September 8, 2004; 5 pp.; In English; 7th Military and Aerospace Programmable Logic Device (MAPLD) International Conference, 8 Sep. 2004, Washington, DC, USA; Original contains black and white illustrations

Report No.(s): B159-MAPLD/2004; Copyright; Avail.: Other Sources

ONLINE: <http://hdl.handle.net/2014/40528>

This paper describes the operation of FPGAs at very low temperatures eg -160(deg)C. Both Actel and Xilinx parts are tested. It was found that low temperature operations is not a problem with the parts tested, but there is a problem with powering on an FPGA at cold temperatures.

Author

Field-Programmable Gate Arrays; Low Temperature; Ambient Temperature; Circuits

20070036000 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

THz Hot-Electron Photon Counter

Karasik, Boris S.; Sergeev, Andrei V.; October 3, 2004; 4 pp.; In English; IEEE Transactions on Applied Superconductivity Applied Superconductivity Conference, 3-8 Oct. 2004, Jacksonville, FL, USA; Original contains black and white illustrations; Copyright; Avail.: Other Sources

ONLINE: <http://hdl.handle.net/2014/40549>

We present a concept for the hot-electron transition-edge sensor capable of counting THz photons. The main need for such a sensor is a spectroscopy on future space telescopes where a background limited NEP approx. $10(\exp -20)$ W/H($\exp 1/2$) is expected at around 1 THz. Under these conditions, the rate of photon arrival is very low and any currently imaginable detector with sufficient sensitivity will operate in the photon counting mode. The Hot-Electron Photon Counter based on a submicron-size Ti bridge has a very low heat capacity which provides a high enough energy resolution (approx. 140 GHz) at 0.3 K. With the sensor time constant of a few microseconds, the dynamic range would be approx. 30 dB. The sensor couples

to radiation via a planar antenna and is read by a SQUID amplifier or by a 1-bit RSFQ ADC. A compact array of the antenna-coupled counters can be fabricated on a silicon wafer without membranes.

Author

Photons; Counters; Hot Electrons; Spaceborne Telescopes; Dynamic Range

20070036057 ITT Industries, Inc., Albuquerque, NM USA

JOLT: A Highly Directive, Very Intensive, Impulse-Like Radiator

Baum, Carl E; Baker, W L; Prather, W D; Lehr, J M; O'Loughlin, J P; Giri, D V; Smith, I D; Altes, Robert; Fockler, James; McLemore, Donald; Abdalla, M D; Skipper, M C; May 1, 2006; 44 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F29601-00-D-0074/0023; Proj-4867

Report No.(s): AD-A470565; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470565>

Ultra-wideband (UWB) systems that radiate very high-level transient waveforms and exhibit operating bandwidths of over two decades are now in demand for a number of applications. Such systems are known to radiate impulse-like waveforms with risetimes around 100 picoseconds (ps) and peak electric field values of 10s of kV/m. Such waveforms, if properly radiated will exhibit an operating spectrum of over two decades, making them ideal for applications such as concealed object detection, countermine, transient radar, and communications

DTIC

Electromagnetic Properties; Impulses; Radar Antennas

20070036102 Mississippi State Univ., Mississippi State, MS USA

A Comparison of SiC Power Switches for High-Rel Defense Applications (preprint)

Mazzola, Michael S; Casady, Jeffrey B; Jul 2007; 6 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F33615-01-D-2103-0005; Proj-1604

Report No.(s): AD-A470628; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470628>

SiC VJFETs are an ideal device for a number of power electronics applications, including, but not limited to, high temperature motor drives, switch modules, and DC-DC or DC-AC inverters/converters. These applications are relevant to a number of military applications, such as shipboard power systems, more electric vehicles (including hybrid vehicles), and power conditioning systems in hostile and/or high temperature environments. The SiC VJFETs combine the switching speed of Si MOSFETs with the voltage and current handling properties of IGBTs and the thermal properties of SiC material. Since the VJFET is a unipolar device, it can easily be paralleled over the entire operating temperature range of the device. The SiC VJFET has a lower specific on resistance than the best Si IGBT and lacks the gate oxide problems of the SiC MOSFET. Because of the thermal properties of SiC and the lack of a gate oxide, they are capable of higher temperature operation than either device. The vertical channel structures provide for excellent packing density on the wafer and low per-unit production costs.

DTIC

JFET; Reliability; Silicon Carbides; Switches

20070036138 Aerospace Corp., El Segundo, CA USA

Stroboscopic Imaging Interferometer for MEMS Performance Measurement

Conway, J A; Osborn, J V; Fowler, J D; Jul 15, 2007; 21 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): FA8802-04-C-0001

Report No.(s): AD-A470710; ATR-2007(8555)-1; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470710>

The insertion of MEMS components into aerospace systems requires advanced testing to characterize performance in a space environment. Here we report a novel stroboscopic interferometer test system that measures nanometer-scale displacements of moving MEMS devices. By combining video imagery and phase-shift interferometry with an environmental chamber, rapid visualization of the dynamic device motion under the actual operational conditions can be measured. The utility of this system is further enhanced by integrating the interferometer onto the chamber window, allowing for robust interferometric testing in a noisy environment without requiring a floating optical table. To demonstrate these unique

capabilities, we present the time-resolved images of an electrostatically actuated MEMS cantilevered beam showing the first-through sixth-order plate modes under vacuum.

DTIC

Aerospace Systems; Imaging Techniques; Interferometers; Metrology; Microelectromechanical Systems

20070036141 Vanderbilt Univ., Nashville, TN USA

Enhancing the Interfacial and Dynamic Failure Behavior of Advanced Hybrid Structures Using Nanocomposite Materials

Xu, Luoyu R; Aug 8, 2007; 16 pp.; In English

Contract(s)/Grant(s): N00014-03-1-0505

Report No.(s): AD-A470720; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470720>

A novel interfacial joint was developed for reducing the interfacial stress levels. The proposed design, inspired by the shape and mechanics of trees, effectively removed the stress singularity at the interfacial joint for most engineering materials through an integrated theoretical and experimental investigation. Significant tensile loading capacity increase was obtained (up to 81%) using this new joint, while the material volume of the new joint actually was reduced. Dynamic tension experiments showed that the new convex joint yielded an increase in final failure strength (22%). This new joint can be employed to accurately evaluate the interfacial strength improvement of dissimilar material joints. Nanofiber-reinforced epoxy bonding with linker molecules was synthesized and tested for metal/metal and polymer/polymer joints. Mechanical properties including tension and shear bonding strengths showed very low increase or even decrease of nanocomposite bonding over that of pure epoxy bonding.

DTIC

Bonding; Dynamic Characteristics; Epoxy Matrix Composites; Failure; Hybrid Structures; Nanocomposites; Nanotechnology

20070036285 Harvard Univ., Cambridge, MA USA

Maskless Lithography Using Surface Plasmon Enhanced Illumination

Larson, Dale; Apr 30, 2007; 4 pp.; In English

Contract(s)/Grant(s): FA9550-04-1-0426

Report No.(s): AD-A470721; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The ability of surface plasmon enhanced illumination (SPEI) devices to use visible wavelengths to expose photoresist with subwavelength features has been demonstrated and a manuscript is being prepared for submission to PNAS. The SPEI devices consist of a regular array of nanometric features in a metal/dielectric laminate device that transmit light via extraordinary optical transmission (EOT) with a semicollimated beam of light. This beam of light is scanned across a photoresist coated wafer to expose the photoresist and create the desired pattern. In this project SPEI devices and probes were created, a nanoscale scanner was designed and fabricated, and photoresist was developed to determine the geometric properties of the beam of light emitted from these SPEI devices, and a system throughput study was prepared to assess the throughput of a SPEI system when incorporated into a stepper system. The fundamental feasibility of this approach has been demonstrated. Harvard's licensing office is currently in discussions with Zeiss to commercialize this technology for the semiconductor industry.

DTIC

Lithography; Plasmons

20070036293 North Carolina Univ., Charlotte, NC USA

Structural and Electrical-Optical Characterizations of Semiconductor-Atomic Superlattice

Tsu, Raphael; May 1, 2007; 18 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAAD19-02-1-0290

Report No.(s): AD-A470737; 2007.5 ARO-43318MS 551067 FINAL; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The following work was accomplished under this funding: (A) Semiconductor-Atomic Superlattice (SAS) consisting of Si-Si/O/Si-Si as a period. By repeating, a superlattice, SL is formed. Oxygen is introduced by gas adsorption, resembling mono-oxide rather than SiO₂ which cannot be epitaxial. This epi-system has a theoretical strain ~ 6%, which is not prohibitive. This SAS shows PL and EL ~2.3eV. Reverse current in I-V is reduced more than 2 orders of magnitude, may be used as an epitaxial gate for possible 3D ICs. (B) By defining a wave impedance or wave conductance the ratio of Poyting vector to

energy stored, similar to the definition of photons, for electron, $G = ge^2/h$, commonly known as fundamental conductance, where $g = 1,2,3...$ More remarkably, in 3D, we found that g is a tensor consisting of integers as well as fractions. (C) We consider N electrons confined inside a dielectric sphere, by minimizing the total interaction energy due to electron-electron term, polarization terms as well as self polarization term, we found that the E/N interaction energy per electron versus N consists of features identical to the periodic table of elements, while using Poisson equation instead of Schrodinger equation. More remarkably is the fact that Pauli's exclusion principle was never imposed.

DTIC

Atoms; Semiconductor Devices; Semiconductors (Materials); Superlattices

20070036413 Brown Univ., Providence, RI USA

Fabrication of Highly Ordered Anodic Aluminium Oxide Templates on Silicon Substrates

Yin, A; Tzolov, M; Cardimona, D; Guo, L; Xu, J; Jan 2007; 6 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): F29601-02-C-0214; Proj-4846

Report No.(s): AD-A470986; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The controlled fabrication of highly ordered anodic aluminium oxide (AAO) templates of unprecedented pore uniformity directly on Si, enabled by new advances on two fronts -- direct and timed anodisation of a high-purity Al film of unprecedented thickness (50 micrometres) on Si, and anodizing a thin but pre-textured Al film on Si, has been reported. To deposit high-quality and ultra-thick Al on a non-compliant substrate, a prerequisite for obtaining highly ordered pore arrays on Si by self-organisation while retaining a good adhesion, a specially designed process of e-beam evaporation followed by in situ annealing has been deployed. To obtain an AAO template with the same high degree of ordering and uniformity but from a thin Al film, which is not achievable by the self-organisation alone, pre-patterning of the thin Al surface by reactive ion etching using a free-standing AAO mask that was formed in a separate process was performed. The resultant AAO/Si template provides a good platform for integrated growth of nanotube, nanowire or nanodot arrays on Si. Template-assisted growth of carbon nanotubes (CNTs) directly on Si was demonstrated via a chemical vapour deposition method. By controllably removing the AAO barrier layer at the bottom of the pores and partially etching back the AAO top surface, new CNT/Si structures were obtained with potential applications in field emitter, sensors, oscillators and photodetectors.

DTIC

Aluminum Compounds; Aluminum Oxides; Anodes; Anodizing; Carbon Nanotubes; Evaporation; Fabrication; Metal Films; Silicon; Substrates; Templates

20070036445 Rensselaer Polytechnic Inst., Troy, NY USA

GaN Light-Emitting Triodes (LETs) for High-Efficiency Hole Injection and for Assessment of the Physical Origin of the Efficiency Droop

Schubert, E F; Kim, Jong K; Jul 6, 2007; 13 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAAD19-03-1-0161; J11384

Report No.(s): AD-A471030; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The light-emitting triode (LET) is a three-terminal p-n junction device that accelerates carriers in the lateral direction, i.e. parallel to the p-n junction plane, by means of an electric field between two anodes. The lateral field provides additional energy to carriers thereby allowing them to overcome barriers and increasing the carrier injection efficiency into the active region. Both the current between Anode 1 and the cathode, and the light-output power increase with increasing negative bias to the Anode 2. This is consistent with the expectation that a negative bias to the second anode allows carriers to acquire a high kinetic energy thereby enabling them to overcome the barrier for holes, resulting in high injection efficiency into the active region that lies beyond the barrier. In addition, we have proposed an innovative approach that allows us to investigate the relationship between the hole-injection efficiency and the efficiency droop by using the LET (the efficiency droop is the decrease in efficiency of III-V nitride pn-junction devices with increasing injection current). Our simulation reveals that the electron overflow into the p-type GaN cladding layer, caused by low hole-injection efficiency into the MQW active region, is the origin of the efficiency droop. Therefore, the LET, in which the hole-injection efficiency can be controlled by the bias to the second anode, can be an effective method to investigate the physical origin of the efficiency droop. We believe that our research has been highly successful because it has allowed us to analyze and identify the origin of the efficiency droop in III-V nitride pn junction devices. Since this is known to be a major problem, the resolution of this problem is a major step forward in the development of III-V emitter technology including UV emitter technology.

DTIC

Electroluminescence; Injection; Luminaires; Triodes

20070036447 Missile Defense Agency, Washington, DC USA

MDA/MP Radar and RF Insertion

Aug 23, 2005; 29 pp.; In English; Original contains color illustrations

Report No.(s): AD-A471033; No Copyright; Avail.: Defense Technical Information Center (DTIC)

MDA/MP Radar Program investing in a number of technologies and approaches: WBG high power amplifier producibility and reliability; advanced thermal management to support HPA insertion; new architectures for T/R modules/TRIMMS to Enhance Thermal Management/lower cost; active and passive heat extraction at TRIMM level; heat exchangers at the system level; composite materials to reduce antenna weight/enhance thermal; system engineering approach for HPA to Ultimate Heat Sink (air/sea).

DTIC

Antimissile Defense; Manufacturing; Radar; Radio Frequencies; Systems Engineering; Technology Transfer

20070036450 Georgia Inst. of Tech., Atlanta, GA USA

Feasibility of T/R Module Functionality in a Single SiGe IC

Cressler, John D; Comeau, Jonathan; Andrews, Joel; Kuo, Lance; Morton, Matt; Papapolymerou, John; Mitchell, Mark; Wallace, Tracy; Harris, Mike; Parks, Bob; Aug 2005; 25 pp.; In English; Original contains color illustrations

Report No.(s): AD-A471036; No Copyright; Avail.: Defense Technical Information Center (DTIC)

No abstract available

Germanium; Radar; Silicon

20070036452 Georgia Tech Research Inst., Atlanta, GA USA

SPEAR: Scalable Panels for Efficient, Affordable Radar

Mitchell, Mark; Wallace, Tracy; Wright, Darrell; McHarg, Jeffrey C; Coutts, Scott; Dalrymple, Thomas; Lesniak, Christopher; Parks, Bob; Wilson, Gisele; Jun 14, 2005; 20 pp.; In English; Original contains color illustrations

Report No.(s): AD-A471039; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Outline: Low Power Density Radar System Considerations; The SPEAR Program; Low Cost Panel Technologies; Summary.

DTIC

Antimissile Defense; Panels; Radar

20070036471 NASA Marshall Space Flight Center, Huntsville, AL, USA

Comparison of Measured Dark Current Distributions with Calculated Damage Energy Distributions in HgCdTe

Marshall, C. J.; Marshall, P. W.; Howe, C. L.; Reed, R. A.; Weller, R. A.; Mendenhall, M.; Waczynski, A.; Ladbury, R.; Jordan, T. M.; [2007]; 7 pp.; In English; To be published in the Transactions on Nuclear Science (TNS) Special Edition, Institute of Electrical and Electronic Engineers (IEEE), June 2007; Copyright; Avail.: CASI: [A02](#), Hardcopy

This paper presents a combined Monte Carlo and analytic approach to the calculation of the pixel-to-pixel distribution of proton-induced damage in a HgCdTe sensor array and compares the results to measured dark current distributions after damage by 63 MeV protons. The moments of the Coulombic, nuclear elastic and nuclear inelastic damage distributions were extracted from Monte Carlo simulations and combined to form a damage distribution using the analytic techniques first described in [1]. The calculations show that the high energy recoils from the nuclear inelastic reactions (calculated using the Monte Carlo code MCNPX [2]) produce a pronounced skewing of the damage energy distribution. While the nuclear elastic component (also calculated using the MCNPX) contributes only a small fraction of the total nonionizing damage energy, its inclusion in the shape of the damage across the array is significant. The Coulombic contribution was calculated using MRED [3-5], a Geant4 [4,6] application. The comparison with the dark current distribution strongly suggests that mechanisms which are not linearly correlated with nonionizing damage produced according to collision kinematics are responsible for the observed dark current increases. This has important implications for the process of predicting the on-orbit dark current response of the HgCdTe sensor array.

Author

Current Distribution; Energy Distribution; Mercury Cadmium Tellurides; Monte Carlo Method; Damage; Dark Current; Nuclear Reactions

20070036574 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Automated Hybridization of X-ray Absorber Elements-A Path to Large Format Microcalorimeter Arrays

Moseley, S.; Kelley, R.; Allen, C.; Kilbourne, C.; Costen, N.; Miller, T.; [2007]; 1 pp.; In English; 12th International Workshop on Low Temperature Detectors, 22-27 Jul. 2007, Paris, France; No Copyright; Avail.: Other Sources; Abstract Only

In the design of microcalorimeters, it is often desirable to produce the X-ray absorber separately from the detector element. In this case, the attachment of the absorber to the detector element with the required thermal and mechanical characteristics is a major challenge. In such arrays, the attachment has been done by hand. This process is not easily extended to the large format arrays required for future X-ray astronomy missions such as the New x-ray Telescope or NeXT. In this paper we present an automated process for attaching absorber tiles to the surface of a large-scale X-ray detector array. The absorbers are attached with stycast epoxy to a thermally isolating polymer structure made of SU-8. SU-8 is a negative epoxy based photo resist produced by Microchem. We describe the fabrication of the X-ray absorbers and their suspension on a handle die in an adhesive matrix. We describe the production process for the polymer isolators on the detector elements. We have developed a new process for the alignment, and simultaneous bonding of the absorber tiles to an entire detector array. This process uses equipment and techniques used in the flip-chip bonding industry and approaches developed in the fabrication of the XRS-2 instrument. XRS-2 was an X-ray spectrometer that was launched on the Suzaku telescope in July 10, 2005. We describe the process and show examples of sample arrays produced by this process. Arrays with up to 300 elements have been bonded. The present tests have used dummy absorbers made of Si. In future work, we will demonstrate bonding of HgTe absorbers.

Author

Automatic Control; X Ray Astronomy; Absorbers; Fabrication; Calorimeters; Arrays

20070036635 Chinese Inst. of Engineers, Taipei, Taiwan, Province of China

Journal of the Chinese Institute of Engineers, Volume 29, No. 7

Chen, Shi-Shuenn, Editor; Tsai, Hsien-Lung, Editor; Chern, Ming-Jyh, Editor; Lee, Liang-Sun, Editor; Young, Der-Liang, Editor; Pan, Ching-Tsai, Editor; Chen, Jean-Lien, Editor; Shieh, Ce-Kuen; Chao, Ching-Kong, Editor; Chang, Kai, Editor, et al.; Nov. 2006; ISSN 0253-3839; 132 pp.; In English; See also 20070036636 - 20070036644; Original contains black and white illustrations; Copyright; Avail.: Other Sources

The following topics are discussed: a) A Novel Algorithm for Node-Encircling and Link Candidate P-Cycles Design in WDM Mesh Network; b) A Survey on Localization Techniques for Wireless Networks; c) An Integrated Analysis for MC-CDMA System with Synchronization Errors over Fading Channels; d) Design of A Resource Advertisement and Discovery Protocol for Large and Dense Manets; e) Design of Non-Uniform Linear Phased Arrays Using Genetic Algorithms to Provide Maximum Interference Reduction Capability in a Wireless Communication System; f) Development of 60 GHz Front End Circuits for High Data Rate Communication System at Chalmers University; g) Low Complexity Adaptive Error Control for Receiver-Driven Layered Video Multicast; and h) Node Architectures for Aggregation of Traffic from Access Networks Stack Robust Fine Granularity Scalable Video Coding.

Derived from text

Microwave Circuits; Wireless Communication; Phased Arrays; Linear Arrays; Adaptive Control; Genetic Algorithms; Fading; Code Division Multiple Access

20070036636 Auburn Univ., AL, USA

A Survey on Localization Techniques for Wireless Networks

Pandey, Santosh; Agrawal, Prathima; Journal of the Chinese Institute of Engineers, Volume 29, No. 7; Nov. 2006, pp. 1125-1148; In English; See also [20070036635](#); Copyright; Avail.: Other Sources

Wireless networks have displaced the well established and widely deployed wired communication networks of the past. Tetherless access and new services offered to mobile users contribute to the popularity of these networks. Thus users have access from many locations and can roam ubiquitously. The knowledge of the physical location of mobile user devices, such as phones, laptops and PDAs, is important in several applications such as network planning, location based services, law enforcement and for improving network performance. A device s location is usually estimated by monitoring a distance dependent parameter such as wireless signal strength from a base station whose location is known. In practical deployments, signal strength varies with time and its relationship to distance is not well defined. This makes location estimation difficult. Many location estimation or localization schemes have been proposed for networks adopting a variety of wireless technologies. This paper reviews a broad class of localization schemes that are differentiated by the fundamental techniques adopted for distance estimation, indoor vs. outdoor environments, relative cost and accuracy of the resulting estimates and ease

of deployment. The paper exposes many challenges that remain and elaborates on several future research problems that need to be solved.

Author

Wireless Communication; Surveys; Estimating; Deployment; Communication Networks

20070036637 Chung Cheng Inst. of Tech., Taiwan, Province of China

An Integrated Analysis for MC-CDMA System with Synchronization Errors over Fading Channels

Chang, Chung-Liang; Huang, Ping S.; Tu, Te-Ming; Journal of the Chinese Institute of Engineers, Volume 29, No. 7; Nov. 2006, pp. 1185-1193; In English; See also [20070036635](#); Copyright; Avail.: Other Sources

Synchronization errors and fading channels are individually considered in many previous studies. This study derives the average bit error rate (BER) of the uplink and downlink MC-CDMA systems using equal gain combining (EGC) with synchronization errors over the fading channels. The obtained average BER of the uplink and downlink MC-CDMA systems simultaneously considers most of the synchronization errors and the parameters of the fading channel. Since it is difficult to acquire the closed-form of average BER, the Chernoff bound is adopted to derive the upper bound of the average BER instead. Computer simulation results show that the performance of the uplink and downlink MC-CDMA systems are degraded by the fading channel and synchronization errors such as frequency offset, carrier phase jitter and timing jitter. This fully corresponds to theoretical derivations. Also, by comparing the uplink to the downlink systems, we conclude that the average BER of the downlink MC-CDMA system degrades faster due to the increasing value of synchronization errors.

Author

Code Division Multiple Access; Synchronism; Channels (Data Transmission); Systems Engineering; Bit Error Rate; Signal Fading

20070036638 National Taiwan Univ. of Science and Technology, Taipei, Taiwan, Province of China

Design of A Resource Advertisement and Discovery Protocol for Large and Dense Manets

Wang, Shun-Te; Wu, Jean-Lien C.; Hsu, Chun-Yen; Journal of the Chinese Institute of Engineers, Volume 29, No. 7; Nov. 2006, pp. 1161-1171; In English; See also [20070036635](#)

Contract(s)/Grant(s): NSC94-2213-E-011-009; Copyright; Avail.: Other Sources

With remarkable advances in wireless technologies, applications of mobile ad hoc networks will be in widespread use in the near future. Thus, the geographical network environments may become large and dense. In such network environments, a large number of resource discovery queries may be generated when specific resources or services are needed. In order to effectively utilize the limited bandwidth of the networks, and reduce power used by mobile devices, the design for resource discovery protocols should take both the operational cost and the network performance into account. Moreover, the results of resource discoveries may further be used in later route discovery processes of certain ad hoc routing protocols. In this paper we propose a simple resource advertisement and discovery (SRAD) protocol for mobile ad hoc networks. The SRAD protocol self-organizes a proximity network and works in a fully distributed architecture without centralized control or management to prevent performance bottleneck. In addition, a resource description and management scheme is also devised to share loads among mobile nodes. The simulation results show that the SRAD protocol can achieve the same level of performance as in broadcast-based protocols while generating fewer transmitted messages in large and dense mobile ad hoc networks.

Author

Protocol (Computers); Computer Networks; Mobile Communication Systems; Nodes (Standing Waves)

20070036639 Chalmers Univ. of Technology, Goeteborg, Sweden

Development of 60 GHz Front End Circuits for High Data Rate Communication System at Chalmers University

Zirath, Herbert; Masuda, Toru; Ferndahl, Mattias; Kozhuharov, Rumen; Gunnarsson, Sten E.; Karnfelt, Camilla; Alping, Arne; Journal of the Chinese Institute of Engineers, Volume 29, No. 7; Nov. 2006, pp. 1173-1183; In English; See also [20070036635](#); Copyright; Avail.: Other Sources

Front-end circuits such as mixers, amplifiers, frequency multipliers, IF-amplifiers with gain-control, and VCOs are presented. Promising results on VCOs based on a coupled Colpitt VCO topology, designed in both HEMT and HBT technologies, have been achieved. A novel balanced 7 - 28 GHz MMIC frequency quadrupler is described and compared with a single ended quadrupler at the same input frequencies. A 3-stage MHEMT wideband amplifier covering 43-64 GHz with a gain of 24 dB, a minimum noise figure of 2.5 dB and ripple of 2 dB is also described. In order to reduce the manufacturing cost for future 60 GHz products, a higher integration level is necessary. Recently, a multifunctional receiver/transmitter

utilizing 60 GHz amplifier, frequency converter, and x8 frequency multiplier was demonstrated based on a commercial pHEMT-process.

Author

Frequency Multipliers; Integrated Circuits; High Electron Mobility Transistors; Voltage Controlled Oscillators; Frequency Converters; Bipolar Transistors; Broadband

20070036640 Tamaulipas Univ., Tamulipas, Mexico

Design of Non-Uniform Linear Phased Arrays Using Genetic Algorithms to Provide Maximum Interference Reduction Capability in a Wireless Communication System

Panduro, M. A.; Journal of the Chinese Institute of Engineers, Volume 29, No. 7; Nov. 2006, pp. 1195-1201; In English; See also [20070036635](#)

Contract(s)/Grant(s): J50839-Y; Copyright; Avail.: Other Sources

This paper deals with the interference reduction capability of non-uniform antenna arrays with linear geometry at the base station of a cellular system. The well-known method of genetic algorithms is used to determine the optimal non-uniform array geometry between antenna elements in order to provide maximum interference reduction. The performance criterion for interference reduction employed in this paper is the interference suppression coefficient. Simulation results using different numbers of antenna elements for nonuniform linear arrays are provided. Simulation results show that the optimization of the array provides better interference reduction capability with respect to the uniform separation case.

Author

Linear Arrays; Phased Arrays; Design Analysis; Antenna Arrays; Genetic Algorithms; Wireless Communication; Nonuniformity

20070036641 National Chiao Tung Univ., Hsinchu, Taiwan, Province of China

Stack Robust Fine Granularity Scalable Video Coding

Huang, Hsiang-Chun; Chiang, Tihao; Journal of the Chinese Institute of Engineers, Volume 29, No. 7; Nov. 2006, pp. 1203-1214; In English; See also [20070036635](#); Copyright; Avail.: Other Sources

A novel scalable video coding technique, namely Stack Robust Fine Granularity Scalability (SRFGS), is presented to provide both temporal and SNR scalability. The SRFGS first simplifies the temporal prediction architecture of RFGS. The approach is further generalized using a reconstructed frame from the previous time instance of the same layer to temporally predict the quantization error of the lower layer. With this concept, the RFGS architecture can be extended to multi-layer stack architecture. The SRFGS can be optimized at several operating points to meet the requirements of various applications, while maintaining the fine granularity and error robustness of RFGS. An optimized macroblock-based alpha adaptation scheme is proposed to improve the coding efficiency. A single-loop enhancement layer decoding scheme is proposed to reduce the decoder complexity. The simulation results show that SRFGS can improve the performance of RFGS by 0.4 to 3.0 dB in PSNR. SRFGS has been reviewed by the MPEG committee and ranked as one of the best algorithms according to subjective testing in the Report on Call for Evidence on Scalable Video Coding.

Author

Decoding; Robustness (Mathematics); Algorithms; Decoders; Coding

20070036642 University of Electronics Science and Technology of China, Chengdu, China

A Novel Algorithm for Node-Encircling and Link Candidate P-Cycles Design in WDM Mesh Network

Zhao, Taifei; Yu, Hongfang; Li, Leming; Journal of the Chinese Institute of Engineers, Volume 29, No. 7; Nov. 2006, pp. 1227-1233; In English; See also [20070036635](#)

Contract(s)/Grant(s): NNSFC-60302010; Copyright; Avail.: Other Sources

A Fault recovery system that is fast and reliable is essential in survivability design in wavelength-division-multiplexing (WDM) mesh networks. The Pre-configuration Cycle (p-cycle) is a promising approach for protecting working capacities in optical mesh networks. Finding good candidate cycles is the first and a very important step in p-cycle design. We first introduce the definition of the local-map and several algorithms for finding cycles. A novel heuristic algorithm, called Local-map Cycles Mining Algorithm (LCMA), for finding simple node-encircling and link candidate p-cycles based on the local-map is proposed in this paper. We perform the expanding algorithms on the cycle generated by LCMA to get more efficient candidate p-cycles. Comparisons are made between this algorithm and the Depth First Search (DFS) algorithm and the result shows that the

LCMA can find more candidate p-cycles with good efficiency in optical mesh networks without enumerating all cycles.

Author

Wavelength Division Multiplexing; Heuristic Methods; Algorithms; Cycles

20070036643 Ching Yun Univ., Chung-Li, Taiwan, Province of China

Low Complexity Adaptive Error Control for Receiver-Driven Layered Video Multicast

Ou, Chien-Min; Hwang, Wen-Jyi; Lo, Tsung-Yen; Wei, Hui-Hsien; Journal of the Chinese Institute of Engineers, Volume 29, No. 7; Nov. 2006, pp. 1215-1226; In English; See also [20070036635](#); Copyright; Avail.: Other Sources

A novel error control algorithm for robust video transmission is presented in this paper. In the algorithm, both the source packets and parity packets are delivered in layers. Each receiver, in accordance with its available bandwidth and packet loss rate employs the optimal policy for subscribing source layers and parity layers minimizing the average distortion of the reconstructed frames. The algorithm is able to perform fast policy adaptation for location- and time-varying network environments. The implementation of the fast adaptive algorithm is based on a novel table look-up process, in which the tables are constructed using a dynamic programming technique. Our experiments show that the algorithm is an effective alternative for video broadcast applications where the robust transmissions over the heterogeneous network environment are desired.

Author

Adaptive Control; Errors; Broadcasting; Dynamic Programming; Receivers; Bandwidth; Algorithms

20070036644 Create-Net, Trento, Italy

Node Architectures for Aggregation of Traffic from Access Networks

Ye, Yabin; Woesner, Hagen; Chlamtac, Imrich; Journal of the Chinese Institute of Engineers, Volume 29, No. 7; Nov. 2006, pp. 1149-1160; In English; See also [20070036635](#); Copyright; Avail.: Other Sources

This article surveys and classifies recent prototypes of node architectures for dynamic traffic aggregation in all-optical access-core networks. These networks act as backbones for optical line terminators (OLT) or electronic switches that serve optical access networks. For reasons of economy they are typically constructed as unidirectional rings or busses. Well-known optical time and wavelength division networks and hybrid versions following the photonic slot routing principle are introduced and compared. All of the architectures shown here perform some kind of carrier sensing to avoid collisions in a de-centralized way. We give approximations of the expectable gain of dynamic channel sharing over static assignment and the tuning time penalty. Technological limitations and cost driving factors are analyzed with respect to a low-cost implementation of a dynamic traffic aggregation.

Author

Switching Circuits; Detection; Surveys; Traffic

20070036656 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

A Hardware Platform for Tuning of MEMS Devices Using Closed-Loop Frequency Response

Ferguson, Michael I.; MacDonald, Eric; Foor, David; March 5, 2005; 6 pp.; In English; IEEE Aerospace Conference, 6-13 Mar. 2004, Big Sky, MT, USA; Original contains black and white illustrations; Copyright; Avail.: Other Sources

ONLINE: <http://hdl.handle.net/2014/40511>

We report on the development of a hardware platform for integrated tuning and closed-loop operation of MEMS gyroscopes. The platform was developed and tested for the second generation JPL/Boeing Post-Resonator MEMS gyroscope. The control of this device is implemented through a digital design on a Field Programmable Gate Array (FPGA). A software interface allows the user to configure, calibrate, and tune the bias voltages on the micro-gyro. The interface easily transitions to an embedded solution that allows for the miniaturization of the system to a single chip.

Author

Microelectromechanical Systems; Frequency Response; Field-Programmable Gate Arrays; Calibrating; Tuning; Feedback Control; Electric Potential

20070036722 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

Thermoelectric Energy Conversion: Future Directions and Technology Development Needs

Fleurial, Jean-Pierre; March 11, 2007; 17 pp.; In English; Indo-US Workshop on Emerging Trends in Energy Technology, 11-16 Mar. 2007, New Delhi, India; Original contains color and black and white illustrations; Copyright; Avail.: Other Sources

ONLINE: <http://hdl.handle.net/2014/40347>

This viewgraph presentation reviews the process of thermoelectric energy conversion along with key technology needs

and challenges. The topics include: 1) The Case for Thermoelectrics; 2) Advances in Thermoelectrics: Investment Needed; 3) Current U.S. Investment (FY07); 4) Increasing Thermoelectric Materials Conversion Efficiency Key Science Needs and Challenges; 5) Developing Advanced TE Components & Systems Key Technology Needs and Challenges; 6) Thermoelectrics; 7) 200W Class Lightweight Portable Thermoelectric Generator; 8) Hybrid Absorption Cooling/TE Power Cogeneration System; 9) Major Opportunities in Energy Industry; 10) Automobile Waste Heat Recovery; 11) Thermoelectrics at JPL; 12) Recent Advances at JPL in Thermoelectric Converter Component Technologies; 13) Thermoelectrics Background on Power Generation and Cooling Operational Modes; 14) Thermoelectric Power Generation; and 15) Thermoelectric Cooling.

Derived from text

Energy Conversion; Thermoelectricity; Technology Utilization; Thermoelectric Power Generation; Thermoelectric Materials

20070036790 American Inst. of Aeronautics and Astronautics, Reston, VA, USA

Lab-on-a-Chip Finds Jobs for Mr. Clean

Flinn, Edward D.; Aerospace America; August 2007; ISSN 0740-722X; Volume 45, No. 8, pp. 34-35; In English; Original contains black and white illustrations; Copyright; Avail.: Other Sources

The discovery of a large globule of dirty, microbe invested water on board the Russian Space Station Mir points out the difficulty of keeping a spacecraft used by humans as clean as required for safe operation. In spite of regular cleaning of surfaces on the Mir, the microorganisms found conditions right to grow. The presence of microbes in spacecraft can pose problems for not only human health, but can also endanger the spacecraft. In order to determine the nature of the microorganisms found on the space station Marshall Space Flight Center is developing the Lab-on-a-Chip Application Development--Portable Test System (LOCAD-PTS), a handheld device that can detect the presence of bacteria or fungi on the surfaces of a spacecraft within minutes.

CASI

Microfluidic Devices; Microorganisms; Microelectromechanical Systems; Detection

34

FLUID MECHANICS AND THERMODYNAMICS

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

20070035073 NASA Glenn Research Center, Cleveland, OH, USA

Pyrolysis of Large Black Liquor Droplets

Bartkus, Tadas P.; Dietrich, Daniel L.; T'ien, James S.; Wessel, Richard A.; October 2007; 25 pp.; In English
Contract(s)/Grant(s): WBS 567524.04.02.03

Report No.(s): NASA/TM-2007-214945; E-15949-1; Copyright; Avail.: CASI: **A03**, Hardcopy

This paper presents the results of experiments involving the pyrolysis of large black liquor droplets in the NASA KC-135 reduced gravity aircraft. The reduced gravity environment facilitated the study of droplets up to 9 mm in diameter extending the results of previous studies to droplet sizes that are similar to those encountered in recovery boilers. Single black liquor droplets were rapidly inserted into a 923 K oven. The primary independent variables were the initial droplet diameter (0.5 mm to 9 mm), the black liquor solids content (66.12% - 72.9% by mass), and the ambient oxygen mole fraction (0.0 - 0.21). Video records of the experiments provided size and shape of the droplets as a function of time. The results show that the particle diameter at the end of the drying stage ($D_{\text{sub DRY}}$) increases linearly with the initial particle diameter ($D_{\text{sub O}}$). The results further show that the ratio of the maximum swollen diameter ($D_{\text{sub MAX}}$) to $D_{\text{sub O}}$ decreases with increasing $D_{\text{sub O}}$ for droplets with $D_{\text{sub O}}$ less than 4 mm. This ratio was independent of $D_{\text{sub O}}$ for droplets with $D_{\text{sub O}}$ greater than 4 mm. The particle is most spherical at the end of drying, and least spherical at maximum swollen size, regardless of initial sphericity and droplet size.

Author

C-135 Aircraft; Drops (Liquids); Pyrolysis; Microgravity; Combustion

20070035225 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

Efficiency and Pressure Loss Characteristics of an Ultra-Compact Combustor with Bulk Swirl

Radtke, James T; Jun 2007; 145 pp.; In English; Original contains color illustrations

Report No.(s): AD-A470159; AFIT/GAE/ENY/07-J18; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470159>

Research was conducted on a novel combustor design using a highly centrifugal loaded circumferential cavity to enhance

flame speeds and lower mixing time to lower overall combustion time achieving improved efficiency and stability. This Ultra-Compact Combustor (UCC) is fed air with a bulk swirl, resembling gas leaving a compressor without the final set of compressor guide vanes to straighten the flow, at higher than normal Mach numbers for a combustor. The larger Mach numbers in the combustor do not cause a total pressure loss in excess of what Rayleigh theory would dictate for the given heat addition taking place within the combustor. Tests were conducted on the UCC with a clockwise or counter-clockwise swirl direction in the circumferential cavity using JP-8 and natural gas derived Fischer-Tropsch synthetic jet fuel with each direction. The results for lean blow out stability, combustion efficiency, and emissions proved that the best configuration uses counterclockwise swirl. The two fuels performed equally with no noticeable differences between JP-8 and the synthetic Fischer-Tropsch fuel.

DTIC

Combustion; Combustion Chambers; Losses

20070035246 Naval Research Lab., Bay Saint Louis, MS USA

Tropical Wave-Induced Oceanic Eddies at Cabo Corrientes and the Maria Islands, Mexico

Zamudio, Luis; Hurlburt, Harley E; Metzger, E J; Tilburg, Charles E; May 30, 2007; 18 pp.; In English; Original contains color illustrations

Report No.(s): AD-A470198; NRL/JA/7304-04-1; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470198>

[1] TOPEX/Poseidon and ERS-2 satellite altimeter observations and the 1/16 degree Naval Research Laboratory (NRL) Layered Ocean Model (NLOM) show the existence of anticyclonic eddies in the Cabo Corrientes - Maria Islands region off the Mexican West Coast. Analysis of the results demonstrates that: (1) The Cabo Corrientes - Maria Islands region is characterized by mean poleward coastal currents, driven by local wind forcing. (2) The local currents are intensified by the arrival of baroclinic down welling coastally trapped waves (CTWs), generated in the equatorial Pacific. (3) Anticyclonic eddies are generated as the intensified local currents pass cape-like features in the coastline or shelf-break geometry. (4) From 1979 to 2001 the CTWs generated an average of 2.35 (2.5) Cabo Corrientes (Maria Islands) anticyclonic eddies per year. (5) The formation of eddies carries interannually, increasing (decreasing) during El Nino (La Nina) years. Comparison of a variety of numerical simulations, which include different dynamics and/or different wind forcing and/or different topographic effects, suggests that bottom topography, local wind, and baroclinic instabilities are not essential for the eddy generation. It is (a) the capes at Cabo Corrientes and the Maria Islands and (b) the strong transient events associated with the CTWs that are essential to the formation of these newly recognized eddies

DTIC

Islands; Ocean Surface; Tropical Regions; Vortices; Water Waves

20070035283 Naval Surface Warfare Center, Bethesda, MD USA

Characterization of the Bubble Flow and Transom Wave of the R/V Athena I

Fu, Thomas; Karion, Anna; Fullerton, Anne; Rice, James; Walker, Don; May 2007; 24 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): N00014-06-W-X20449

Report No.(s): AD-A470268; NSWCCD-50-TR-2007-049; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470268>

The bubble flow and transom wave associated with the naval research vessel Athena I was characterized during a field experiment conducted in June 2005 by several research groups. The bubbly flow around the passing ship was documented by stationary divers using underwater cameras. The free surface behind the ship was characterized in the near field using Quantitative Visualization, a laser-imaging technique developed and used by the Naval Surface Warfare Center, Carderock Division. The far-field transom wave was quantified using LIDAR instrumentation operated by the Scripps Institution of Oceanography. Results from the near and far-field measurements in the stern, along with images of from underwater video, are given in the report. The overall objective of the current experiment was to obtain full scale qualitative and quantitative breaking wave field data of the naval combatant surface ship for use in CFD code development and validation.

DTIC

Bubbles; Computational Fluid Dynamics; Flow Visualization; Liquid-Gas Mixtures; Two Phase Flow

20070035453 Naval Surface Warfare Center, Bethesda, MD USA

Velocity Measurements Through the Pump of the X-Craft Tow Tank Model 5612

Chesnakas, Christopher J; May 2007; 38 pp.; In English; Original contains color illustrations

Report No.(s): AD-A470270; NSWCCD-50-TR-2007-009; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Flow through the pumps on a 1/15th scale model of the X-Craft, Model 5612, was measured. An external, strut-mounted, three-component LDV system was used to measure the flow ahead of the pump inlet, and an internal, three-component LDV system was used to measure the flow ahead of the rotor and inside the nozzle of the waterjet. These tests revealed the flow structure within the pump, and allowed the calculation of terms required for an analysis of the pump performance. The pump was tested at two underway speeds corresponding to 25 and 40 knots full scale and at two bollard conditions.

DTIC

Marine Propulsion; Velocity Measurement

20070035463 Minnesota Univ., Minneapolis, MN USA

Code Validation Studies of High-Enthalpy Flows

Candler, Graham V; Nompelis, Ioannis; Dec 2006; 69 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): FA9550-04-1-0114

Report No.(s): AD-A470282; No Copyright; Avail.: Defense Technical Information Center (DTIC)

During the past three years, we have worked to develop and analyze a high-enthalpy flow dataset for CFD code validation. In collaboration with CUBRC Inc. personnel, we designed the experimental conditions for the double-cone geometry used in previous low-enthalpy nitrogen tests. We then used our standard CFD codes and thermo-chemical models to analyze these flows. In general, the comparisons with nitrogen flows are good, even at high enthalpy (10MJ/kg). But the comparisons between predictions and experiments for air above 5MJ/kg is poor. We find that as the enthalpy increases, the agreement gets worse. In particular, the CFD predicts that the separation zone decreases in size much more rapidly than given in the experiments.

DTIC

Computational Fluid Dynamics; Enthalpy; Hypersonic Flow

20070035844 Colorado Univ., Boulder, CO USA

Molecular Rotors

Price, John; Hersam, Mark; Michl, Josef; Ratner, Mark; Rogers, Charles; Oct 31, 2006; 65 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAAD19-01-1-0521

Report No.(s): AD-B329016; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Most mechanical machines contain rotating parts and it is likely that the nanomachines of the future will be no exception. We proposed to find out how rotors 1-2 nm in size can be synthesized and attached to surfaces, and what their fundamental properties are. We studied their equilibrium behavior and driven response, the effects of rotational barriers and friction, and mutual and environmental interactions with potential future applications in mind in areas as diverse as molecular transistors, extremely compact microwave signal processing components, and micro-fluidic devices. The project involved the preparation, surface mounting, and characterization of single molecular rotors with both vertical and horizontal shafts, and both with and without large dipole moments. Our basic device is a surface mounted molecular dipolar rotor that has a base or bases that attach covalently to a flat insulating surface and support an axle oriented either perpendicularly to the surface by a single base, which in turn support a balanced 1 2 nm diameter rotor portion with a large in-plane electric dipole moment or support an axle oriented parallel to the surface by two bases and a similar rotor. The bearing consists of a single covalent bond, a fundamental element of molecular-scale mechanics.

DTIC

Rotors; Shafts (Machine Elements); Microwave Equipment; Friction

20070035855 Saint Martin's Coll., Lacey, WA, USA; NASA Dryden Flight Research Center, Edwards, CA, USA

Effect of Insertion of a Heat Flux Gage into a High Temperature Cylindrical Blackbody Cavity on the Gage

Abdelmessih, Amanie N.; Horn, Thomas J.; November 11, 2007; 9 pp.; In English; 2007 ASME International Mechanical Engineering Congress and Exposition, 11-15 Nov. 2007, Seattle, WA, USA; Original contains color and black and white illustrations

Report No.(s): IMECE2007-42255; Copyright; Avail.: Other Sources

Detailed transient thermal models have been developed to simulate a heat flux gage calibration process capable of

generating high heat flux levels. These heat flux levels are of interest to the reciprocating and gas turbine engine industries as well as the aerospace industry. The transient models are based on existing, experimentally validated steady state models of a cylindrical blackbody calibration system. The steady state models were modified to include insertion of a heat flux gage into the hot zone of the calibration system, time-varying electrical current that passes through the resistance heated blackbody, and the resulting heating of the heat flux gage. Heat fluxes computed using detailed transient models were compared to experimental measurements. The calculated and measured transient heat fluxes agreed to within 2 percent, indicating that the models had captured the physical phenomena in the transient calibration. The predicted and measured transient heat fluxes were also compared for two different blackbody configurations. The effect of convection on the blackbody extension was evaluated and found to be a minor factor.

Author

Heat Flux; Measuring Instruments; Calibrating; Gas Turbine Engines; Temperature Distribution; High Temperature

20070036295 California Inst. of Tech., Pasadena, CA USA

Turbulent Mixing and Combustion for High-Speed Air-Breathing Propulsion Application

Dimotakis, Paul E; Aug 12, 2007; 126 pp.; In English

Contract(s)/Grant(s): FA9550-04-1-0020; Proj-2308

Report No.(s): AD-A470739; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Work was completed on mixing, chemical-reaction, and combustion processes in turbulent, subsonic, and supersonic flows. Research included high-speed internal flows of interest to scramjet mixing and combustion, aimed at flow-control and flame holding issues. The control authority and mixing in subsonic and transonic flows affected by mass injection and heat release was quantified. In parallel, Large Eddy Simulation (LES) with Sub-Grid Scale (SGS) modeling of these flows was conducted with codes verified against predictions of Linear Stability Analysis (LSA) theory. Research on hydrocarbon combustion was conducted on premixed methane-air, ethane-air, and (diluted) ethylene-air flames. Detailed measurements of flame extinction strain-rate and flame speed were obtained at different compositions at atmospheric pressure. Direct Numerical Simulations (DNS) of axisymmetric unsteady flows in both cold and chemically reacting impinging jets with full chemistry were also performed. Experimental investigations of the three-dimensional full-field structure of scalar dispersion fields in grid turbulence were initiated.

DTIC

Air Breathing Engines; Combustion; Computational Fluid Dynamics; High Speed; Turbulent Mixing

20070036334 Howard Univ., Washington, DC USA

Computational Study of Inlet Active Flow Control

Smith, Sonya T; Scribber, Angela; Goettke, Matthew; May 2007; 11 pp.; In English

Contract(s)/Grant(s): F33615-03-D-3307-0005; Proj-A0A2

Report No.(s): AD-A470860; No Copyright; Avail.: Defense Technical Information Center (DTIC)

A study was performed using the Air Vehicles Unstructured Solver (AVUS) to solve internal flow fields for diffusing S-ducts with separated flow. The study examined various boundary conditions, inflow, outflow and initial conditions, and grid sizes. The effort struggled to find an overall setup that agreed well with previously published results on the chosen geometry. In the end, it was discovered that several key issues were the cause. These issues included lack of a refined, structured, boundary layer grid region; high CFL numbers; and improper boundary conditions. The case was re-run with more appropriate conditions and a grid better suited to capture the boundary layer impact. The key issues encountered are documented here as well as the setup for the successful test case. This study demonstrated the criticality of proper boundary conditions, the benefit of initializing the flow field, and the importance of understanding critical solution health parameters such as y^+ . Additionally, the importance of a well constructed grid has been demonstrated. This is of particular importance for solutions that involve or may potentially involve separated boundary layers. Other parameters that may prove crucial are CFL number and sweeps per iteration.

DTIC

Active Control; Computational Fluid Dynamics; Flow; Flow Distribution; Inlet Flow

20070036665 NASA Marshall Space Flight Center, Huntsville, AL, USA

TFAWS: Ares Thermal Overview

Sharp, John R.; September 13, 2007; 20 pp.; In English; Thermal/Fluids Analysis Workshop (TFAWS), 10-14 Sep. 2007, Cleveland, OH, USA; Original contains color illustrations; No Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: <http://hdl.handle.net/2060/20070036665>

As part of a Constellation session at the 2007 Thermal & Fluids Analysis Workshop (TFAWS), an overview of the Crew

Launch Vehicle (CLV), Crew Exploration Vehicle (CEV) and Lunar Lander systems will be given. This presentation provides a general description of the CLV (also known as Ares-I) and Ares-V vehicles portion of the session. The presentation will provide an overview of the thermal requirements, design environments, challenges and thermal modeling examples.

Author

Ares 5 Cargo Launch Vehicle; Spacecrews; Thermal Analysis; Thermal Environments

20070036728 NASA Marshall Space Flight Center, Huntsville, AL, USA

Modeling of Compressible Flow with Friction and Heat Transfer Using the Generalized Fluid System Simulation Program (GFSSP)

Bandyopadhyay, Alak; Majumdar, Alok; August 10, 2007; 14 pp.; In English; Thermal Fluid Analysis Workshop (TSAWS), 10-14 Sep. 2007, Cleveland, OH, USA; Original contains color and black and white illustrations; Copyright; Avail.:

CASI: [A03](#), Hardcopy

The present paper describes the verification and validation of a quasi one-dimensional pressure based finite volume algorithm, implemented in Generalized Fluid System Simulation Program (GFSSP), for predicting compressible flow with friction, heat transfer and area change. The numerical predictions were compared with two classical solutions of compressible flow, i.e. Fanno and Rayleigh flow. Fanno flow provides an analytical solution of compressible flow in a long slender pipe where incoming subsonic flow can be choked due to friction. On the other hand, Rayleigh flow provides analytical solution of frictionless compressible flow with heat transfer where incoming subsonic flow can be choked at the outlet boundary with heat addition to the control volume. Nonuniform grid distribution improves the accuracy of numerical prediction. A benchmark numerical solution of compressible flow in a converging-diverging nozzle with friction and heat transfer has been developed to verify GFSSP's numerical predictions. The numerical predictions compare favorably in all cases.

Author

Computational Fluid Dynamics; Compressible Flow; Heat Transfer; Subsonic Flow; Convergent-Divergent Nozzles; Friction

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INSTRUMENTATION AND PHOTOGRAPHY

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

20070035259 Woods Hole Oceanographic Inst., MA USA

Adaptive Sampling in Autonomous Marine Sensor Networks

Eickstedt, Donald P; Jun 2006; 215 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): N00014-97-1-0202; N00014-05-G-0106

Report No.(s): AD-A470223; MIT/WHOI-2006-10; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470223>

In this thesis, an innovative architecture for real-time adaptive and cooperative control of autonomous sensor platforms in a marine sensor network is described in the context of the autonomous oceanographic network scenario. This architecture has three major components, an intelligent, logical sensor that provides high-level environmental state information to a behavior-based autonomous vehicle control system, a new approach to behavior-based control of autonomous vehicles using multiple objective functions that allows reactive control in complex environments with multiple constraints, and an approach to cooperative robotics that is a hybrid between the swarm cooperation and intentional cooperation approaches. The mobility of the sensor platforms is a key advantage of this strategy, allowing dynamic optimization of the sensor locations with respect to the classification or localization of a process of interest including processes which can be time varying, not spatially isotropic and for which action is required in real-time.

DTIC

Adaptation; Autonomy; Networks; Sampling

20070035478 Department of the Navy, Washington, DC USA

Signal Processing Fault Detection System

Hughes, Derke R, Inventor; Jul 13, 2007; 28 pp.; In English; Original contains color illustrations

Report No.(s): AD-A470302; No Copyright; Avail.: Other Sources

A fault detection system designed to evaluate the structural integrity of a material employs an array of sensors disposed

over the material being evaluated. The sensors detect vibrations in the material and the sensor signals are fed to a data processor. The processor employs a method to analyze the linear and nonlinear characteristics of the sensor signals and then determines whether to proceed with a linear signal processing analysis or a nonlinear signal processing analysis of the sensor signals. Once the analysis is completed, the results are compared to baseline results to determine what if any divergence exists between the results and the baseline results. A significant divergence indicates a potential material failure. The fault detection system will indicate such a potential failure through a visual alarm on a graphical user interface.

DTIC

Detection; Fault Detection; Patent Applications; Signal Processing

20070035535 Naval Research Lab., Bay Saint Louis, MS USA

Euphotic Zone Depth: Its Derivation and Implication to Ocean-Color Remote Sensing

Lee, ZhongPing; Weidemann, Alan; Kindle, John; Amone, Robert; Carder, Kendall L; Davis, Curtiss; Mar 16, 2007; 12 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): N00014-02-1-0211

Report No.(s): AD-A470399; NRL/JA/7330-06-6258; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Euphotic zone depth, Z1%, reflects the depth where photosynthetic available radiation (PAR) is 1% of its surface value. The value Of Z1% is a measure of water clarity, which is an important parameter regarding ecosystems. Based on the Case-1 water assumption, Z1% can be estimated empirically from the remotely derived concentration of chlorophyll-a ([Chl]), commonly retrieved by employing band ratios of remote sensing reflectance (Rrs). Recently, a model based on water's inherent optical properties (IOPs) has been developed to describe the vertical attenuation of visible solar radiation. Since IOPs can be near-analytically calculated from Rrs, so too can Z1%. In this study, for measurements made over three different regions and at different seasons (Z1% were in a range of 4.3-82.0 m with [Chl] ranging from 0.07 to 49.4 mg/m³), Z1% calculated from Rrs was compared with Z1% from in situ measured PAR profiles. It is found that the Z1% values calculated via Rrs-derived IOPs are, on average, within 14% of the measured values, and similar results were obtained for depths of 10% and 50% of surface PAR. in comparison, however, the error was 33% when Z1% is calculated via Rrs-derived [Chl]. Further, the importance of deriving euphotic zone depth from satellite ocean-color remote sensing is discussed.

DTIC

Marine Environments; Optical Properties; Photosynthesis; Regions; Remote Sensing; Remote Sensors; Water Color

20070035748 NASA Goddard Space Flight Center, Greenbelt, MD, USA

The EBIT Calorimeter Spectrometer: A New, Permanent User Facility at the LLNL EBIT

Porter, S.; [2007]; 1 pp.; In English; 12th International Workshop on Low Temperature Detectors, 21-28 Jul. 2007, Paris, France; No Copyright; Avail.: Other Sources; Abstract Only

The EBIT Calorimeter Spectrometer (ECS) has recently been completed and is currently being installed at the EBIT facility at the Lawrence Livermore National Laboratory. The ECS will replace the smaller XRS/EBIT spectrometer that has been in almost continuous operation since 2000. The XRS/EBIT was based on a spare laboratory cryostat and an engineering model detector system from the Suzaku/XRS observatory. The new ECS spectrometer was built from the ground up to be a low maintenance, high performance microcalorimeter spectrometer with 4 eV resolution at 6 keV, 32 detector channels, 10 us event timing, and capable of uninterrupted acquisition sessions of over 70 hours at 50 mK. The XRS/EBIT program has been extremely successful, producing over two-dozen refereed publications on topics such as laboratory astrophysics, atomic physics, nuclear physics, and calibration of the spectrometers for the National Ignition Facility, with many more publications in preparation. The ECS spectrometer will continue this work into the future with improved spectral resolution, integration times, and ease-of-use. We designed the ECS instrument with TES detectors in mind by using the same highly successful magnetic shielding as our laboratory TES cryostats. This design will lead to a future TES instrument at the LLNL EBIT. This proposed future instrument would include a hybrid detector system with 0.8 eV resolution in the band from 0.1-1.0 keV, 2 eV from 0.1-10 keV, and 30 eV from 0.5-100 keV, with high quantum efficiency in each band. Here we discuss the legacy of the XRS/EBIT program, the performance of the new ECS spectrometer, and plans for a future TES spectrometer.

Author

Laboratory Astrophysics; Calorimeters; Calibrating; Atomic Physics; Nuclear Physics; Quantum Efficiency

20070035756 Northrop Grumman Space Technology, USA; NASA Goddard Space Flight Center, Greenbelt, MD, USA
Contamination Effects and Requirements Derivation for the James Webb Space Telescope
Arenberg, Jonathan; Wooldridge, Eve; July 19, 2007; 21 pp.; In English; Contamination and Coatings Workshop, 17019 Jul. 2007, Columbia, MD, USA; Original contains color illustrations; Copyright; Avail.: CASI: [A03](#), Hardcopy

This viewgraph presentation reviews the contamination requirements and its effects on the James Webb Space Telescope (JWST).

CASI

Contamination; James Webb Space Telescope; Requirements; Light (Visible Radiation)

20070035966 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

Multi-Band Large Format Infrared Imaging Arrays

Bandara, Sumith V.; Gunapala, Sarath D; Liu, John K.; Hill, Cory J.; Mumolo, Jason M.; Ting, David Z.; June 12, 2005; 3 pp.; In English; World of Photonics Congress, 12-17 Jun. 2005, Munich, Germany; Original contains color and black and white illustrations; Copyright; Avail.: Other Sources

ONLINE: <http://hdl.handle.net/2014/40533>

Large-format and multi-band focal plane arrays (FPA) based on quantum well and quantum dot infrared photodetectors have been developed for various instruments such as imaging interferometers and hyperspectral imagers. The spectral response of these detectors are tailorable within the mid- and long-wavelength infrared bands.

Author

Infrared Imagery; Quantum Wells; Imaging Techniques; Focal Plane Devices; Quantum Dots; Infrared Radiation

20070035972 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

Bias Reduction and Filter Convergence for Long Range Stereo

Sibley, Gabe; Matthies, Larry; Sukhatme, Gaurav; October 12, 2005; 10 pp.; In English; International Symposium of Robotics Research, 12-15 Oct. 2005, San Francisco, CA, USA; Original contains black and white illustrations; Copyright; Avail.: Other Sources

ONLINE: <http://hdl.handle.net/2014/40548>

We are concerned here with improving long range stereo by filtering image sequences. Traditionally, measurement errors from stereo camera systems have been approximated as 3-D Gaussians, where the mean is derived by triangulation and the covariance by linearized error propagation. However, there are two problems that arise when filtering such 3-D measurements. First, stereo triangulation suffers from a range dependent statistical bias; when filtering this leads to over-estimating the true range. Second, filtering 3-D measurements derived via linearized error propagation leads to apparent filter divergence; the estimator is biased to under-estimate range. To address the first issue, we examine the statistical behavior of stereo triangulation and show how to remove the bias by series expansion. The solution to the second problem is to filter with image coordinates as measurements instead of triangulated 3-D coordinates.

Author

Bias; Error Analysis; Series Expansion; Cameras; Estimating; Convergence; Sequencing

20070035984 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

GeoSTAR: A New Approach for a Geostationary Microwave Sounder

Lambrigtsen, Bjorn; October 29, 2003; 24 pp.; In English; International Television Infrared Observation Satellite (TIROS) Operational Vertical Sounder (TOVS) Study Conferences(ITSC), 29 Oct. - 4 Nov. 2004, Ste Adele, Canada; Original contains black and white illustrations; Copyright; Avail.: Other Sources

ONLINE: <http://hdl.handle.net/2014/40460>

This viewgraph presentation reviews GeoSTAR, a microwave sounder intended for GEO deployment. GeoSTAR will perform visibility measurements, calibration measurements, and interferometric imaging. GeoSTAR is an interferometric system, capable of performing multiple calibration measurements. The development of a prototype of the GeoSTAR is ongoing. Block diagrams of several parts are shown. An overview roadmap that will make the GeoStar system ready to launch by 2012 is reviewed.

CASI

Imaging Techniques; Interferometry; Microwave Sounding; Synthetic Apertures

20070035986 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

Optomechanical Design of Ten Modular Cameras for the Mars Exploration Rovers

Ford, Virginia G.; Karlmann, Paul; Hagerott, Ed; Scherr, Larry; April 9, 2003; 23 pp.; In English; The Optical Society of Southern California Meeting, 9 Apr. 2003, El Segundo, CA, USA; Original contains black and white illustrations; Copyright; Avail.: Other Sources

ONLINE: <http://hdl.handle.net/2014/40452>

This viewgraph presentation reviews the design and fabrication of the modular cameras for the Mars Exploration Rovers. In the 2003 mission there were to be 2 landers and 2 rovers, each were to have 10 cameras each. Views of the camera design, the lens design, the lens interface with the detector assembly, the detector assembly, the electronics assembly are shown.

CASI

Cameras; Fabrication; Mars Exploration

20070036007 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

Low-Complexity Lossless Compression of Hyperspectral Imagery Via Adaptive Filtering

Klimesh, Matthew A.; July 26, 2005; 10 pp.; In English; Consultative Committee for Space Data Systems (CCSDS) Area and Working Group Meeting, Data Compression Working Group, 13-15 Sep. 2005, Atlanta, GA, USA; Copyright; Avail.: Other Sources

ONLINE: <http://hdl.handle.net/2014/40561>

A low-complexity, adaptive predictive technique for lossless compression of hyperspectral data is presented. The technique relies on the sign algorithm from the repertoire of adaptive filtering. The compression effectiveness obtained with the technique is competitive with that of the best of previously described techniques with similar complexity.

Author

Data Compression; Adaptive Filters; Algorithms; Data Systems; Predictions; Imagery

20070036116 Forschungsgesellschaft fuer Angewandte Naturwissenschaften e.V, Wachtberg-Werthhoven, Germany

Very High Resolution SAR and Multichannel SAR/MTI

Berens, Patrick; Sep 1, 2006; 15 pp.; In English; Original contains color illustrations

Report No.(s): AD-A470648; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470648>

No abstract available

Detection; High Resolution; Synthetic Aperture Radar; Target Acquisition

20070036129 Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Cologne, Germany

Polarimetric Interferometry

Hellmann, Martin; Cloude, Shane R; Feb 1, 2007; 15 pp.; In English; Original contains color illustrations

Report No.(s): AD-A470690; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470690>

No abstract available

Interferometry; Polarimetry; Synthetic Aperture Radar; Vector Analysis

20070036130 Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Cologne, Germany

Polarimetric Interferometry - Target Detection Applications

Hellmann, Martin; Cloude, Shane R; Feb 1, 2007; 23 pp.; In English; In English; Original contains color illustrations

Report No.(s): AD-A470692; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470692>

No abstract available

Detection; Interferometry; Polarimetry; Simulation; Target Acquisition

20070036132 Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Wesseling, Germany

Polarimetry and Interferometry Applications

Keydel, Wolfgang; Feb 1, 2007; 29 pp.; In English; Original contains color illustrations

Report No.(s): AD-A470694; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470694>

No abstract available

Forecasting; Interferometry; Polarimetry; Synthetic Aperture Radar; Targets

20070036320 Texas Univ., Arlington, TX USA

Studies on Radar Sensor Networks

Liang, Qilian; Aug 8, 2007; 145 pp.; In English

Contract(s)/Grant(s): N00014-07-1-0395

Report No.(s): AD-A470811; No Copyright; Avail.: Defense Technical Information Center (DTIC)

During the period of 12/8/2006-6/30/2007, we performed the following studies in radar sensor network: (1) Sense-through-foliage target detection using UWB radar sensor network based on real-world data; (2) Foliage clutter modeling using UWB radars; (3) Outdoor UWB channel modeling based on field data; (4) Multi-target detection using radar sensor networks (theoretical studies); (5) SVD-QR and graph theory for MIMO channel selection; (6) Image fusion using radar sensor network; (7) Performance analysis of energy detection for cognitive radio wireless networks; (8) Superimposed code-based channel assignment in multi-radio multi-channel wireless mesh networks.

DTIC

Detection; Foliage; Radar; Radar Detection; Target Acquisition

20070036339 Duke Univ., Durham, NC USA

Discrimination, Identification, and Tracking of Unresolved Targets Using Tomographic Integration of Multiplex Sensor Data

Brady, David J; Dec 20, 2006; 6 pp.; In English

Contract(s)/Grant(s): DAAD19-03-1-0352

Report No.(s): AD-A470868; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The objective of this research is the development of a low cost sensor system with applications in biometric tracking and authentication. We have demonstrated the ability to classify and track human motion using low cost, off-the-shelf pyroelectric detectors. We have designed fieldable sensor units that are anonymous and can perform multiple tasks such as biometric classification, multiple object tracking, and camera pointing. We have demonstrated the ability to track two individuals and demonstrated the ability to recognize multiple humans with an accuracy of 86%. We have integrated the units through wireless communication to allow the creation of a cluster field of detectors.

DTIC

Infrared Detectors; Motion; Multiplexing; Pyroelectricity; Targets; Tomography

20070036342 UIC-ECE Communications, Chicago, IL USA

Basics of SAR Polarimetry II

Boerner, Wolfgang-Martin; Feb 1, 2007; 31 pp.; In English; Original contains color illustrations

Report No.(s): AD-A470871; No Copyright; Avail.: Defense Technical Information Center (DTIC)

No abstract available

Polarimetry; Synthetic Aperture Radar

20070036343 Program Executive Office Integrated Warfare Systems, Washington, DC USA

Transmit/Receive Modules

Binder, Brad; Aug 2005; 16 pp.; In English; Original contains color illustrations

Report No.(s): AD-A470873; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Transmit/Receive Module Outline: Future surface navy radar; Performance and cost; Wide bandgap semiconductors; Summary.

DTIC

Modules; Radar; Signal Reception; Transmission; Water

20070036348 Illinois Univ., Chicago, IL USA

Applications of Polarimetric and Interferometric SAR to Environmental Remote Sensing and its Activities: Recent Advances in Extrawideband Polarimetry, Interferometry and Polarimetric Interferometry in Synthetic Aperture Remote Sensing and its Applications

Boerner, Wolfgang-Martin; Feb 1, 2007; 35 pp.; In English; Original contains color illustrations

Report No.(s): AD-A470880; No Copyright; Avail.: Defense Technical Information Center (DTIC)

No abstract available

Detection; Interferometry; Polarimetry; Remote Sensing; Synthetic Aperture Radar; Synthetic Apertures

20070036349 Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Wesseling, Germany
Normal and Differential SAR Interferometry

Keydel, Wolfgang; Feb 1, 2007; 41 pp.; In English; Original contains color illustrations
Report No.(s): AD-A470882; No Copyright; Avail.: Defense Technical Information Center (DTIC)
No abstract available

Differential Interferometry; Interferometry; Synthetic Aperture Radar

20070036352 Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Cologne, Germany
Polarimetric Interferometry - Remote Sensing Applications

Hellmann, Martin; Cloude, Shane R; Feb 1, 2007; 23 pp.; In English; Original contains color illustrations
Report No.(s): AD-A470886; No Copyright; Avail.: Defense Technical Information Center (DTIC)
No abstract available

Detection; Interferometry; Polarimetry; Remote Sensing; Synthetic Aperture Radar

20070036376 Northwestern Univ., Evanston, IL USA
A 10,000-Pen Nanoplotter with Integrated Ink Delivery System

Mirkin, Chad A; Mar 3, 2007; 26 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAAD19-03-1-0065
Report No.(s): AD-A470917; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This report summarizes major scientific and technological accomplishments during the three years of this grant. It includes an extensive list of articles published in peer reviewed journals and participation in scientific meetings, workshops, and lectures. Finally, patent disclosures, transitions, and awards earned by the participating investigators are listed. Over the three-year project period significant progress has been made in both areas. The Liu group took the lead in developing new DPN hardware and developed many advanced tools for SPL including 1-D and 2-D passive arrays, a 1-D active probe array, polydimethylsiloxane (PDMS) passive probes, a multifunctional active probe array and a microfluidic inking chip, and the development of electrostatic actuation probes. The advanced scanning probes and probe arrays that were developed under this program expanded the capabilities of scanning probe nanolithography (SPL) and have advanced SPL technology for commercial applications. Mirkin focused on the development of new DPN applications, in particular the development of protocols for the fabrication of electronically active nanostructures, for biodetection, and multiple-pen DPN, while the majority of important milestones was reached, as well as exceeded future challenges remain. Currently the main challenge in the field of Dip-Pen Nanolithography is to develop protocols for the fabrication of multi-component nanoarrays composed of different biological and chemical molecules.

DTIC

Inks; Lithography; Nanofabrication; Nanotechnology; Pins; Systems Integration

20070036396 Massachusetts Inst. of Tech., Cambridge, MA USA
Optical Detection of Nuclear Spin States

Cory, David; Ramanathan, Chandrasekhar; Havel, Timothy; Jan 31, 2007; 20 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAAD19-03-1-0125
Report No.(s): AD-A470958; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The goal of this project was to improve our control over nuclear spins in the solid state, and to extend this control to coupled electron-nuclear spins. Our key results are summarized below. 1. We extended the control techniques developed in liquid state NMR quantum information processing to the control of a three-qubit solid state NMR quantum information processor. 2. To explore multi-body spin dynamics and their sensitivity to decoherence, we have measured the decay of NMR multiple quantum coherence intensities in the presence and absence of the dipolar Hamiltonian, in a cubic and a one-dimensional spin system. 3. We also studied the transport of polarization in the one-dimensional fluoroapatite system, both experimentally and theoretically, and created special states in which the polarization is localized to the ends of the chain. This enables both universal Quantum Computing and Quantum Simulation in 1-D systems. 4. We devised a novel scheme for electron-nuclear quantum information processing that exploits the anisotropic hyperfine coupling. This scheme enables universal control over a 1-electron, N-nuclear spin system, addressing only a single electron spin transition. Not having to address the nuclear spins directly significantly speeds up the control. We designed and fabricated a pulsed electron spin resonance spectrometer, along with a cryogenic probe which we used to experimentally implement this scheme on a single

crystal sample of irradiated malonic acid. 5. We demonstrated the role of nuclear spin dipolar diffusion in dynamic nuclear polarization (DNP) experiments, in dielectric samples with abundant nuclear spins. We achieved a ^{29}Si polarization of 8.3% at 66 GHz and 1.1 K in single crystal P-doped, the highest ever reported, using DNP.

DTIC

Detection; Nuclear Spin; Optical Measurement; Particle Spin; Quantum Numbers

20070036400 National Inst. of Standards and Technology, Gaithersburg, MD USA

High Accuracy Verification of a Correlated-Photon-Based Method for Determining Photon-Counting Detection Efficiency

Polyakov, Sergey V; Migdall, Alan L; Jan 2007; 20 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAAD19-03-1-0199

Report No.(s): AD-A470970; No Copyright; Avail.: Defense Technical Information Center (DTIC)

We have characterized an independent primary standard method to calibrate detection efficiency of photon-counting detectors based on two-photon correlations. We have verified this method and its uncertainty by comparing it to a substitution method using a conventionally calibrated transfer detector tied to a national primary standard detector scale. We obtained a relative standard uncertainty for the correlated-photon method of 0.18 % ($k=1$) and for the substitution method of 0.17 % ($k=1$). From a series of measurements we found that the two independent calibration techniques differ by 0.14(14) %, which is within the established uncertainty of comparison. We believe this is the highest accuracy characterization and independent verification of the correlated photon method yet achieved.

DTIC

Counting; Detection; Photons; Quantum Efficiency

20070036453 UIC-ECE Communications, Chicago, IL USA

Recent Advances In Radar Polarimetry And Polarimetric SAR Interferometry

Boerner, Wolfgang-Martin; Feb 1, 2007; 31 pp.; In English; Original contains color illustrations

Report No.(s): AD-A471040; No Copyright; Avail.: Defense Technical Information Center (DTIC)

No abstract available

Interferometry; Polarimetry; Radar Imagery; Synthetic Aperture Radar

20070036663 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Lessons Learned from the Wide Field Camera 3 TV1 Test Campaign and Correlation Effort

Peabody, Hume; Stavley, Richard; Bast, William; [2007]; 6 pp.; In English; TF SAWS Workshop, 10-14 Sep. 2007, Cleveland, OH, USA; Original contains black and white illustrations; Copyright; Avail.: CASI: A02, Hardcopy

In January 2004, shortly after the Columbia accident, future servicing missions to the Hubble Space Telescope (HST) were cancelled. In response to this, further work on the Wide Field Camera 3 instrument was ceased. Given the maturity level of the design, a characterization thermal test (TV1) was completed in case the mission was re-instated or an alternate mission found on which to fly the instrument. This thermal test yielded some valuable lessons learned with respect to testing configurations and modeling/correlation practices, including: 1. Ensure that the thermal design can be tested 2. Ensure that the model has sufficient detail for accurate predictions 3. Ensure that the power associated with all active control devices is predicted 4. Avoid unit changes for existing models. This paper documents the difficulties presented when these recommendations were not followed.

Author

Cameras; Correlation; Thermal Vacuum Tests; General Overviews; Spaceborne Telescopes

20070036720 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

TPF-I Emma X-Array: 2007 Design Team Study

Martin, Stefan R.; Rodriguez, Jose; Scharf, Dan; Smith, Jim; McKinstry, David; Wirz, Richie; Purcell, George; Wayne, Len; Scherr, Larry; Mennesson, Bertrand; Lay, Oliver; April 16, 2007; 145 pp.; In English; Darwin Proposal Meeting, 16-17 Apr. 2007, Heidelberg, Germany; Original contains color and black and white illustrations; Copyright; Avail.: Other Sources

ONLINE: <http://hdl.handle.net/2014/40342>

This viewgraph presentation is a study of an Emma design for Terrestrial Planet Finder (TPF) formation flying

interferometer. The objective is to develop a design with reduced cost compared to TPF-I X-Array, derive mass and cost estimates, and study thermal and radiation issues.

CASI

Formation Flying; Interferometers; Terrestrial Planets; Linear Arrays

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*.

20070035098 NASA Goddard Space Flight Center, Greenbelt, MD, USA

X-ray Spectral Variation of (eta) Car through the 2003 X-ray Minimum

Hamaguchi, Kenji; Corcoran, Michael F.; Gull, Theodore; Nielsen, Krister E.; Kober, Gladys Vieira; Ishibashi, Kazunori; Pittard, Julian M.; Hillier, D. John; Damieneli, Augusto; Davidson, Kris; [2007]; 34 pp.; In English; Original contains black and white illustrations

Contract(s)/Grant(s): GO-4008A; Copyright; Avail.: CASI: [A03](#), Hardcopy

The Lunar Orbiting Laser Altimeter (LOLA) will fly on the Lunar Reconnaissance Orbiter (LRO). The laser is based upon the one in the Mercury Laser Altimeter (MLA). LOLA will fly two lasers instead one in laser cavity. The MLA laser has a six year flight to station. Lasers can fire in air with O₂ present. During testing and on orbit, LOLA will fire in vacuum. The laser cavity must be sealed against molecular and particulate contaminants. Mission to Moon will start with 60 days of launch. Derived from text

Laser Altimeters; Lunar Orbiter; Reconnaissance; Multispectral Linear Arrays; Laser Cavities

20070035099 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Development of a New Flight Vent for the LOLA Laser Cavity

Ramsey, W. Lawrence; Rosecrans, Glenn; July 17, 2007; 21 pp.; In English; Contamination and Coatings Workshop, 17-19 Jul. 2007, Columbia, MD, USA; Original contains black and white illustrations; Copyright; Avail.: CASI: [A03](#), Hardcopy

The Lunar Orbiting Laser Altimeter (LOLA) will fly on the Lunar Reconnaissance Orbiter (LRO). The laser is based upon the one in the Mercury Laser Altimeter (MLA). LOLA will fly two lasers instead of one in the laser cavity. The MLA laser has a six year flight to station.

Derived from text

Lunar Orbiter; Laser Altimeters; Multispectral Linear Arrays; Vents; Lasers

20070035224 Naval Postgraduate School, Monterey, CA USA

Laguerre-Gaussian Modes in the Free Electron Laser

Kampouridis, Anastasios; Jun 2007; 87 pp.; In English; Original contains color illustrations

Report No.(s): AD-A470158; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470158>

In a free electron laser (FEL) system knowing the optical beam characteristics is of great importance. A beam may be comprised of higher-order modes due to the interaction with the electron beam or from non-ideal operational conditions such as mirror distortions and misalignments or from imperfect injection of the electron beam. In this thesis the basic FEL theory is initially reviewed. The parabolic wave equation is then solved for the 'fundamental Gaussian mode and for higher-order modes. Working in rectangular coordinates a complete and orthogonal set of solutions involving Hermite polynomials is found. When the wave equation is solved in cylindrical coordinates we arrive at a set of solutions that contain Laguerre polynomials. The so-called Laguerre-Gaussian modes are analyzed. The evolution of these laser modes is also explored yielding quite unexpected results due to their phase structure and orbital angular momentum of light. Lastly we study a common case where higher-order optical modes appear in order to quantify the tolerances of an FEL.

DTIC

Electron Beams; Free Electron Lasers

20070035228 Naval Postgraduate School, Monterey, CA USA

A Systems Approach Towards High Energy Laser Implementation Aboard Navy Ships

Holbrook, II, James A; Reyes, David L; Jun 2007; 63 pp.; In English; Original contains color illustrations

Report No.(s): AD-A470165; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470165>

The next generation of naval surface vessels will feature a weapon system with pinpoint accuracy, deep magazines, lower cost per kill shot ratio, and delivery at the speed of light. This transformational weapon system will provide significant advantages over the conventional systems of today. The Free Electron Laser maintains the greatest potential to become the Navy's first line of shipboard defense and possibly a major component in the National Missile Defense Shield. This is possible because the Free Electron Laser will, in theory, be capable of scaling high power levels to that of the megawatt class, which is considered the threshold for military application. The focus of this thesis is to study the implementation of this directed energy weapon from a systems perspective and to determine if such implementation is plausible within the constraints of a naval platform. The thesis will discuss the components of implementation, such as the electric drive, integrated power system, pointer-tracker system, etc., which are vital to the total ship weapon package.

DTIC

Antiship Missiles; Cruise Missiles; Free Electron Lasers; High Power Lasers; Lasers; Navy; Ships

20070035280 Library of Congress, Washington, DC USA

Airborne Laser (ABL): Issues for Congress

Bolkcom, Christopher; Hildreth, Steven A; Jul 9, 2007; 19 pp.; In English

Report No.(s): AD-A470265; CRS-RL32123; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470265>

Funding for the Airborne Laser (ABL) program began in FY1994, but the technologies supporting the ABL effort has evolved over 25 years of research and development concerning laser power concepts, pointing and tracking, and adaptive optics. Delayed now for many years, the ABL program plans to conduct a lethality test now scheduled for August 2009. To date, about \$4.3 billion has been spent on the ABL program, including \$632 million for FY2007. For FY2008, the Administration requested \$548.8 billion, which was cut substantially in the House and Senate defense authorization bills. This report examines the ABL program and budget status. It also examines some of the issues raised above. This report does not provide a detailed technical assessment of the ABL program (see CRS Report RL30185, The Airborne Laser Anti-Missile Program, by Michael E. Davey and Frederick Martin.). This report is updated periodically as necessary.

DTIC

Airborne Lasers; Antimissile Defense; Ballistic Missiles; Laser Weapons

20070035744 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Near-infrared Single-photon-counting Detectors for Free-space Laser Receivers

Krainak, Michael A.; Sun, Xiaoli; Hasselbrack, William; Wu, Stewart; Waczynski, Augustyn; Miko, Laddawan; [2007]; 2 pp.; In English; SPW 2007 (Single-photon Workshop 2007), 25-28 Sep. 2007, Turin, Italy; No Copyright; Avail.: CASI: [A01](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20070035744>

We compare several photon-counting detector technologies for use as near-infrared timeresolved laser receivers in science instrument, communication and navigation systems. The key technologies are InGaAs(P) photocathode hybrid photomultiplier tubes and InGaAs(P) and HgCdTe avalanche photodiodes. We discuss recent experimental results and application.

Author

Free-Space Optical Communication; Receivers; Near Infrared Radiation; Photons; Lasers; Radiation Counters; Fabrication

20070036114 Florida International Univ., Miami, FL USA

Experimental Characterization of Near-Infrared Laser Energy Absorption, Scattering, and Transmittance in Biological Tissue

Laffitte, John; Roelant, David; Denton, Michael L; Thomas, Robert J; Mar 2007; 86 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): F41624-02-D-7003; Proj-2312

Report No.(s): AD-A470641; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470641>

Many infrared (IR) laser systems are being used in tactical military ground and airborne applications. Understanding the

biological impact of IR laser energy absorbed by skin and ocular tissues is essential for developing models that can predict collateral hazards. Due to the lack of IR wavelength-dependent microscopic cross sections for skin, research is needed to understand biological damage caused by IR radiation in tissues. Florida International University (FIU) carried out a series of experiments on 34 biological skin samples to measure transmission, reflectance and absorption of IR lasers at 1064 and 1313 nm. Tissue samples varied in thickness from millimeters to microns. Readings from three IR detectors were used to calculate the diffuse reflectance, diffuse transmittance, and collimated transmittance. These values were entered into an Inverse Adding Doubling program to calculate the tissue's optical properties. The results varied as much as an order of magnitude from published results. A secondary goal of this research was for FIU to gain experience in preparation, handling, and measurement of IR in tissues to become a future resource to the U.S. Air Force.

DTIC

Absorption Spectroscopy; Energy Absorption; Infrared Lasers; Laser Spectroscopy; Optical Properties; Scattering; Tissues (Biology); Transmittance

20070036294 Northrop Grumman Corp., San Antonio, TX USA

Damage Thresholds for Cultures RPE Cells Exposed to Lasers at 532 nm and 458 nm

Denton, Michael L; Foltz, Michael S; Schuster, Kurt J; Estlack, Larry E; Thomas, Robert J; Jun 2007; 9 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): F41624-02-D-7003; Proj-2312

Report No.(s): AD-A470738; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The determination of safe exposure levels for lasers has come from damage assessment experiments in live animals, which typically involve correlating visually identifiable damage with laser dosimetry. Studying basic mechanisms of laser damage in animal retinal systems often requires tissue sampling (animal sacrifice), making justification and animal availability problematic. We determined laser damage thresholds in cultured monolayers of a human retinal pigment epithelial RPE cell line. By varying exposure duration and laser wavelength, we identified conditions leading to damage by presumed photochemical or thermal mechanisms. A comparison with literature values for ocular damage thresholds validates the in vitro model. The in vitro system described will facilitate molecular and cellular approaches for understanding laser-tissue interaction.

DTIC

Eye (Anatomy); Laser Damage; Lasers; Photochemical Reactions; Pigments; Yield Point

20070036316 Purdue Univ., West Lafayette, IN USA

Equipment for Parallel High Speed Nano-Manufacturing

Xu, Xianfan; Apr 29, 2006; 4 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): N00014-04-1-0808

Report No.(s): AD-A470798; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This project is to request equipment funding for a novel parallel, high speed, large scale nano-manufacturing instrument. The key element of the instrument is a nanoscale optical antenna capable of producing a nanometer size light spot, which has been demonstrated in the PI's laboratory. With the use of an array of nanoscale optical antenna to produce a large number of nanometer size laser beams, a large number of patterns can be fabricated simultaneously, or a complex pattern with nanometer size features can be fabricated over a large area. We have acquired the necessary equipment and have built the instrument. Current research is focused on testing the instrument for parallel nano-manufacturing.

DTIC

High Speed; Laser Beams; Lithography; Manufacturing; Nanotechnology

20070036369 State Univ. of New York, Stony Brook, NY USA

Experimental and Theoretical Study of the Temperature Performance of Type-II Quantum Well Lasers

Belenky, Gregory; Kisin, Mikhail V; Suchalkin, Sergey; May 31, 2007; 15 pp.; In English

Contract(s)/Grant(s): DAAD19-03-1-0259

Report No.(s): AD-A470907; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The method of analyzing the temperature performance of type-II Interband Cascade (IC) GaSb-based semiconductor lasers has been developed. The method includes comparing the temperature-concentration dependence at the laser threshold with steady-state carrier heating characteristics. The number of cascades in prototype type-II IC lasers has been optimized with respect to the highest achievable operating temperature. An ultra-sensitive single-pass measurement technique was developed

to study optical absorption in thin-layered laser heterostructures. The presence of strong non-radiative recombination in type-II laser structures was demonstrated by our measurement technique. We show that thermally induced hole escape from the active quantum wells is responsible for deterioration of the optical emission both in type-I and type-II laser structures at elevated temperatures. New method of laser temperature characterization has been developed and tested on high-power diode arrays, which are especially vulnerable to heat generation and kinetics. The study of type-II IC laser structures resulted in a proposal of a novel electrically tunable mid-IR light source. We have designed and experimentally demonstrated a working prototype of multimode electrically tunable IC laser operating in mid-infrared spectral region. The device demonstrates ultra-wide wavelength tuning in the range of up to 120 nm.

DTIC

Lasers; Quantum Well Lasers; Semiconductor Lasers; Sensitivity; Temperature Effects

20070036443 Michigan Univ., Ann Arbor, MI USA

Development of an Electron-Positron Source for Positron Annihilation Lifetime Spectroscopy

Nees, John A.; Jan 2007; 18 pp.; In English

Contract(s)/Grant(s): DAAD19-03-1-0287

Report No.(s): AD-A471027; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Laser intensities capable driving relativistic phenomena are delivered in a single-wavelength spot size on solid targets producing energetic electrons for positron production. This program has accomplished the production of >1 MeV electron energies with laser pulse energy of ~ 1mJ at 500Hz repetition rate. The properties of the laser, diagnostics and the energetic electron emission are discussed. Application of the laser-produced plasma phenomena to positron generation is discussed and future directions are briefly stated.

DTIC

Electron Spectroscopy; Positron Annihilation; Positrons; Spectroscopy

20070036589 NASA Goddard Space Flight Center, Greenbelt, MD, USA

NASA Goddard's Application of Lasers in Space

Abshire, James B.; Krainak, Michael A.; Degnan, John J.; [2007]; 1 pp.; In English; 20th Annual Solid State and Diode Laser Technology Review Directed Energy Professional Society, 25-28 Jun. 2007, Los Angeles, CA, USA; No Copyright;

Avail.: Other Sources; Abstract Only

Researchers at NASA Goddard have been applying lasers for space measurements for over 4 decades, starting with satellite laser ranging in the mid 1960s. This talk will briefly review the history of Goddard's application to lasers to the scientific exploration of space, provide an overview of its ongoing laser-related programs, and give some possibilities for the future.

Author

Laser Applications; Spaceborne Lasers; General Overviews; Histories

38

QUALITY ASSURANCE AND RELIABILITY

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

20070036794 NASA Marshall Space Flight Center, Huntsville, AL, USA

Development of Natural Flaw Samples for Evaluating Nondestructive Testing Methods for Foam Thermal Protection Systems

Workman, Gary L.; Davis, Jason; Farrington, Seth; Walker, James; October 22, 2007; 1 pp.; In English; 4th Pan-American Conference for NDT, 22-26 Oct. 2007, Buenos Aires, Argentina; No Copyright; Avail.: Other Sources; Abstract Only

Low density polyurethane foam has been an important insulation material for space launch vehicles for several decades. The potential for damage from foam breaking away from the NASA External Tank was not realized until the foam impacts on the Columbia Orbiter vehicle caused damage to its Leading Edge thermal protection systems (TPS). Development of improved inspection techniques on the foam TPS is necessary to prevent similar occurrences in the future. Foamed panels with drilled holes for volumetric flaws and Teflon inserts to simulate debonded conditions have been used to evaluate and calibrate nondestructive testing (NDT) methods. Unfortunately the symmetric edges and dissimilar materials used in the preparation of these simulated flaws provide an artificially large signal while very little signal is generated from the actual defects themselves. In other words, the same signal are not generated from the artificial defects in the foam test panels as produced when inspecting

natural defect in the ET foam TPS. A project to create more realistic voids similar to what actually occurs during manufacturing operations was begun in order to improve detection of critical voids during inspections. This presentation describes approaches taken to create more natural voids in foam TPS in order to provide a more realistic evaluation of what the NDT methods can detect. These flaw creation techniques were developed with both sprayed foam and poured foam used for insulation on the External Tank. Test panels with simulated defects have been used to evaluate NDT methods for the inspection of the External Tank. A comparison of images between natural flaws and machined flaws generated from backscatter x-ray radiography, x-ray laminography, terahertz imaging and millimeter wave imaging show significant differences in identifying defect regions.

Author

Nondestructive Tests; Polyurethane Foam; Voids; Fault Detection; Foams; Defects

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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*.

20070035075 NASA Glenn Research Center, Cleveland, OH, USA

Development of Probabilistic Structural Analysis Integrated with Manufacturing Processes

Pai, Shantaram S.; Nagpal, Vinod K.; October 2007; 25 pp.; In English; ASME Turbo Expo 2007, 14-17 May 2007, Montreal, Canada; Original contains color illustrations

Contract(s)/Grant(s): WBS 685676.02.99.03.02

Report No.(s): NASA/TM-2007-214989; E-16154; GT2007-27510; Copyright; Avail.: CASI: [A03](#), Hardcopy

An effort has been initiated to integrate manufacturing process simulations with probabilistic structural analyses in order to capture the important impacts of manufacturing uncertainties on component stress levels and life. Two physics-based manufacturing process models (one for powdered metal forging and the other for annular deformation resistance welding) have been linked to the NESSUS structural analysis code. This paper describes the methodology developed to perform this integration including several examples. Although this effort is still underway, particularly for full integration of a probabilistic analysis, the progress to date has been encouraging and a software interface that implements the methodology has been developed. The purpose of this paper is to report this preliminary development.

Author

Manufacturing; Simulation; Probability Theory; Structural Analysis; Systems Integration; Mathematical Models; Mechanical Properties

20070035080 NASA Marshall Space Flight Center, Huntsville, AL, USA

Evolutionary Optimization of a Geometrically Refined Truss

Hull, P. V.; Tinker, M. L.; Dozier, G. V.; June 2007; 36 pp.; In English; Original contains color and black and white illustrations

Report No.(s): NASA/TP-2007-214960; M-1189; No Copyright; Avail.: CASI: [A03](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20070035080>

Structural optimization is a field of research that has experienced noteworthy growth for many years. Researchers in this area have developed optimization tools to successfully design and model structures, typically minimizing mass while maintaining certain deflection and stress constraints. Numerous optimization studies have been performed to minimize mass, deflection, and stress on a benchmark cantilever truss problem. Predominantly traditional optimization theory is applied to this problem. The cross-sectional area of each member is optimized to minimize the aforementioned objectives. This Technical Publication (TP) presents a structural optimization technique that has been previously applied to compliant mechanism design. This technique demonstrates a method that combines topology optimization, geometric refinement, finite element analysis, and two forms of evolutionary computation: genetic algorithms and differential evolution to successfully optimize a benchmark structural optimization problem. A nontraditional solution to the benchmark problem is presented in this TP, specifically a geometrically refined topological solution. The design process begins with an alternate control mesh formulation, multilevel

geometric smoothing operation, and an elastostatic structural analysis. The design process is wrapped in an evolutionary computing optimization toolset.

Author

Structural Analysis; Trusses; Genetic Algorithms; Topology; Design Optimization

20070035263 Library of Congress, Washington, DC USA

U.S. Embassy in Iraq

Epstein, Susan B; Jul 13, 2007; 6 pp.; In English

Report No.(s): AD-A470229; CRS-RS21867; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470229>

Concerns about the U.S. Embassy in Iraq have surfaced regarding the quality of construction and reported assertions of trafficking-like labor practices by First Kuwaiti General Trade and Contracting Company, the primary builder of the U.S. Embassy in Baghdad. The Bush Administration's FY2008 budget request includes \$65 million for base funding for operations in Iraq. In addition, the Administration requested \$823.9 million for mission operations in an FY2007 supplemental request and another \$1.9 million for mission operations in an FY2008 emergency request. On May 24, 2007, Congress passed a compromise supplemental appropriation (H.R. 2206), which the President signed into law (P.L. 110-28) on May 25. The enacted law included \$750 million for State Department operations in Iraq. A previous emergency supplemental appropriation (H.R. 1268/P.L. 109-13), signed into law on May 11, 2005, included \$592 million for embassy construction -- all that is needed for construction of the U.S. Embassy in Baghdad, according to the Department of State. Completion of the embassy is expected by the end of summer 2007. This report will be updated as information becomes available.

DTIC

Buildings; Construction; Federal Budgets; Iraq

20070035892 NASA Marshall Space Flight Center, Huntsville, AL, USA

Topology Synthesis of Structures Using Parameter Relaxation and Geometric Refinement

Hull, P. V.; Tinker, M. L.; June 2007; 32 pp.; In English; Original contains color and black and white illustrations

Contract(s)/Grant(s): NRA8-31

Report No.(s): NASA/TP-2007-214962; M-1191; No Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: <http://hdl.handle.net/2060/20070035892>

Typically, structural topology optimization problems undergo relaxation of certain design parameters to allow the existence of intermediate variable optimum topologies. Relaxation permits the use of a variety of gradient-based search techniques and has been shown to guarantee the existence of optimal solutions and eliminate mesh dependencies. This Technical Publication (TP) will demonstrate the application of relaxation to a control point discretization of the design workspace for the structural topology optimization process. The control point parameterization with subdivision has been offered as an alternative to the traditional method of discretized finite element design domain. The principle of relaxation demonstrates the increased utility of the control point parameterization. One of the significant results of the relaxation process offered in this TP is that direct manufacturability of the optimized design will be maintained without the need for designer intervention or translation. In addition, it will be shown that relaxation of certain parameters may extend the range of problems that can be addressed; e.g., in permitting limited out-of-plane motion to be included in a path generation problem.

Author

Parameterization; Topology; Relaxation (Mechanics); Mathematical Models; Design Optimization; Structural Engineering; Grid Refinement (Mathematics)

20070036119 Army Command and General Staff Coll., Fort Leavenworth, KS USA

'Making the Spoon:' Analyzing and Employing Stability Power in Counterinsurgency Operations

Davis, Sean P; May 11, 2007; 90 pp.; In English; Original contains color illustrations

Report No.(s): AD-A470661; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470661>

This thesis seeks to determine if the U.S. Military's conduct of counterinsurgency (COIN) operations requires the assignment of combat sustainment and support units as the main effort. In assigning these units this new decisive role, the military maximizes their intrinsic organizational advantages in non-kinetic stability operations. Such stability operations encompass what is decisive in defeating an insurgency. However, the design of current combat power analysis tools is not applicable for stability operations. The determination of a unit's capability in stability operations requires a new analysis

model. Therefore, the military needs Relative Stability Power Analysis. Defining an organization's relative stability power is its ability to simultaneously represent all the elements of national power in proportion to the scale of the intervention to stabilize a failing state. As the theory of stability power requires a new analytical model, it also requires a new concept of employment. A concept of employing stability power is a hybrid of subject matter on counterinsurgency, crisis response, and domestic policing. In all, this vision of a force with balanced combat and stability power may prove the only acceptable alternative to meet the immediate emergency and security requirements of a failing state.

DTIC

Combat; Construction; Stability; Support Systems

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*.

20070035059 Library of Congress, Washington, DC USA

The Iran Sanctions Act (ISA)

Katzman, Kenneth; Jul 9, 2007; 7 pp.; In English

Report No.(s): AD-A470034; CRS-RS20871; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470034>

No firms have been sanctioned under the Iran Sanctions Act (ISA). Set to expire in August 2006, legislation in the 109th Congress (the Iran Freedom Support Act, P.L. 109-293) extended it until December 31, 2011, terminated application to Libya, and added provisions, although with substantial Administration flexibility in implementation. Proposed ISA-related legislation in the 110th Congress, such as H.R. 1400, would remove some of that flexibility. See also CRS Report RL32048, 'Iran: U.S. Concerns and Policy Responses,' by Kenneth Katzman.

DTIC

Crude Oil; Economics; Industries; International Trade; Iran; Law (Jurisprudence); Natural Gas

20070035104 NASA Goddard Space Flight Center, Greenbelt, MD, USA

A First Approach to Global Runoff Simulation using Satellite Rainfall Estimation

Hong, Yang; Adler, Robert F.; Hossain, Faisal; Curtis, Scott; Huffman, George J.; [2007]; 23 pp.; In English; Original contains color illustrations; Copyright; Avail.: CASI: [A03](#), Hardcopy

Many hydrological models have been introduced in the hydrological literature to predict runoff but few of these have become common planning or decision-making tools, either because the data requirements are substantial or because the modeling processes are too complicated for operational application. On the other hand, progress in regional or global rainfall-runoff simulation has been constrained by the difficulty of measuring spatiotemporal variability of the primary causative factor, i.e. rainfall fluxes, continuously over space and time. Building on progress in remote sensing technology, researchers have improved the accuracy, coverage, and resolution of rainfall estimates by combining imagery from infrared, passive microwave, and space-borne radar sensors. Motivated by the recent increasing availability of global remote sensing data for estimating precipitation and describing land surface characteristics, this note reports a ballpark assessment of quasi-global runoff computed by incorporating satellite rainfall data and other remote sensing products in a relatively simple rainfall-runoff simulation approach: the Natural Resources Conservation Service (NRCS) runoff Curve Number (CN) method. Using an Antecedent Precipitation Index (API) as a proxy of antecedent moisture conditions, this note estimates time-varying NRCS-CN values determined by the 5-day normalized API. Driven by multi-year (1998-2006) Tropical Rainfall Measuring Mission (TRMM) Multi-satellite Precipitation Analysis, quasi-global runoff was retrospectively simulated with the NRCS-CN method and compared to Global Runoff Data Centre data at global and catchment scales. Results demonstrated the potential for using this simple method when diagnosing runoff values from satellite rainfall for the globe and for medium to large river basins. This work was done with the simple NRCS-CN method as a first-cut approach to understanding the challenges that lie ahead in advancing the satellite-based inference of global runoff. We expect that the successes and limitations revealed in this study will lay the basis for applying more advanced methods to capture the dynamic variability of the global hydrologic

process for global runoff monitoring in real time. The essential ingredient in this work is the use of global satellite-based rainfall estimation.

Author

Hydrology Models; Rain; Decision Making; Earth Resources; Estimates; Moisture; Remote Sensing; River Basins; Drainage

20070035107 Tasmania Univ., Australia; NASA Goddard Space Flight Center, Greenbelt, MD, USA

ARISE (Antarctic Remote Ice Sensing Experiment) in the East 2003: Validation of Satellite-derived Sea-ice Data Product

Massom, Robert A.; Worby, Anthony; Lytle, Victoria; Markus, Thorsten; Allison, Ian; Scambos, Theodore; Enomoto, Hiroyuki; Tateyama, Kazutaka; Haran, Terence; Comiso, Josefino C.; Pfaffling, Andreas; Tamura, Takeshi; Muto, Atsuhiko; Kanagaratnam, Pannir; Giles, Barry; Young, Neal; Hyland, Glenn; Key, Erica; *Annals of Glaciology*; November 2006; Volume 44, No. 1, pp. 288-296; In English; Original contains black and white illustrations

Contract(s)/Grant(s): NRA-OES-03; AAS Project 2298; Copyright; Avail.: Other Sources

Preliminary results are presented from the first validation of geophysical data products (ice concentration, snow thickness on sea ice ($h_{\text{sub s}}$) and ice temperature ($T_{\text{sub i}}$)) from the NASA EOS Aqua AMSR-E sensor, in East Antarctica (in September-October 2003). The challenge of collecting sufficient measurements with which to validate the coarse-resolution AMSR-E data products adequately was addressed by means of a hierarchical approach, using detailed in situ measurements, digital aerial photography and other satellite data. Initial results from a circumnavigation of the experimental site indicate that, at least under cold conditions with a dry snow cover, there is a reasonably close agreement between satellite- and aerial-photo-derived ice concentrations, i.e. $97.2 \pm 0.6\%$ for NT2 and $96.5 \pm 2.5\%$ for BBA algorithms vs 94.3% for the aerial photos. In general, the AMSR-E concentration represents a slight overestimate of the actual concentration, with the largest discrepancies occurring in regions containing a relatively high proportion of thin ice. The AMSR-E concentrations from the NT2 and BBA algorithms are similar on average, although differences of up to 5% occur in places, again related to thin-ice distribution. The AMSR-E ice temperature ($T_{\text{sub i}}$) product agrees with coincident surface measurements to approximately 0.5 C in the limited dataset analyzed. Regarding snow thickness, the AMSR $h_{\text{sub s}}$ retrieval is a significant underestimate compared to in situ measurements weighted by the percentage of thin ice (and open water) present. For the case study analyzed, the underestimate was 46% for the overall average, but 23% compared to smooth-ice measurements. The spatial distribution of the AMSR-E $h_{\text{sub s}}$ product follows an expected and consistent spatial pattern, suggesting that the observed difference may be an offset (at least under freezing conditions). Areas of discrepancy are identified, and the need for future work using the more extensive dataset is highlighted.

Author

Sea Ice; In Situ Measurement; Aerial Photography; Aqua Spacecraft; Remote Sensing; Geophysics

20070035111 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

The Impact of the AIRS Spatial Response on Channel-to-Channel and Multi-Instrument Data Analyses

Elliott, Denis A.; Pagano, Thomas S.; Aumann, H. H.; August 13, 2006; 30 pp.; In English; SPIE Optics and Photonics, San Diego, CA, USA; Original contains color illustrations; Copyright; Avail.: Other Sources

ONLINE: <http://hdl.handle.net/2014/40354>

The Atmospheric Infrared Sounder (AIRS) measures the infrared spectrum in 2378 channels between 3.7 and 15.4 microns with a very high spectral resolution of approximately 1200. AIRS footprints are approximately 1.1 by 0.6 degrees. Because AIRS is a grating spectrometer, each channel has a unique spatial response. Image rotation due to the scan mirror causes these spatial responses to rotate. In effect, each channel has 90 spatial responses, one for each scene footprint in the scan line. Although the spatial response for most channels is symmetric and nearly uniform, some channels have significantly asymmetric response. This paper reviews and describes the prelaunch measurements that characterized the spatial response functions. Next, it describes the conversion of the ground-based results into footprint-specific response functions valid in flight. Then we describe the postlaunch validation of the measurements, including centroid location, axes orientations, and a check on the full two-dimensional response functions. This latter check involves comparison of AIRS data with that of the Moderate Resolution Imaging Spectrometer (MODIS), which flies on the same platform as AIRS. An important result is that AIRS/MODIS brightness temperature comparisons are significantly improved (scatter reduced) when the AIRS spatial response is explicitly taken into account. Finally, a status report is given on attempts to fully verify the prelaunch measurements by deriving the AIRS spatial response from flight data alone.

Author

Data Processing; Spectrometers; Atmospheric Sounding; Earth Observations (From Space); Remote Sensing; Data Reduction; Brightness Temperature; Multisensor Applications

20070035134 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Evaluation of Integrating the Invasive Species Forecasting System to Support National Park Service Decisions on Fire Management Activities and Invasive Plant Species Control

Ma, Peter; Morisette, T.; Rodman, Ann; McClure, Craig; Pedelty, Jeff; Benson, Nate; Paintner, Kara; Most, Neal; Ullah, Asad; Cai, Weijie; Rocca, Monique; Silverman, Joel; Schunase, John L.; July 23, 2007; 1 pp.; In English; International Geoscience and Remote Sensing Symposium (IGARSS) '07, 23-27 Jul. 2007, Barcelona, Spain; Copyright; Avail.: Other Sources; Abstract Only

The USGS and NASA, in conjunction with Colorado State University, George Mason University and other partners, have developed the Invasive Species Forecasting System (ISFS), a flexible tool that capitalizes on NASA's remote sensing resource to produce dynamic habitat maps of invasive terrestrial plant species across the USA. In 2006 ISFS was adopted to generate predictive invasive habitat maps to benefit noxious plant and fire management teams in three major National Park systems: The Greater Yellowstone Area (Yellowstone / Grand Tetons National Parks), Sequoia and Kings Canyon National Park, and interior Alaskan (between Denali, Gates of The Arctic and Yukon-Charley). One of the objectives of this study is to explore how the ISFS enhances decision support apparatus in use by National Park management teams. The first step with each park system was to work closely with park managers to select top-priority invasive species. Specific species were chosen for each study area based on management priorities, availability of observational data, and their potential for invasion after fire disturbances. Once focal species were selected, sources of presence/absence data were collected from previous surveys for each species in and around the Parks. Using logistic regression to couple presence/absence points with environmental data layers, the first round of ISFS habitat suitability maps were generated for each National Park system and presented during park visits over the summer of 2006. This first engagement provided a demonstration of what the park service can expect from ISFS and initiated the ongoing dialog on how the parks can best utilize the system to enhance their decisions related to invasive species control. During the park visits it was discovered that separate 'expert opinion' maps would provide a valuable baseline to compare against the ISFS model output. Opinion maps are a means of spatially representing qualitative knowledge into a quantitative two-dimensional map. Furthermore, our approach combines the qualitative expert opinion habitat maps -- with the quantitative ISFS habitat maps in a difference map that shows where the two maps agree and disagree. The objective of the difference map is to help focus future field sampling and improve model results. This paper presents a demonstration of the habitat, expert opinion, and difference map for Yellowstone National Park.

Author

Remote Sensing; Yellowstone National Park (ID-MT-WY); Decision Making; Plants (Botany); Fires; Geological Surveys

20070035146 Library of Congress, Washington, DC USA

The Iran Sanctions Act (ISA)

Katzman, Kenneth; Jul 9, 2007; 7 pp.; In English

Report No.(s): AD-A470034; CRS-RS20871; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470034>

No firms have been sanctioned under the Iran Sanctions Act (ISA). Set to expire in August 2006, legislation in the 109th Congress (the Iran Freedom Support Act, P.L. 109-293) extended it until December 31, 2011, terminated application to Libya, and added provisions, although with substantial Administration flexibility in implementation. Proposed ISA-related legislation in the 110th Congress, such as H.R. 1400, would remove some of that flexibility. See also CRS Report RL32048, 'Iran: U.S. Concerns and Policy Responses,' by Kenneth Katzman.

DTIC

Crude Oil; Economics; Industries; International Trade; Iran; Law (Jurisprudence); Natural Gas

20070035486 Woods Hole Oceanographic Inst., MA USA

Migratory Patterns of American Shad (*Alosa Sapidissima*) Revealed by Natural Geochemical Tags in Otoliths

Walther, Benjamin; Feb 2007; 207 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): OCE-0215905; OCE-0134998

Report No.(s): AD-A470316; MIT/WHOI-2007-06; No Copyright; Avail.: Defense Technical Information Center (DTIC)

In an assessment of river-specific signatures in American shad (*Alosa sapidissima*), stable isotope and elemental ratios in otoliths of juveniles produced accurate natal tags from 12 rivers. The database was expanded to include 20 rivers from Florida to Quebec, encompassing all major spawning populations. Regressions between otolith and water chemistry for those rivers where both were collected showed significant relationships for Sr:Ca, Ba:Ca, 8180, and t7Sr: 86Sr ratios but not for Mg:Ca or Mn:Ca. Cross-validated classification accuracies of known-origin juveniles averaged 93%. Adults returning to spawn in the York River were classified according to their otolith composition. Only 6% of spawners originated from rivers other than the

York, supporting the hypothesis that most American shad spawn in their natal river. Of remaining spawners, 79% originated from the Mattaponi River and 21% from the Pamunkey River, suggesting less fidelity to individual tributaries. Otolith signatures were also used in mixed-stock analyses of immature migrants in the Gulf of Maine. Mixed-stock compositions were dominated by fish from the Shubenacadie and Hudson rivers, with an increasing proportion of Potomac River fish over time. In contrast to results from adult tagging studies, southern stocks were virtually absent. These data suggest ontogenetic shifts in migratory behavior.

DTIC

Data Bases; Fishes; Geochemistry

20070035490 Woods Hole Oceanographic Inst., MA USA

Experimental and Seismological Constraints on the Rheology, Evolution, and Alteration of the Lithosphere at Oceanic Spreading Centers

deMartin, Brian J; Feb 2007; 215 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): OCE-0095936; OCE-9907224

Report No.(s): AD-A470322; MIT/WHOI-2007-07; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Oceanic spreading centers are sites of magmatic, tectonic, and hydrothermal processes. In this thesis I present experimental and seismological constraints on the evolution of these complex regions of focused crustal accretion and extension. Experimental results from drained, triaxial deformation experiments on partially molten olivine reveal that melt extraction rates are linearly dependent on effective mean stress when the effective mean stress is low and non-linearly dependent on effective mean stress when it is high. Microearthquakes recorded above an inferred magma reservoir along the TAG segment of the Mid-Atlantic Ridge delineate for the first time the arcuate, subsurface structure of a long-lived, active detachment fault. This fault penetrates the entire oceanic crust and forms the high-permeability pathway necessary to sustain long-lived, high-temperature hydrothermal venting in this region. Long-lived detachment faulting exhumes lower crustal and mantle rocks. Residual stresses generated by thermal expansion anisotropy and mismatch in the uplifting, cooling rock trigger grain boundary microfractures if stress intensities at the tips of naturally occurring flaws exceed a critical stress intensity factor. Experimental results coupled with geomechanical models indicate that pervasive grain boundary cracking occurs in mantle peridotite when it is uplifted to within 4 km of the seafloor. Whereas faults provide the high-permeability pathways necessary to sustain high-temperature fluid circulation, grain boundary cracks form the interconnected network required for pervasive alteration of the oceanic lithosphere. This thesis provides fundamental constraints on the rheology, evolution, and alteration of the lithosphere at oceanic spreading centers.

DTIC

Lithosphere; Ocean Bottom; Oceans; Rheology; Seismology; Spreading

20070035527 Woods Hole Oceanographic Inst., MA USA

Geoacoustic Inversion by Mode Amplitude Perturbation

Poole, Travis L; Feb 2007; 129 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): N00014-02-1-0337

Report No.(s): AD-A470379; MIT/WHOI-2007-03; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This thesis introduces an algorithm for inverting for the geoacoustic properties of the seafloor in shallow water. The input data required by the algorithm are estimates of the amplitudes of the normal modes excited by a low-frequency pure-tone sound source, and estimates of the water column sound speed profiles at the source and receiver positions. The algorithm makes use of perturbation results, and computes the small correction to an estimated background profile that is necessary to reproduce the measured mode amplitudes. Range-dependent waveguide properties can be inverted for so long as they vary slowly enough in range that the adiabatic approximation is valid. The thesis also presents an estimator which can be used to obtain the input data for the inversion algorithm from pressure measurements made on a vertical line array (VLA). The estimator is an Extended Kalman Filter (EKF), which treats the mode amplitudes and eigenvalues as state variables. Numerous synthetic and real-data examples of both the inversion algorithm and the EKF estimator are provided. The inversion algorithm is similar to eigenvalue perturbation methods, and the thesis also presents a combination mode amplitude/eigenvalue inversion algorithm, which combines the advantages of the two techniques.

DTIC

Algorithms; Inversions; Perturbation

20070035750 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Application of NASA Giovanni to Coastal Zone Remote Sensing Search

Acker, James; Leptoukh, Gregory; Kempner, Steven; Berrick, Stephen; Rui, Hualan; Shen, Suhung; [2007]; 13 pp.; In English; European Association of Remote Sensing Laboratories (EARSeL) 2007 Annual Symposium, 4-6 Jun. 2007, Bolzano, Italy; Original contains black and white illustrations; No Copyright; Avail.: CASI: [A03](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20070035750>

The Goddard Earth Sciences Data and Information Services Center (GES DISC) Interactive Online Visualization AND aNalysis Infrastructure (Giovanni) provides rapid access to, and enables effective utilization of, remotely-sensed data that are applicable to investigations of coastal environmental processes. Data sets in Giovanni include precipitation data from the Tropical Rainfall Measuring Mission (TRMM), particularly useful for coastal storm investigations; ocean color radiometry data from the Sea-viewing Wide Field-of-view Sensor (SeaWiFS) and Moderate Resolution Imaging Spectroradiometer (MODIS), useful for water quality evaluation, phytoplankton blooms, and terrestrial-marine interactions; and atmospheric data from MODIS and the Advanced Infrared Sounder (AIRS), providing the capability to characterize atmospheric variables. Giovanni provides a simple interface allowing discovery and analysis of environmental data sets with accompanying graphic visualizations. Examples of Giovanni investigations of the coastal zone include hurricane and storm impacts, hydrologically-induced phytoplankton blooms, chlorophyll trend analysis, and dust storm characterization. New and near-future capabilities of Giovanni will be described.

Author

Coasts; Earth Sciences; Remote Sensing; Sea-Viewing Wide Field-of-View Sensor; MODIS (Radiometry); TRMM Satellite; Storms (Meteorology); Phytoplankton

20070035751 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Morphological Feature Extraction for Automatic Registration of Multispectral Images

Plaza, Antonio; LeMoigne, Jacqueline; Netanyahu, Nathan S.; [2007]; 6 pp.; In English; IEEE International Geosciences and Remote Sensing Symposium (IGARSS) '07, 23-27 Jul. 2007, Barcelona, Spain; Original contains color and black and white illustrations; Copyright; Avail.: CASI: [A02](#), Hardcopy

The task of image registration can be divided into two major components, i.e., the extraction of control points or features from images, and the search among the extracted features for the matching pairs that represent the same feature in the images to be matched. Manual extraction of control features can be subjective and extremely time consuming, and often results in few usable points. On the other hand, automated feature extraction allows using invariant target features such as edges, corners, and line intersections as relevant landmarks for registration purposes. In this paper, we present an extension of a recently developed morphological approach for automatic extraction of landmark chips and corresponding windows in a fully unsupervised manner for the registration of multispectral images. Once a set of chip-window pairs is obtained, a (hierarchical) robust feature matching procedure, based on a multiresolution overcomplete wavelet decomposition scheme, is used for registration purposes. The proposed method is validated on a pair of remotely sensed scenes acquired by the Advanced Land Imager (ALI) multispectral instrument and the Hyperion hyperspectral instrument aboard NASA's Earth Observing-1 satellite.

Author

Pattern Registration; Pattern Recognition; Remote Sensing; Automatic Control; Image Processing; Morphology

20070035786 Naval Research Lab., Washington, DC USA

Hydrodynamic Agents in the Littoral Environment. Phase 1 Progress Report

Bachmann, Charles M; Nichols, C R; Mied, Richard P; Read, Chung H; Bennert, Ellen; Fusina, Robert A; Donato, Timothy F; Jul 6, 2007; 84 pp.; In English; Original contains color illustrations

Report No.(s): AD-A470390; NRL/MR/7230--07-9056; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Hydrodynamic Agents in the Littoral Environment (HALE) is a National Geospatial-Intelligence Agency program aimed at producing tidal predictions from imagery-derived water levels. HALE has been divided into three phases which lead to a protocol. This report describes Phase I and introduces work for Phase II. Approximately 62 satellite images of the Han River Estuary, Republic of Korea, over the 20-year period from 1987 to 2006 were processed and analyzed. The fundamental procedure involved semi-automated extraction of waterlines from high-resolution commercial imagery. Rules such as application of a red-edge index are used in quality controlling waterlines, estimating the extend of mudflats, and assessing shoreline changes due to erosion and/or sedimentation. Elevations were estimated using waterlines and a high-precision Digital Elevation Model (DEM). Elevations are determined from the intersection of the waterline with a beach profile derived from the DEM. Favorable locations have a flat gradient allowing any transects to be extended below Mean High Water

(MHW). Analyses highlight the importance of shallow water tidal constituents and the utility of seasonal DEMs. Subsequent work during Phase II will focus on time series analysis involving the use of random water elevations corresponding to simulated imagery for Seward, Alaska.

DTIC

Oceans; Photographs; Satellite Imagery; Tides

20070035872 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

TerraLook: Increased Access to Satellite Images

Geller, Gary N.; May 2007; 38 pp.; In English; St Andrews Prize Finalist Meeting, St. Andrews, Scotland, UK, May 7-9, 2007, 7-9 May 2007, Saint Andrews, Scotland, UK; Original contains color illustrations; Copyright; Avail.: Other Sources
ONLINE: <http://hdl.handle.net/2014/40319>

This viewgraph presentation reviews TerraLook which is a collection of images from a particular theme. The contents include: 1) Uses of images; 2) Access problems; and 3) TerraLook (Protected Area Archive) Demonstration, Current status, Relationship to SERVIR and Outreach.

CASI

Satellite Imagery; Remote Sensing; Mapping; Geological Surveys

20070035883 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Differential Radiometers Using Fabry-Perot Interferometric Technique for Remote Sensing Determination of Various Atmospheric Trace Gases

Georgieva, E. M.; Heaps, W. S.; Wilson, E. L.; [2007]; 2 pp.; In English; International Geoscience and Remote Sensing Symposium, 23-27 Jul. 2007, Barcelona, Spain; Original contains color illustrations; No Copyright; Avail.: CASI: [A01](#),
Hardcopy

ONLINE: <http://hdl.handle.net/2060/20070035883>

New type of remote sensing instrument based upon the Fabry-Perot interferometric technique has been developed at NASA's Goddard Space Flight Center. Fabry-Perot interferometry (FPI) is a well known, powerful spectroscopic technique and one of its many applications is to be used to measure greenhouse gases and also some harmful species in the atmosphere. With this technique, absorption of particular species is measured and related to its concentration. A solid Fabry-Perot etalon is used as a frequency filter to restrict the measurement to particular absorption bands of the gas of interest. With adjusting the thickness of the etalon that separation (in frequency) of the transmitted fringes can be made equal to the almost constant separation of the gas absorption lines. By adjusting the temperature of the etalon, which changes the index of refraction of its material, the transmission fringes can be brought into nearly exact correspondence with absorption lines of the particular species. With this alignment between absorption lines and fringes, changes in the amount of a species in the atmosphere strongly affect the amount of light transmitted by the etalon and can be related to gas concentration. The instrument that we have developed detects the absorption of various atmospheric trace gases in direct or reflected sunlight. Our instrument employing Fabry-Perot interferometer makes use of two features to achieve high sensitivity. The first is high spectral resolution enabling one to match the width of an atmospheric absorption feature by the instrumental band pass. The second is high optical throughput enabled by using multiple spectral lines simultaneously. For any species that one wishes to measure, this first feature is available while the use of multiple spectral features can be employed only for species with suitable spectra and freedom from interfering species in the same wavelength region. We have developed an instrument for use as ground based, airborne and satellite sensor for gases such as carbon dioxide (1570 nm), oxygen (762 nm and 768 nm lines sensitive to changes in oxygen pressure and oxygen temperature) and water vapor (940 nm). Our current goal is to develop an ultra precise, inexpensive, ground based device suitable for wide deployment as a validation instrument for the Orbiting Carbon Observatory (OCO) satellite. We show sensitivity measurements for CO₂, O₂, and H₂O, compare our measurements to those obtained using other types of sensors and discuss some of the peculiarities that must be addressed in order to provide the very high quality column detection required for solving problems about global distribution of greenhouse gases and climatological models. In another area of research we are interested in developing a small-size channel for CO₂ capable of doing simultaneous measurements with the AERONET (Aerosol Robotic Network) at NASA, Goddard to study the hypothesis that atmospheric aerosols affect the regional terrestrial carbon cycle. We present recent data from our ground based measurements of O₂, CO₂, H₂O and (13)CO₂ and discuss extension of the technique to new species and applications.

Derived from text

Absorption Spectra; Atmospheric Composition; Interferometry; Radiometers; Earth Atmosphere; Remote Sensing; Remote Sensors

20070035884 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Initial Performance Assessment of CALIOP

Winker, David; Hunt, Bill; McGill, Matthew; [2007]; 18 pp.; In English; Original contains black and white illustrations; Copyright; Avail.: CASI: [A03](#), Hardcopy

The Cloud-Aerosol Lidar with Orthogonal Polarization (CALIOP, pronounced the same as 'calliope') is a spaceborne two-wavelength polarization lidar that has been acquiring global data since June 2006. CALIOP provides high resolution vertical profiles of clouds and aerosols, and has been designed with a very large linear dynamic range to encompass the full range of signal returns from aerosols and clouds. CALIOP is the primary instrument carried by the Cloud-Aerosol Lidar and Infrared Pathfinder Satellite Observations (CALIPSO) satellite, which was launched on April, 28 2006. CALIPSO was developed within the framework of a collaboration between NASA and the French space agency, CNES. Initial data analysis and validation intercomparisons indicate the quality of data from CALIOP meets or exceeds expectations. This paper presents a description of the CALIPSO mission, the CALIOP instrument, and an initial assessment of on-orbit measurement performance.

Derived from text

Aerosols; Optical Radar; Clouds (Meteorology); Remote Sensing; Meteorology; Earth Observations (From Space)

20070035913 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

UAV-Based L-Band SAR with Precision Flight Path Control

Madsen, Soren N.; Hensley, Scott; Wheeler, Kevin; Sadowy, Greg; Miller, Tim; Muellerschoen, Ron; Lou, Yunling; Rosen, Paul; November 8, 2004; 10 pp.; In English; Remote Sensing of the Atmosphere, Ocean, Environment, and Space, 8-11 Nov. 2004, Honolulu, HI, USA; Original contains color illustrations; Copyright; Avail.: Other Sources

ONLINE: <http://hdl.handle.net/2014/40529>

NASA's Jet Propulsion Laboratory is currently implementing a reconfigurable polarimetric L-band synthetic aperture radar (SAR), specifically designed to acquire airborne repeat track interferometric (RTI) SAR data, also known as differential interferometric measurements. Differential interferometry can provide key displacement measurements, important for the scientific studies of earthquakes and volcanoes. Using precision real-time GPS and a sensor controlled flight management system, the system will be able to fly predefined paths with great precision. The radar will be designed to operate on a UAV (Unmanned Aerial Vehicle) but will initially be demonstrated on a minimally piloted vehicle (MPV), such as the Proteus build by Scaled Composites. The application requires control of the flight path to within a 10 meter tube to support repeat track and formation flying measurements. The design is fully polarimetric with an 80 MHz bandwidth (2 meter range resolution) and 16 kilometer range swath. The antenna is an electronically steered array to assure that the actual antenna pointing can be controlled independent of the wind direction and speed. The system will nominally operate at 45,000 ft. The program started out as a Instrument Incubator Project (IIP) funded by NASA Earth Science and Technology Office (ESTO).

Author

Interferometry; Synthetic Aperture Radar; Flight Control; Global Positioning System; Remote Sensing; Pilotless Aircraft

20070035968 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

Increasing Access and Usability of Remote Sensing Data: The NASA Protected Area Archive

Geller, Gary N.; November 22, 2004; 7 pp.; In English; 25th Asian Conference on Remote Sensing, 22-26 Nov. 2004, Chiang Mai, Thailand; Original contains black and white illustrations; Copyright; Avail.: Other Sources

ONLINE: <http://hdl.handle.net/2014/40531>

Although remote sensing data are now widely available, much of it at low or no-cost, many managers of protected conservation areas do not have the expertise or tools to view or analyze it. Thus access to it by the protected area management community is effectively blocked. The Protected Area Archive will increase access to remote sensing data by creating collections of satellite images of protected areas and packaging them with simple-to-use visualization and analytical tools. The user can easily locate the area and image of interest on a map, then display, roam, and zoom the image. A set of simple tools will be provided so the user can explore the data and employ it to assist in management and monitoring of their area. The 'Phase 1' version requires only a Windows-based computer and basic computer skills, and may be of particular help to protected area managers in developing countries.

Author

Data Bases; Remote Sensing; Satellite Imagery

20070035993 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

Estimation of Forest Fuel Load from Radar Remote Sensing

Saatchi, Sassan; Despain, Don G.; Halligan, Kerry; Crabtree, Robert; IEEE Transactions on Geoscience and Remote Sensing; June 2007; Volume 45, No. 6; 3 pp.; In English

Contract(s)/Grant(s): NNS06AA23G; Copyright; Avail.: Other Sources; Abstract Only

ONLINE: <http://dx.doi.org/10.1109/TGRS.2006.887002>

Understanding fire behavior characteristics and planning for fire management require maps showing the distribution of wildfire fuel loads at medium to fine spatial resolution across large landscapes. Radar sensors from airborne or spaceborne platforms have the potential of providing quantitative information about the forest structure and biomass components that can be readily translated to meaningful fuel load estimates for fire management. In this paper, we used multifrequency polarimetric synthetic aperture radar imagery acquired over a large area of the Yellowstone National Park (YNP) by the AIRSAR sensor, to estimate the distribution of forest biomass and canopy fuel loads. Semi-empirical algorithms were developed to estimate crown and stem biomass and three major fuel load parameters, canopy fuel weight, canopy bulk density, and foliage moisture content. These estimates when compared directly to measurements made at plot and stand levels, provided more than 70% accuracy, and when partitioned into fuel load classes, provided more than 85% accuracy. Specifically, the radar generated fuel parameters were in good agreement with the field-based fuel measurements, resulting in coefficients of determination of $R(\text{sup } 2) = 85$ for the canopy fuel weight, $R(\text{sup } 2) = .84$ for canopy bulk density and $R(\text{sup } 2) = 0.78$ for the foliage biomass.

Author

Remote Sensing; Forests; Synthetic Aperture Radar; Fire Control; Fuels; Algorithms; Radar Imagery; Polarimetry

20070036041 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

An Integrated Multiangle, Multispectral, and Polarimetric Imaging Concept for Aerosol Remote Sensing from Space

Diner, David J.; Chipman, Russell A.; Beaudry, Neil; Cairns, Brian; Foo, Leslie D.; Macenka, Steven A.; Cunningham, Thomas J.; Seshadri, Suresh; Keller, Christoph; November 8, 2004; 9 pp.; In English; SPIE Asia Pacific Environmental Remote Sensing Symposium, 8-12 Nov. 2004, Honolulu, HI, USA; Original contains black and white illustrations; Copyright; Avail.: Other Sources

ONLINE: <http://hdl.handle.net/2014/40521>

Techniques for passive remote sensing of aerosol optical and microphysical properties from space include visible, near and shortwave-infrared imaging (e.g., from MODIS), multiangle intensity imaging (e.g., ATSR-2, AATSR, MISR), near-ultraviolet mapping (e.g., TOMSIOMI), and polarimetry (e.g., POLDER, APS). Each of these methods has unique strengths. In this paper, we present a concept for integrating these approaches into a unified sensor. Design goals include spectral coverage from the near-UV to the shortwave infrared; intensity and polarimetric imaging simultaneously at multiple view angles; global coverage within a few days; kilometer to sub-kilometer spatial resolution; and measurement of the degree of linear polarization (DOLP) for a subset of the spectral complement with an uncertainty of 0.5% or less.

Author

Infrared Imagery; Remote Sensing; Optical Properties; Aerosols; Imaging Techniques; Imaging Spectrometers; MODIS (Radiometry)

20070036252 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Application of NASA Giovanni to Coastal Zone Remote Sensing Research

Acker, James; Leptoukh, Gregory; Kempster, Steven; Berrick, Stephen; Rui, Hualan; Shen, Suhung; June 04, 2007; 13 pp.; In English; European Association of Remote Sensing Laboratories (EARSeL) 2007 Annual Symposium, 4-6 Jun. 2007, Bolzano, Italy; Original contains black and white illustrations; No Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: <http://hdl.handle.net/2060/20070036252>

The Goddard Earth Sciences Data and Information Services Center (GES DISC) Interactive Online Visualization AND aNalysis Infrastructure (Giovanni) provides rapid access to, and enables effective utilization of, remotely-sensed data that are applicable to investigations of coastal environmental processes. Data sets in Giovanni include precipitation data from the Tropical Rainfall Measuring Mission (TRMM), particularly useful for coastal storm investigations; ocean color radiometry data from the Sea-viewing Wide Field-of-view Sensor (SeaWiFS) and Moderate Resolution Imaging Spectroradiometer (MODIS), useful for water quality evaluation, phytoplankton blooms, and terrestrial-marine interactions; and atmospheric data from MODIS and the Advanced Infrared Sounder (AIRS), providing the capability to characterize atmospheric variables. Giovanni provides a simple interface allowing discovery and analysis of environmental data sets with accompanying graphic visualizations. Examples of Giovanni investigations of the coastal zone include hurricane and storm impacts, hydrologically-

induced phytoplankton blooms, chlorophyll trend analysis, and dust storm characterization. New and near-future capabilities of Giovanni will be described.

Author

On-Line Systems; Scientific Visualization; Remote Sensing; TRMM Satellite; Sea-Viewing Wide Field-of-View Sensor; MODIS (Radiometry); Coasts

20070036284 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Simulation Studies of the Effect of Forest Spatial Structure on InSAR Signature

Sun, Guoqing; Liu, Dawei; Ranson, K. Jon; Koetz, Benjamin; March 12, 2007; 1 pp.; In English; 10th International Symposium on Physical Measurements and Signatures in Remote Sensing, ISPRS, 12-14 Mar. 2007, Davos, Switzerland; Copyright; Avail.: Other Sources; Abstract Only

The height of scattering phase retrieved from InSAR data is considered being correlated with the tree height and the spatial structure of the forest stand. Though some researchers have used simple backscattering models to estimate tree height from the height of scattering center, the effect of forest spatial structure on InSAR data is not well understood yet. A three-dimensional coherent radar backscattering model for forest canopies based on realistic three-dimensional scene was used to investigate the effect in this paper. The realistic spatial structure of forest canopies was established either by field measurements (stem map) or through use of forest growth model. Field measurements or a forest growth model parameterized using local environmental parameters provides information of forest species composition and tree sizes in certain growth phases. A fractal tree model (L-system) was used to simulate individual 3-D tree structure of different ages or heights. Trees were positioned in a stand in certain patterns resulting in a 3-D medium of discrete scatterers. The radar coherent backscatter model took the 3-D forest scene as input and simulates the coherent radar backscattering signature. Interferometric SAR images of 3D scenes were simulated and heights of scattering phase centers were estimated from the simulated InSAR data. The effects of tree height, crown cover, crown depth, and the spatial distribution patterns of trees on the scattering phase center were analyzed. The results will be presented in the paper.

Author

Forests; Radar Scattering; Signatures; Simulation; Spatial Distribution; Synthetic Aperture Radar; Three Dimensional Models; Remote Sensing

20070036377 Army Engineer Research and Development Center, Vicksburg, MS USA

Geophysical Surveys for Assessing Levee Foundation Conditions, Sacramento River Levees, Sacramento, CA

Lipis, Jose L; Smith, Eric W; North, Ryan E; Jul 2007; 61 pp.; In English; Original contains color illustrations
Report No.(s): AD-A470918; ERDC/GSL-TR-07-21; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Effective flood and coastal storm emergency response depends on the ability of emergency managers to obtain information on the condition of flood damage reduction structures in near-real time. This report describes the results of a series of geophysical investigations performed to determine the potential of geophysical methods to provide supplemental geologic data between existing borings in a rapid fashion in an area of complex geology located along the toe of the Sacramento River levees. The geophysical study was conducted along selected portions of the Sacramento River levee between Natomas Cross Canal and Powerline Road. Electromagnetic, ground penetrating radar and capacitively-coupled resistivity surveys were conducted to infer soil type.

DTIC

Geophysics; Ground Penetrating Radar; Rivers; Surveys

20070036632 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Laboratory-Based BRDF Calibration of Radiometric Tarps

Georgiev, Georgi T.; Butler, James J.; March 06, 2007; 41 pp.; In English; Original contains color and black and white illustrations; Copyright; Avail.: CASI: [A03](#), Hardcopy

The current study provides the remote sensing community with important high accuracy laboratory-based BRDF calibration of radiometric tarps. The results illustrate the dependence of tarps' weft and warp threads orientation on BRDF. The study was done at incident angles of 0deg, 10deg, and 30deg; scatter zenith angles from 0deg to 60deg, and scatter azimuth angles of 0deg, 45deg, 90deg, 135deg, and 180deg. The wavelengths were 485nm, 550nm, 633nm and 800nm. The dependence is well defined at all measurement geometries and wavelengths. It can be as high as 8% at 0deg incident angle and 2% at 30deg incident angle. The fitted BRDF data show a very small discrepancy from the measured ones. New data on the forward and backscatter properties of radiometric tarps is reported. The backward scatter is well pronounced for the white

samples. The black sample has well pronounced forward scatter. The BRDF characterization of radiometric tarps can be successfully extended to other structured surface fabric samples. The results are NIST traceable.

Author

Remote Sensing; Fabrics; Threads; Calibrating; Azimuth; Zenith

20070036724 NASA Marshall Space Flight Center, Huntsville, AL, USA

Impacts of Urbanization in the Coastal Tropical City of San Juan, Puerto Rico

Comarazamy, Daniel E.; Gonzalez, Jorge E.; Luvall, Jeffrey C.; Rickman, Douglass; September 08, 2007; 2 pp.; In English; AMS 2007 Seventh Conference on Coastal Atmospheric and Oceanic Prediction and Processes, 8-15 Sep. 2007, San Diego, CA, USA; No Copyright; Avail.: Other Sources; Abstract Only

Urban sprawl in tropical locations is rapidly accelerating and it is more evident in islands where a large percentage of the population resides along the coasts. This paper focuses on the analysis of the impacts of land use and land cover for urbanization in the tropical coastal city of San Juan, in the Caribbean island of Puerto Rico. A mesoscale numerical model, the Regional Atmospheric Modeling System (RAMS), is used to study the impacts of land use for urbanization in the environment including specific characteristics of the urban heat island in the San Juan Metropolitan Area (SJMA), one of the most noticeable urban cores of the Caribbean. The research also makes use of the observations obtained during the airborne San Juan Atlas Mission. Surface and raw insonde data from the mission are used to validate the atmospheric model yielding satisfactory results. Airborne high resolution remote sensing data are used to update the model's surface characteristics in order to obtain a more accurate and detailed configuration of the SJMA and perform a climate impact analysis based on land cover/land use (LCLU) changes. The impact analysis showed that the presence of the urban landscape of San Juan has an impact reflected in higher air temperatures over the area occupied by the city, with positive values of up to 2.5 degrees C, for the simulations that have specified urban LCLU indexes in the model's bottom boundary. One interesting result of the impact analysis was the finding of a precipitation disturbance shown as a difference in total accumulated rainfall between the present urban landscape and with a potential natural vegetation, apparently induced by the presence of the urban area. Results indicate that the urban-enhanced cloud formation and precipitation development occur mainly downwind of the city, including the accumulated precipitation. This spatial pattern can be explained by the presence of a larger urbanized area in the southwest sector of the city, and of the approaching northeasterly trade winds.

Author

Urban Development; Atmospheric Models; Land Use; Heat Islands; Remote Sensing; Air

20070036750 Naval Postgraduate School, Monterey, CA USA

Extensible 3D (X3D) Earth Technical Requirements Workshop Summary Report

Brutzman, Don; Sadagic, Amela; Norbraten, Terry; Aug 1, 2007; 156 pp.; In English; Original contains color illustrations Contract(s)/Grant(s): MIPR6MCE20042A

Report No.(s): AD-A470643; NPS-MV-07-003; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470643>

The initial X3D Earth Technical Requirement Workshop called together leading experts to determine a broad set of technical requirements that will be necessary to construct an X3D Earth. This workshop was held 14-15 November 2006 at the Naval Postgraduate School (NPS) in Monterey, California, USA. The main goal in the creation of an Extensible 3D (X3D) Earth will be achieved by Web3D Consortium members who are preparing to build a standards-based suite of software tools usable by governments, industry, scientists, academia and the general public. X3D mappings of world terrain, cartography and imagery will be made available for use in any scene, making it easy to geospatially reference and share X3D models. Open standards, the Web architecture, utilization of the Extensible Markup Language (XML) and open protocols will be leveraged throughout. Both commercial and open-source software codebases will be able to utilize these best practices and contribute to these shared assets. The goal of this technical requirements workshop was for participants to identify and prioritize the technical requirements, available capabilities, open challenges and strategic partnerships needed for a Web3D working group to execute this ambitious project. Emphasis was placed on extensibly adapting existing resources and in cooperation towards achieving shared goals, especially with other open geospatial organizations and standards. These workshop results document participant contributions, next-step activities and goal milestones. The workshop concluded that X3D Earth is feasible and that the effort can be started now. Many resources are already available, yet work will be needed to make them compatibly available. No showstoppers were discovered; a nice surprise after so many diverse inputs. Finally, lots of collaboration and coordinated work are needed to proceed successfully in order to build a web-services infrastructure and develop a server-side specification to enable X3D Earth.

DTIC

Document Markup Languages; Protocol (Computers); Earth (Planet)

20070036795 NASA Marshall Space Flight Center, Huntsville, AL, USA

Diurnal Lightning Distributions as Observed by the Optical Transient Detector (OTD) and the Lightning Imaging Sensor (LIS)

Bailey, Jeff C.; Blakeslee, Richard J.; Buechler, Dennis E.; Christian, Hugh J.; August 13, 2007; 1 pp.; In English; International Conferences on Atmospheric Electricity (ICAE), 13-17 Aug. 2007, Beijing, China; Copyright; Avail.: Other Sources; Abstract Only

Data obtained from the OTD (April 1995 to March 2000) and LIS (December 1997 to December 2005) satellites (70 and 35 degree inclination low earth orbits, respectively) are used to statistically determine the number of flashes in the diurnal cycle both as a function of local and universal time. Also included are global flash density maps. The data are further subdivided by season, continental versus oceanic, night time versus day time, northern versus southern hemisphere, and other regions of interest. The data include corrections for detection efficiency and instrument view time. The data are compared with both the 'Carnegie Curve' and the diurnal global thunderstorm contributions from thunderday statistics from different continents, and are found to agree closely in phase and amplitude with the global thunderday statistics. The analysis also indicates that the southern hemisphere spring (September to November) has larger amplitude than the southern hemisphere fall (March to May). This may be due to differences in the contribution from the Brazilian rain forest during these periods. In general, as highlighted by a difference analysis, more lightning is observed in local springtime than the fall for continental locations, while oceanic regions display an opposite effect. For some areas of the world, the peak of diurnal curve appears to be shifted to later in the evening.

Author

Lightning; Diurnal Variations; Thunderstorms; Remote Sensing; Remote Sensors

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ENERGY PRODUCTION AND CONVERSION

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

20070035061 Naval Postgraduate School, Monterey, CA USA

Indium Gallium Nitride Multijunction Solar Cell Simulation Using Silvaco Atlas

Garcia Jr , Baldomero; Jun 2007; 113 pp.; In English; Original contains color illustrations

Report No.(s): AD-A470036; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470036>

This thesis investigates the potential use of wurtzite Indium Gallium Nitride as photovoltaic material. Silvaco Atlas was used to simulate a quad-junction solar cell. Each of the junctions was made up of Indium Gallium Nitride. The band gap of each junction was dependent on the composition percentage of Indium Nitride and Gallium Nitride within Indium Gallium Nitride. The findings of this research show that Indium Gallium Nitride is a promising semiconductor for solar cell use.

DTIC

Gallium Nitrides; Indium; Simulation; Solar Cells

20070035148 Naval Postgraduate School, Monterey, CA USA

Indium Gallium Nitride Multijunction Solar Cell Simulation Using Silvaco Atlas

Garcia Jr , Baldomero; Jun 2007; 113 pp.; In English; Original contains color illustrations

Report No.(s): AD-A470036; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470036>

This thesis investigates the potential use of wurtzite Indium Gallium Nitride as photovoltaic material. Silvaco Atlas was used to simulate a quad-junction solar cell. Each of the junctions was made up of Indium Gallium Nitride. The band gap of each junction was dependent on the composition percentage of Indium Nitride and Gallium Nitride within Indium Gallium Nitride. The findings of this research show that Indium Gallium Nitride is a promising semiconductor for solar cell use.

DTIC

Gallium Nitrides; Indium; Simulation; Solar Cells

20070035166 Naval Postgraduate School, Monterey, CA USA

Linear and Planar Array Formation in Wireless Sensor Networks

Gkionis, Charalampos; Jun 2007; 124 pp.; In English; Original contains color illustrations

Report No.(s): AD-A470075; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470075>

Wireless sensor networking (WSN) is a relatively new field of research with many applications, both military and commercial. In the military applications, WSNs could be used in hostile environments to minimize the need for human presence. A WSN consists of a large number of small sensor nodes that are deployed in an area of interest for collecting information. A subgroup of nodes then collaborate their transmissions to achieve beamforming. The information collected by the WSN is relayed to an unmanned aerial vehicle (UAV), which is synchronized with the transmission beam of the network. This study investigates the positioning of the nodes in a WSN to find a method that will ensure the best combination of nodes for beamforming given a random distribution in the sensor field. Additionally, the method is expandable in two dimensions and capable of forming a planar antenna array that will improve the beamforming gain. A simulation model was developed in MATLAB code to study the formation of linear and planar antenna arrays of nodes. When the existing iterative method used to form a linear antenna array was compared with the proposed method, the results showed an improvement in linearity.

DTIC

Antenna Arrays; Beamforming; Computer Networks; Electric Power Transmission; Fitting; Linear Arrays; Planar Structures; Wireless Communication

20070036118 Texas Univ., Austin, TX USA

A Feasibility Study of RF Time-Domain Reflectometry as a Railgun Armature Tracking Technique

Levinson, S; Stefani, F; Snyder, E; Aug 8, 2007; 13 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAAD17-01-D-0001-0012

Report No.(s): AD-A470653; IAT.R-0475; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470653>

Since past investigations have shown that radio frequency (RF) signal transmission in the bore of a railgun can be practical, the feasibility of using time domain reflectometry and well-established transmission line theory is investigated as a means to determine armature position during launch. This report describes the transmission line model of the HEMCL and initial measurements suggesting that such an approach might be used to provide dynamic armature position profiles. However, subsequent continuous wave analyses of RF transmission line measurements shows that the electrical transmission line characteristics of the HEMCL railgun make it unfeasible to use RF time-domain reflectometry to characterize its dynamic behavior. The laminated containment structure enclosing copper rails of the HEMCL form a very lossy, poorly matched transmission line making it impractical to couple the RF signal into it; high RF attenuation diminishes that portion of the signal that it is coupled. Measurements showed that signals below 900 MHz are completely reflected at the 50-ohm/HEMCL-muzzle interface. A fraction of RF signals at higher frequencies (900-2400 MHz) can be coupled, but will attenuate by 20 dB or more after propagating only a few tens of centimeters.

DTIC

Armatures; Electromagnetic Pulses; Feasibility; Optical Measurement; Radio Frequencies; Railgun Accelerators

20070036624 Naval Undersea Warfare Center, Newport, RI USA

Battery Monitoring and Charging System

Thivierge, Daniel P, Inventor; Jul 31, 2007; 17 pp.; In English

Report No.(s): AD-D020305; No Copyright; Avail.: Other Sources

A battery monitoring device for a battery having cells grouped in modules. The device includes a monitoring circuit for each module which monitors the voltage in each cell and the overall module voltage. The monitoring circuits can also detect module temperatures. The monitoring circuits are networked to a control computer. The device can be used with a power supply and relays for each module to interrupt charging when a fault condition is detected by the monitoring circuits. Other features of the device allow equalization of cells having excessive voltages.

DTIC

Circuits; Electric Batteries; Storage Batteries

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*.

20070035199 Naval Postgraduate School, Monterey, CA USA

Test and Evaluation of the Micro-Observer Sensor System for Use as a Seismic Surveillance Device in an Integrated Sensor Network

Fry, Bryan D; Jun 2007; 219 pp.; In English; Original contains color illustrations

Report No.(s): AD-A470120; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470120>

This thesis investigated the feasibility of deploying unattended seismic ground sensors in an operational environment to provide persistent surveillance and early warning detection capabilities. The system employed was the commercially available MicroObserver Sensor System. A robust testing and evaluation plan was created to measure the system's objective performance based on specific criteria. The tests focused on the capabilities of the sensor system across a broad range of deployment environments. Tests were conducted to determine probabilities of detection, battery life, and operational effectiveness. Prediction models of the sensor system's ability to detect targets also were created to assist planners in assessing the utility of the MicroObserver Sensor System in specific operations. Although the sensing capabilities satisfied the established metrics, the sensor system possessed inherent limitations inhibiting its adequacy for use in many military operations. However, the sensor network would work well in many security applications where specific sensor system weaknesses could be anticipated and mitigated.

DTIC

Computer Networks; Detection; Evaluation; Security; Seismic Waves; Surveillance; System Effectiveness; Warning Systems; Wireless Communication

20070035254 Columbia Univ., Palisades, NY USA

Collaborative Research: Calibration for IMS Stations in Eastern Asia

Richards, Paul; Armbruster, John; Khalturin, Vitaly L; Kim, Won-Young; Schaff, David; Waldhauser, Felix; West, Michael; Jul 2007; 286 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DTRA01-00-C-0031; DTRA01-00-C-0029

Report No.(s): AD-A470217; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470217>

We have completed a three-year consortium effort led by Lamont to improve the capability to locate seismic events based on data acquired by 30 International Monitoring System (IMS) stations in East Asia. We have developed and tested Source Specific Station Corrections (SSSCs) for Pn and Sn travel times at these 30 IMS stations (or suitable surrogates), and for 127 other stations used for validation testing. First we developed SSSCs via a 3-D model of the P-wave velocity for East Asia, and then we refined them empirically by applying a kriging algorithm to travel-time residuals for 525 Ground-Truth (GT) events whose epicenters in East Asia we showed are known to within 5 km. Using a leave-one-out approach, we relocated these 525 events recorded by various combinations of 140 regional stations. Microlocations were reduced for 66% of the events using the model-based SSSCs and for 85% of the events using kringed SSSCs. Meridian miclocation improved from 16.9 km to 11.4 km and 6.5 km respectively. Median error ellipse area was reduced from 2616 sq. km to 1633 sq. km, respectively. Error ellipse coverage was maintained at close to 90%.

DTIC

Asia; Calibrating; Seismic Waves

20070035279 Air Force Research Lab., Hanscom AFB, MA USA

Simultaneous DMSP, All-Sky Camera, and IMAGE FUV Observations of the Brightening Arc at a Substorm Pseudo-Breakup

Yago, K; Shiohara, K; Yumoto, K; Baishev, D G; Solov'yev, S I; Rich, F J; Mar 2007; 6 pp.; In English; Original contains color illustrations

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

Report No.(s): AD-A470262; AFRL-VS-HA-TR-2007-1060; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470262>

Auroral particles, field-aligned currents, and plasma convections in the vicinity of the brightening arc at substorm onset

are still not well understood, since it is very rare to have conjugate satellite measurements above the brightening arc. In this paper, we investigate the characteristics of auroral particles and fields associated with the brightening arc at a pseudo-onset of substorm on October 31, 2000, using ground all-sky TV images, IMAGE FUV auroral images, and particle, magnetic field, and plasma flow data obtained by the DMSP F12 satellite. The arc brightening at Tixie (66.0 MLAT), Russia, occurred at 1004 UT (18.75 MLT) coincident with a coherent Pi 2 pulsation at midlatitudes and with the DMSP crossing above the arc. The brightening arc did not develop on a global scale, indicating that this event is a pseudo auroral breakup, which occurred approximately 16 min before the major substorm expansion onset. IMAGE aurora images indicate that the longitude of the brightening center was approximately 2.5 h nightside of Tixie. The DMSP data show that the precipitating particles associated with the brightening arc correspond to an electron inverted-V structure at the equatorward edge of the electron precipitation region, near the equatorward boundary of the upward region I field-aligned current, and at the peak of the sunward convection velocity. These facts indicate that the brightening arc at duskside of the onset local time was located in the inner plasma sheet at the inner edge of the region I current source in the sunward convection region.

DTIC

Auroras; Cameras; Dmsp Satellites; Magnetic Storms; Plasma Sheaths; Sky Brightness

20070035543 Arcon Corp., Waltham, MA USA

Observation of Tidal Effects on LWIR Radiance Above the Mesopause

Wintersteiner, Peter; Mar 7, 2007; 39 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): FA718-04-C-0031; Proj-2301

Report No.(s): AD-A470415; No Copyright; Avail.: Defense Technical Information Center (DTIC)

An examination of CO₂ infrared limb radiance, directly measured by the SABER instrument aboard the TIMED satellite, reveals unusual structure in the region just above the mesopause, at tangent heights of 95-110 km. Global coverage afforded by SABER makes it possible to investigate this behavior, which includes prominent regions with positive radiance Gradients, as a function of latitude, local time, and season. The local-time dependence, in particular, suggests a role for atmospheric tides using a tidal model, Global Scale Wave Model, and our non-GTE ARC rode, we modeled the 15 Om radiance. These calculations reproduced the main features of the Global radiance structure, including the heights where positive Gradients occur, and its variation with local time for different latitudes and seasons. The conclusion is that tidal perturbation of the temperature field in the lower thermosphere is directly responsible for the observed variability of the long-wave infrared limb radiance.

DTIC

Atmospheric Tides; Mesopause; Radiance; Tides

20070035572 Arizona Univ., Tucson, AZ USA

Using Limited Time Periods as a Means to Elucidate Microwave Sounding Unit Derived Tropospheric Temperature Trend Methods

Randall, Robb M; Jul 2007; 109 pp.; In English; Original contains color illustrations

Report No.(s): AD-A470470; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Limited Time Period (LTP) running trends are used to elucidated Microwave Sounding Unit (MSU) derived tropospheric temperature trend methods. Regression derived coefficients were used to combine lower stratosphere (LS) and mid-troposphere to lower stratosphere (MT) simulated MSU channels from RATPAC radiosonde data using sites not found to have long-term cooling biases. This combination is used to estimate tropospheric temperature trends and then is compared to the actual RATPAC derived tropospheric temperature trends. It is found that statistical LS/MT combination results in greater than 30% error over some LTP. These errors are found to exist when strong cooling in the stratosphere is coincident with the zero trend level above the tropopause. LTP trends are also created from various MSU difference time series between the University of Alabama in Huntsville (UAH) and Remote Sensing System (RSS) group's lower troposphere (LT) and MT channels. This is accomplished in an effort to determine the causes of the greatest discrepancies between the two data sets. Results indicate the greatest discrepancies were over time periods where NOAA- 11 through NOAA-15 adjustments were applied to the raw LT data over land. Discrepancies in the LT channel are shown to be dominated by differences in diurnal correction methods due to orbital drift; however, discrepancies from target parameter differences are also present. Comparison of MSU data with radiosonde data indicate that RSS's method (use of climate model) of determining diurnal effects is overestimating the correction in the LT channel. Diurnal correction signatures still exist in the RSS LT time series and are likely affecting the long term trend with a warm bias. Using these findings it is shown that atmospheric amplification is not happening in globally averaged observations over the MSU era.

DTIC

Atmospheric Temperature; Microwave Sounding; Stratosphere; Troposphere

20070035828 Polytechnic Univ., Brooklyn, NY USA

Basis of Ionospheric Modification by High-Frequency Waves

Kuo, S P; Jun 2007; 21 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): FA8718-04-C-0001; Proj-4827

Report No.(s): AD-A470291; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The requirements of achieving ionospheric modification by ground-transmitted HF heating waves are discussed. The directly relevant processes including linear mode conversion and parametric instabilities are explained physically. The nonlinear & Schrodinger equation for Langmuir waves is reviewed and the initial conditions of two types of nonlinear solutions are discussed; from which the criterion for Langmuir soliton generation is pointed out.

DTIC

Ionospheric Disturbances; High Frequencies; Electromagnetic Surface Waves

47

METEOROLOGY AND CLIMATOLOGY

Includes weather observation forecasting and modification.

20070035063 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Water Vapor Profiling From CoSSIR Radiometric Measurements

Wang, James R.; Chang, L. Aron; Monosmith, B.; Zhang, Z.; [2007]; 34 pp.; In English; Original contains color and black and white illustrations; Copyright; Avail.: Other Sources

Previous water vapor profiling by millimeter-wave radiometry using the 183 GHz absorption line is generally limited to an altitude range of 0-11 km. The additional measurements at the frequencies of 380.2k \pm 0.8, 380.2k \pm 1.8, 380.2k3.3, and 380.2k \pm 6.2 GHz by the new airborne Compact Scanning Submillimeter-wave Imaging Radiometer (CoSSIR) reported in this paper can extend this profiling capability up to an altitude of about 15 km. This is demonstrated by recent CoSSIR measurements on board the NASA WB-57 aircraft in a flight from Texas to Costa Rica on January 14, 2006. Retrievals or water vapor mixing ratio were performed at eight altitudes of 1, 3, 5, 7, 9, 11, 13, and 15 km from the CoSSIR data set acquired at observational angles of 0 and 53.4 degrees. The results were compared with other available measurements from the same aircraft and near-concurrent satellites. The variations of mixing ratios retrieved from CoSSIR and those derived from the JPL LASER Hygrometer (JLH) in the aircraft vicinity, appears to show some connection, although the measurements were referring to different altitudes. A very good agreement was found between the collocated values of total precipitable water derived from the CoSSIR-retrieved water vapor profiles and those estimated from TMI (TRMM Microwave Imager). The accuracy of the retrievals was inferred from an analysis of in-flight CoSSIR radiometric signal fluctuations.

Author

Water Vapor; TRMM Satellite; Hygrometers; Submillimeter Waves; Radiometers; Estimating; Atmospheric Moisture

20070035068 NASA Langley Research Center, Hampton, VA, USA

The Effect of Cumulus Cloud Field Anisotropy on Domain-Averaged Solar Fluxes and Atmospheric Heating Rates

Hinkelman, Laura M.; Evans, K. Franklin; Clothiaux, Eugene E.; Ackerman, Thomas P.; Stackhouse, Paul W., Jr.; August 21, 2006; 51 pp.; In English; Original contains color and black and white illustrations

Contract(s)/Grant(s): 354048-AQ5; 354879-AQ5; DE-FG02-90ER-61071; DE-A1005-90ER-61069; WBS 509496-02.01.01.13; Copyright; Avail.: CASI: A04, Hardcopy

Cumulus clouds can become tilted or elongated in the presence of wind shear. Nevertheless, most studies of the interaction of cumulus clouds and radiation have assumed these clouds to be isotropic. This paper describes an investigation of the effect of fair-weather cumulus cloud field anisotropy on domain-averaged solar fluxes and atmospheric heating rate profiles. A stochastic field generation algorithm was used to produce twenty three-dimensional liquid water content fields based on the statistical properties of cloud scenes from a large eddy simulation. Progressively greater degrees of x-z plane tilting and horizontal stretching were imposed on each of these scenes, so that an ensemble of scenes was produced for each level of distortion. The resulting scenes were used as input to a three-dimensional Monte Carlo radiative transfer model. Domain-average transmission, reflection, and absorption of broadband solar radiation were computed for each scene along with the average heating rate profile. Both tilt and horizontal stretching were found to significantly affect calculated fluxes, with the amount and sign of flux differences depending strongly on sun position relative to cloud distortion geometry. The mechanisms by which anisotropy interacts with solar fluxes were investigated by comparisons to independent pixel approximation and tilted independent pixel approximation computations for the same scenes. Cumulus anisotropy was found

to most strongly impact solar radiative transfer by changing the effective cloud fraction, i.e., the cloud fraction when the field is projected on a surface perpendicular to the direction of the incident solar beam.

Author

Cumulus Clouds; Atmospheric Heating; Isotropy; Anisotropy; Wind Shear; Solar Radiation; Large Eddy Simulation; Radiation Absorption

20070035076 NASA Langley Research Center, Hampton, VA, USA

Initial Performance Assessment of CALIOP

Winker, Dave; Hunt, Bill; McGill, Matt; [2007]; 14 pp.; In English; Original contains color illustrations; Copyright; Avail.: Other Sources

The Cloud-Aerosol Lidar with Orthogonal Polarization (CALIOP, pronounced the same as 'calliope') is a spaceborne two-wavelength polarization lidar which has been acquiring global data since June 2006. CALIOP has been optimized to measure high resolution vertical profiles of clouds and aerosols, and has been designed with a very large linear dynamic range to encompass the full range of signal returns from aerosols and clouds. CALIOP is the primary instrument carried by the Cloud-Aerosol Lidar and Infrared Pathfinder Satellite Observations (CALIPSO) satellite, which was launched on April, 28 2006. CALIPSO was developed within the framework of a collaboration between NASA and the French space agency, CNES. Initial data analysis and validation intercomparisons indicate the quality of data from CALIOP exceeds expectations. This paper presents a description of the CALIPSO mission, the CALIOP instrument, and an initial assessment of on-orbit measurement performance.

Author

Aerosols; Optical Radar; Clouds (Meteorology); CALIPSO (Pathfinder Satellite); Infrared Astronomy

20070035105 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Identification of Atmospheric Influences on the Estimation of Snow Water Equivalent from AMSR-E Measurements

Wang, J. R.; Tedesco, M.; [2007]; 36 pp.; In English; Original contains color illustrations; Copyright; Avail.: Other Sources

Snow is an important component in studying the hydrological, meteorological and climatological cycles because it affects the land surface albedo, the net radiation balance, as well as boundary layer stability. Many rivers originate from melting snow, which represents a major source of fresh water in many regions. Additionally, glaciers could form from accumulated snow packs in the cold regions. Thus, reliable global remote sensing of snow parameters (e.g., Snow Water Equivalent, SWE) is crucial to understand the evolution of the cryosphere for quantifying the water resources and improving the global climate and hydrological models. Radiometric measurements near 19 and 37 GHz (e.g., from SSM/I, AMSR-E) have been used for estimation of SWE for many years. Most conventional SWE retrieval algorithms depend on the difference between the brightness temperatures ($T_{(sub\ b's)}$) at these frequencies. The effect of atmospheric absorption on SWE estimation is generally assumed to be insignificant, and thus often not taken into account in such estimation. In this paper this effect is closely examined with the aid of AMSR-E and radiosonde data sets over two widely separated regions in the continental U.S.A. Results of the analysis show that even under a clear sky the atmospheric absorption could account for as much as approx. 25-50 % to the estimation of SWE. Under cloudy conditions, the impact of liquid cloud absorption is significant and it appears necessary to perform either cloud screening or quantify the cloud effects on SWE estimation from 19 and 37 GHz radiometric measurements. It is important to account for these atmospheric effects for more reliable SWE estimation

Author

Snow; Hydrology Models; Climatology; Climate Models; Atmospheric Effects; Albedo; Atmospheric Radiation; Radiosondes; Brightness Temperature

20070035131 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Solar Occultation Satellite Data and Derived Meteorological Products: Sampling Issues and Comparisons with Aura MLS

Manney, Gloria; Daffer, William H.; Zawodny, Joseph M.; Bernath, Peter F.; Hoppel, Karl W.; Walker, Kaley A.; Knosp, Brian W.; Boone, Chris; Remsberg, Ellis E.; Santee, Michelle L.; Harvey, V. Lynn; Pawson, Steven; Jackson, David R.; Deaver, Lance; Pumphrey, Hugh C.; Lambert, Alyn; Schwartz, Michael J.; Froidevaux, Lucien; McLeod, Sean; Takacs, Lawrence L.; Suarez, Max J.; Trepte, Charles R.; Livesey, Nathaniel; Harwood, Robert S.; Waters, Joe W.; [2007]; 35 pp.; In English; Original contains color illustrations; Copyright; Avail.: CASI: [A03](#), Hardcopy

Derived Meteorological Products (DMPs, including potential temperature (θ), potential vorticity, equivalent latitude (EqL), horizontal winds and tropopause locations) have been produced for the locations and times of measurements by several

solar occultation (SO) instruments and the Aura Microwave Limb Sounder (MLS). DMPs are calculated from several meteorological analyses for the Atmospheric Chemistry Experiment-Fourier Transform Spectrometer, Stratospheric Aerosol and Gas Experiment II and III, Halogen Occultation Experiment, and Polar Ozone and Aerosol Measurement II and III SO instruments and MLS. Time-series comparisons of MLS version 1.5 and SO data using DMPs show good qualitative agreement in time evolution of O₃, N₂O, H₂O, CO, HNO₃, HCl and temperature; quantitative agreement is good in most cases. EqL-coordinate comparisons of MLS version 2.2 and SO data show good quantitative agreement throughout the stratosphere for most of these species, with significant biases for a few species in localized regions. Comparisons in EqL coordinates of MLS and SO data, and of SO data with geographically coincident MLS data provide insight into where and how sampling effects are important in interpretation of the sparse SO data, thus assisting in fully utilizing the SO data in scientific studies and comparisons with other sparse datasets. The DMPs are valuable for scientific studies and to facilitate validation of non-coincident measurements.

Author

Halogen Occultation Experiment; Meteorological Services; Tropopause; Solar Instruments; Microwave Sounding; Atmospheric Chemistry; Vorticity

20070035136 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Aerosol Radiative Effects on Deep Convective Clouds and Associated Radiative Forcing

Fan, J.; Zhang, R.; Tao, W.-K.; Mohr, I.; [2007]; 47 pp.; In English; Original contains black and white illustrations

Contract(s)/Grant(s): DE-AI02-06ER64177; NSF ATM-04-24885; Copyright; Avail.: CASI: A03, Hardcopy

The aerosol radiative effects (ARE) on the deep convective clouds are investigated by using a spectral-bin cloud-resolving model (CRM) coupled with a radiation scheme and an explicit land surface model. The sensitivity of cloud properties and the associated radiative forcing to aerosol single-scattering albedo (SSA) are examined. The ARE on cloud properties is pronounced for mid-visible SSA of 0.85. Relative to the case excluding the ARE, cloud fraction and optical depth decrease by about 18% and 20%, respectively. Cloud droplet and ice particle number concentrations, liquid water path (LWP), ice water path (IWP), and droplet size decrease significantly when the ARE is introduced. The ARE causes a surface cooling of about 0.35 K and significantly high heating rates in the lower troposphere (about 0.6K/day higher at 2 km), both of which lead to a more stable atmosphere and hence weaker convection. The weaker convection and the more desiccation of cloud layers explain the less cloudiness, lower cloud optical depth, LWP and IWP, smaller droplet size, and less precipitation. The daytime-mean direct forcing induced by black carbon is about 2.2 W/sq m at the top of atmosphere (TOA) and -17.4 W/sq m at the surface for SSA of 0.85. The semi-direct forcing is positive, about 10 and 11.2 W/sq m at the TOA and surface, respectively. Both the TOA and surface total radiative forcing values are strongly negative for the deep convective clouds, attributed mostly to aerosol indirect forcing. Aerosol direct and semi-direct effects are very sensitive to SSA. Because the positive semi-direct forcing compensates the negative direct forcing at the surface, the surface temperature and heat fluxes decrease less significantly with the increase of aerosol absorption (decreasing SSA). The cloud fraction, optical depth, convective strength, and precipitation decrease with the increase of absorption, resulting from a more stable and dryer atmosphere due to enhanced surface cooling and atmospheric heating.

Author

Aerosols; Cloud Physics; Clouds (Meteorology); Convection; Atmospheric Heating; Surface Temperature; Heat Flux; Optical Thickness

20070035266 Naval Research Lab., Bay Saint Louis, MS USA

Validation and Application of Altimetry-Derived Upper Ocean Thermal Structure in the Western North Pacific Ocean for Typhoon-Intensity Forecast

Pun, Iam-Fei; Lin, I-I; Wu, Chau-Ron; Ko, Dong-Shan; Liu, W T; Jun 2007; 16 pp.; In English; Original contains color illustrations

Report No.(s): AD-A470233; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470233>

This paper uses more than 5000 collocated and near coincident in-situ profiles from the National Oceanic and Atmospheric Administration/Global Temperature and Salinity Profile Program database spanning over the period from 2002 to 2005 to systematically validate the satellite-altimetry-derived upper ocean thermal structure in the western North Pacific Ocean as such ocean thermal structure information is critical in typhoon-intensity change. It is found that this satellite-derived information is applicable in the central and the southwestern North Pacific (covering 122-170 degrees E, 9-25 degrees N) but not in the northern part (130-170 degrees E, 25-40 degrees N). However, since > 80% of the typhoons are found to intensify in the central and southern part, this regional dependence should not pose a serious constraint in studying typhoon intensification. Further

comparison with the U.S. Naval Research Laboratory's North Pacific Ocean Nowcast/Forecast System (NPACNFS) hydrodynamic ocean model shows similar regional applicability, but NPACNFS is found to have a general underestimation in the upper ocean thermal structure and causes a large under-estimation of the tropical cyclone heat potential (TCHP) by up to 60 kJ/sq cm. After validation, the derived upper ocean thermal profiles are used to study the intensity change of super typhoon Dianmu (2004). It is found that two upper ocean parameters, i.e., a typhoon's self-induced cooling and the during-typhoon TCHP, are the most sensitive parameters (with $R^2 = 0.7$) to the 6-h intensity change of Dianmu during the study period covering Dianmu's rapid intensification to category 5 and its subsequent decay to category 4. This paper suggests the usefulness of satellite-based upper ocean thermal information in future research and operation that is related to typhoon-intensity change in the western North Pacific.

DTIC

Altimetry; Forecasting; Ocean Models; Oceans; Pacific Ocean; Temperature Distribution; Typhoons

20070035468 Naval Research Lab., Bay Saint Louis, MS USA

Geological and Oceanographic Perspectives on Event Bed Formation during Hurricane Katrina

Keen, T R; Furukawa, Y; Bentley, S J; Slingerland, R L; Teague, W J; Dykes, J D; Rowley, C D; Dec 14, 2006; 6 pp.; In English; Original contains color illustrations

Report No.(s): AD-A470287; NRL/JA/7320-06-6276; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Storm deposits in ancient shelf sediments typically form thick sequences of interbedded sand and mud deposited during shoreline regression, whereas modern shelf sediments are generally thin veneers deposited during shoreline transgression. In this paper we present a preliminary comparison between ancient and modern storm beds deposited in these disparate contexts. Hurricane Katrina deposited a storm bed on the Louisiana shelf with a maximum observed thickness of 0.58 m, which thinned to approximately 0.1 m at 200 km west of landfall. This thickness is similar to event beds observed in both ancient and modern sediments. Using data for tropical cyclone landfalls in the Gulf of Mexico, we estimate the return time for a storm of this size to be 40-50 years in this region. This estimated frequency for deposition of storm beds is useful in evaluating ancient storm sequences that were deposited during similar climatic conditions.

DTIC

Geology; Hurricanes; Oceanography; Sediments; Storms

20070035470 Massachusetts Inst. of Tech., Cambridge, MA USA

Air-Sea Interaction at Contrasting Sites in the Eastern Tropical Pacific: Mesoscale Variability and Atmospheric Convection at 10 deg N

Farrar, J T; Feb 2007; 169 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): NA87RJ0445; NA17RJ1223

Report No.(s): AD-A470292; MIT/WHOI-2007-02; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The role of ocean dynamics in driving air-sea interaction is examined at two contrasting sites on 125 deg W in the eastern tropical Pacific Ocean using satellite data and data from two air-sea interaction moorings. Analysis reveals marked differences in the role of ocean dynamics in modulating sea surface temperature (SST). At a near-equatorial site (3 deg S), the 1997-1998 El Nino event dominated the evolution of SST and surface heat fluxes, and it is found that wind-driven southward Ekman transport was important in the local transition from El Nino to La Nina conditions. At a 10 deg N site near the summertime position of the Inter-tropical Convergence Zone, oceanic mesoscale motions played an important role in modulating SST at intraseasonal (50- to 100-day) timescales. The characteristics and possible generation mechanisms of this mesoscale variability are examined. Focusing on 10 deg N in the eastern tropical Pacific, the hypothesis that mesoscale oceanic SST variability can systematically influence cloud properties is investigated using several satellite data products. A statistically significant relationship between SST and columnar cloud liquid water and surface solar radiation is identified within the wavenumber-frequency band corresponding to oceanic Rossby waves.

DTIC

Air Currents; Air Water Interactions; Atmospheric Circulation; Convection Currents; Mesometeorology; Mesoscale Phenomena; Tropical Regions; Variability

20070035471 Air Force Research Lab., Hanscom AFB, MA USA

Evaluation of WRF Performance for Depicting Orographically-Induced Gravity Waves in the Stratosphere

Hahn, Douglas C; Jun 2007; 10 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): Proj-1010

Report No.(s): AD-A470293; AFRL-VS-HA-TR-2007-1072; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Orographically-induced gravity (buoyancy) waves can propagate through the tropopause to the lower stratosphere causing disruptions to high altitude aircraft operations. In order to forecast this high altitude turbulence (HAT) in real time, there is a need to determine optimal model nesting, vertical structure, upper boundary conditions and diffusion to be able to detect these situations. Besides investigating the abovementioned model options, the WRF-ARW will be closely configured to the operational version used by the Air Force Weather Agency (AFWA). To perform the model evaluation, a case from a field experiment conducted at the Observatoire de Haute-Provence (OHP) in southeastern France between 22 November and 5 December 2004 will be examined. Using a forecast initialized from 00 UTC 23 November, it will be determined how well waves generated by a north/south Mistral type flow over the French Alps north of OHP are represented by the model.

DTIC

Atmospheric Models; Gravity Waves; High Altitude; Mesoscale Phenomena; Models; Stratosphere; Turbulence

20070035482 Naval Research Lab., Bay Saint Louis, MS USA

Which Near-Surface Atmospheric Variable Drives Air-Sea Temperature Difference over the Global Ocean?

Kara, A B; Hurlburt, Harley E; Loh, W -Y; May 15, 2007; 19 pp.; In English; Original contains color illustrations

Report No.(s): AD-A470309; NRL/JA/7304-05-6066; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This paper investigates the influence of atmospheric variables (net solar radiation, wind speed, precipitation and vapor mixing ratio, all of which are at or near the sea surface) on the annual and seasonal cycle of near surface air minus sea surface temperature (Tair-Tsst) over the global ocean. The importance order of these variables is discussed using several statistical methods and two global data sets. After demonstrating that neither Tair nor Tsst exhibit any skill in determining difference between the two, a regression tree model (the so-called Generalized, Unbiased, Interaction Detection and Estimation (GUIDE) algorithm) is used to investigate influences of the atmospheric variables mentioned above in regulating Tair-Tsst. Overall, net solar radiation (sum of net shortwave and longwave radiation) at the sea surface is found to be the most important variable in driving the seasonal cycle of Tair-Tsst over the global ocean when the nonlinear relationship between Tair-Tsst and atmospheric variables is taken into account. This is true for both annual and seasonal (May through August) or monthly (November and December) timescales. Similar to the GUIDE results, a simple linear regression analysis also confirms that the net solar radiation explains most of the variance in the seasonal cycle of Tair-Tsst over most (approx. equal 50%) of the global ocean. The importance of the net solar radiation in controlling Tair-Tsst is even more significant in the regions surrounding the Kuroshio and the Gulf Stream current systems. The results presented in this paper have various implications for air-sea interaction and ocean mixed layer studies.

DTIC

Air Water Interactions; Annual Variations; Atmospheric Temperature; Ocean Surface; Oceans; Solar Radiation; Surface Temperature; Temperature Gradients

20070035485 Scripps Institution of Oceanography, La Jolla, CA USA

Whole Sky Imaging of Clouds in the Visible and IR for Starfire Optical Range

Shields, Janet E; Karr, Monette; Burden, Art R; Johnson, Richard W; Hodgkiss, William S; Jul 31, 2007; 67 pp.; In English

Contract(s)/Grant(s): N00014-01-D-0043-D011

Report No.(s): AD-A470314; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This report describes the work done for the Starfire Optical Range, Kirtland Air Force Base under Contract N00014-01-D-043 DO #11, between 02 September 2004 and 30 April 2006. This work relates to the Air Force's need to characterize the cloud distribution during day and night, for a variety of applications, including support of research into impact of clouds on laser communication and support of satellite tracking. This contract followed Contract N00014-01-D-0043 DO #4, which will be discussed in Section 2, and is documented in Shields et al 2007, Technical Note 271. Under this contract, we began preparing Whole Sky Imager systems for field experiments in support of program goals, adapting the software and refurbishing the hardware. Significant progress was made both in the related cloud algorithms and in methods to assess their accuracy. A related contract was funded through Boeing during 31 January 2005 - 30 November 2005. The tasks completed under that contract are closely related to these tasks, and will also be reported here. In particular, early portions of the night algorithm work reported in Section 7, and early portions of the hardware and software refurbishment were completed partly

under the ONR contract and partly under the Boeing contract. The work under this Boeing contract was finished in May 2005. A follow-on contract, ONR N00014-01-D-0043 DO #13 was funded on 20 April 2006. The work under DO #13 will be reported under a separate report upon completion of the contract.

DTIC

Cameras; Images; Imaging Techniques

20070035499 Washington Univ., Seattle, WA USA

Spatial Averaging of Oceanic Rainfall Variability Using Underwater Sound. Ionian Sea Rainfall Experiment 2004: Acoustic Component

Nystuen, Jeffrey A; Amitai, Eyal; Anagnostou³, Emmanuel N; Anagnostou, Marios N; Jul 2007; 47 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): NSF-0241245

Report No.(s): AD-A470332; APL-UW-TR-0701; No Copyright; Avail.: Defense Technical Information Center (DTIC)

An experiment to evaluate the inherent spatial averaging of the underwater acoustic signal from rainfall was conducted in the winter of 2004 in the Ionian Sea southeast of the coast of Greece. A mooring with four passive aquatic listeners (PALs) at 60, 200, 100, and 2000 m was deployed at 36.85 deg. N, 21.52 deg. E, 17 km west of a dual-polarization X-band coastal radar (XPOL) at Methoni, Greece. A dense rain gauge network was set up in Finikounda, 10 km east from Methoni to calibrate the radar. Eight rain events were recorded during the deployment; six of these events were recorded by both the PALs and the XPOL radar. The acoustic signal is similar at all depths and rainfall was detected at all depths, although the deeper PALs suffered an unexpected sensitivity loss and consequently did not trigger into high sampling mode as often as the shallower PALs. The total accumulation reported is lower for the deeper PALs. The acoustic signal is classified into wind, rain, shipping, and whale categories. The shipping signal increased throughout the deployment. A signal from whales is present roughly 2% of the time, most often at 200 m, and is consistent with the clicking of deep-diving beaked whales, although there was no visual confirmation of whale presence. Acoustic co-detection of rainfall with the radar demonstrates the need to classify the rainfall signal in the presence of other underwater noises. Once detection is made, the correlation between acoustic and radar rainfall rates is high. Spatial averaging of the radar rainfall rates in concentric circles over the mooring shows highest correlations with increasing acoustic recording depth, verifying the larger inherent spatial averaging of the rainfall signal with recording depth. For the PAL at 2000 m, the maximum correlation was at 3-4 km, suggesting a listening area for the acoustic rainfall measurement of roughly circular area = 30-50 km², in contrast to less than 3 km² for the acoustic measurement at 60 m depth.

DTIC

Marine Meteorology; Mediterranean Sea; Rain; Sound Detecting and Ranging; Underwater Acoustics; Variability

20070035506 Naval Research Lab., Bay Saint Louis, MS USA

Upper-Ocean Response to Hurricane Ivan in a 1/25 degree Nested Gulf of Mexico HYCOM

Prasad, T G; Hogan, Patrick J; Apr 18, 2007; 19 pp.; In English; Original contains color illustrations

Report No.(s): AD-A470340; No Copyright; Avail.: Defense Technical Information Center (DTIC)

A 20-layer, 1/25 degree nested Gulf of Mexico (GoM) Hybrid Coordinate Ocean Model (HYCOM) has been employed to examine the evolving three-dimensional ocean response to Hurricane Ivan during 14-16 September 2004. Results from several combinations of numerical experiments with and without assimilation of satellite-altimetry sea-surface height (SSH) are being analyzed and compared for the September 2004 hurricane period. A comparison of simulated zonal and meridional velocities using data assimilation shows improved agreement with profiler observations. The amplitude of the cold wake (-6 degrees C) produced by these simulations compared reasonably well with the observed changes in SST before and after the storm; however, the region of extreme cooling varied depending on the simulated location of the warm core eddy (WCE) that had detached from the Loop Current (LC). While the simulated location of the WCE and LC in the assimilation runs agree better with satellite altimetry, the storm-induced SST cooling was 40%-50% greater than the observed cooling. Overall, 64% of the cooling was due to vertical mixing caused by turbulence generated from strong shear-stress across the base of the mixed layer. Vertical advection (upwelling) caused a significant portion of cooling (23.4%) in those runs that included data assimilation; a three fold increase from the nonassimilative runs (7%). This enhanced upper-ocean cooling was caused primarily by the prestorm thermal stratification; a shallower thermocline (-40 m) and a stronger upper-thermocline temperature gradient compared with the nonassimilative runs. In all the experiments the air-sea exchange was a small component of the mixed-layer heat budget which overall accounted for -4%.

DTIC

Gulf of Mexico; Hurricanes; Ocean Models; Oceans

20070035523 Naval Research Lab., Bay Saint Louis, MS USA

Modeling of Upwelling/Relaxation Events with the Navy Coastal Ocean Model

Shulman, Igor; Kindle, John; Martin, Paul; deRada, Sergio; Doyle, Jim; Penta, Brad; Anderson, Stephanie; Chavez, Francisco; Paduan, Jeff; Ramp, Steve; Jun 26, 2007; 13 pp.; In English; Original contains color illustrations

Report No.(s): AD-A470364; NRL/JA/7330-05-6050; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The Navy Coastal Ocean Model (NCOM) is a free-surface, primitive-equation model that is under development at the Naval Research Laboratory (NRL). The NCOM-based model of the Monterey Bay area is evaluated during a series of upwelling and relaxation wind events in August-September of 2000. The model receives open boundary conditions from a regional NCOM implementation of the California Current System and surface fluxes from the Navy Coupled Ocean/Atmosphere Mesoscale Prediction System (COAMPS(TradeMark))(COAMPS is a registered trademark of the Naval Research Laboratory). Issues investigated in this study are: NCOM-based model simulations of upwelling and relaxation events, coupling to COAMPS, use of sigma versus hybrid (sigma-z) vertical grids, and coupling with a larger-scale model on the open boundaries. The NCOM simulations were able to reproduce the observed sequence of the upwelling and relaxation events, which can be attributed, in part, to the good agreement between the observed and COAMPS winds. Comparisons with the mooring observations show that COAMPS overestimates shortwave radiation values, which makes the NCOM modeled SSTs too warm in comparison with observations. The NCOM runs forced with different resolution atmospheric forcing (3 versus 9 km) do not show significant differences in the predicted SSTs and mixed-layer depths at the mooring locations. At the same time, during the extended upwelling event, the model runs forced with 3 and 9km resolution COAMPS fields show differences in the surface circulation.

DTIC

Coasts; Navy; Ocean Models; Upwelling Water; Wind (Meteorology)

20070035737 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Interannual and Regional Variability of Southern Ocean Snow on Sea Ice and its Correspondence with Sea Ice Cover and Atmospheric Circulation Patterns

Markus, T.; Cavalieri, D. J.; Annals of Glaciology; [2006]; Volume 44; 7 pp.; In English; Original contains black and white illustrations; Copyright; Avail.: Other Sources

Snow depth on sea ice plays a critical role in the heat exchange between ocean and atmosphere because of its thermal insulation property. Furthermore, a heavy snow load on the relatively thin Southern Ocean sea-ice cover submerges the ice floes below sea level, causing snow-to-ice conversion. Snowfall is also an important freshwater source into the weakly stratified ocean. Snow depth on sea-ice information can be used as an indirect measure of solid precipitation. Satellite passive microwave data are used to investigate the interannual and regional variability of the snow cover on sea ice. In this study we make use of 12 years (1992-2003) of Special Sensor Microwave/Imager (SSM/I) radiances to calculate average monthly snow depth on the Antarctic sea-ice cover. The results show a slight increase in snow depth and a partial eastward propagation of maximum snow depths, which may be related to the Antarctic Circumpolar Wave.

Author

Snow Cover; Sea Ice; Air Sea Ice Interactions; Atmospheric Circulation; Microwave Imagery; Remote Sensing; Heat Transfer; Air Water Interactions

20070035740 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Improving Access to MODIS Biophysical Science Products for NACP Investigators

Wolfe, Robert E.; Gao, Feng; Morisette, Jeffrey T.; Ederer, Gregory A.; Pedelty, Jeffrey A.; [2007]; 1 pp.; In English; International Geoscience and Remote Sensing Symposium (IGARSS) '07, 23-27 Jul. 2007, Barcelona, Spain; Copyright; Avail.: Other Sources; Abstract Only

MODIS 4 NACP is a NASA-funded project supporting the North American Carbon Program (NACP). The purpose of this Advancing Collaborative Connections for Earth-Sun System Science (ACCESS) project is to provide researchers with Moderate Resolution Imaging Spectroradiometer (MODIS) biophysical data products that are custom tailored for use in NACP model studies. Standard MODIS biophysical products provide used to improve our understanding on the climate and ecosystem changes. However, direct uses of the MODIS biophysical parameters are constrained by retrieval quality and cloud contamination. Another challenge that NACP users face is acquiring MODIS data in formats and at spatial-temporal resolutions consistent with other data sets they use. We have been working closely with key NACP users to tailor the MODIS products to fit their needs. First, we provide new temporally smoothed and spatially continuous MODIS biophysical data sets.

Second, we are distributing MODIS data at suitable spatial-temporal resolutions and in formats consistent with other data integration into model studies.

Author

Biophysics; Earth Sciences; Climate Change; MODIS (Radiometry); Temporal Resolution; Ecosystems; Imaging Spectrometers

20070035753 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Validation and Determination of Ice Water Content - Radar Reflectivity Relationships during CRYSTAL-FACE: Flight Requirements for Future Comparisons

Sayres, D. S.; Smith, J. B.; Pittman, J. V.; Weinstock, E. M.; Anderson, J. G.; Heymsfield, G.; Fridland, A. M.; Ackerman, A. S.; [2007]; 29 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): NAG5-11548; NAG5-115487; NAG5-8779; NAG1-01095; Copyright; Avail.: CASI: [A03](#), Hardcopy

In order for clouds to be more accurately represented in global circulation models (GCM), there is need for improved understanding of the properties of ice such as the total water in ice clouds, called ice water content (IWC), ice particle sizes and their shapes. Improved representation of clouds in models will enable GCMs to better predict for example, how changes in emissions of pollutants affect cloud formation and evolution, upper tropospheric water vapor, and the radiative budget of the atmosphere that is crucial for climate change studies. An extensive cloud measurement campaign called CRYSTAL-FACE was conducted during Summer 2002 using instrumented aircraft and a variety of instruments to measure properties of ice clouds. This paper deals with the measurement of IWC using the Harvard water vapor and total water instruments on the NASA WB-57 high-altitude aircraft. The IWC is measured directly by these instruments at the altitude of the WB-57, and it is compared with remote measurements from the Goddard Cloud Radar System (CRS) on the NASA ER-2. CRS measures vertical profiles of radar reflectivity from which IWC can be estimated at the WB-57 altitude. The IWC measurements obtained from the Harvard instruments and CRS were found to be within 20-30% of each other. Part of this difference was attributed to errors associated with comparing two measurements that are not collocated in time and space since both aircraft were not in identical locations. This study provides some credibility to the Harvard and CRS-derived IWC measurements that are in general difficult to validate except through consistency checks using different measurement approaches.

Author

Ice Clouds; Atmospheric Models; Atmospheric Circulation; Remote Sensing; Water Vapor; Moisture Content; Ice

20070035755 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Nonspherical and Spherical Characterization of Ice in Hurricane Erin for Wideband Passive Microwave Comparisons

Skofronick-Jackson, Gail; Holthaus, Eric; Albers, Ceres; Kim, Min-Jeong; [2007]; 45 pp.; In English; Original contains black and white illustrations; Copyright; Avail.: CASI: [A03](#), Hardcopy

In order to better understand the characteristics of frozen cloud particles in hurricane systems, computed brightness temperatures were compared with radiometric observations of Hurricane Erin (2001) from the NASA ER-2 aircraft. The focus was on the frozen particle microphysics and the high frequencies (2-85 GHz) that are particularly sensitive to frozen particles. Frozen particles in hurricanes are an indicator of increasing hurricane intensity. In fact 'hot towers' associated with increasing hurricane intensity are composed of frozen ice cloud particles. (They are called hot towers because their column of air is warmer than the surrounding air temperature, but above about 5-7 km to the tops of the towers at 15-19 km, the cloud particles are frozen.) This work showed that indeed, one can model information about cloud ice particle characteristics and indicated that nonspherical ice shapes, instead of spherical particles, provided the best match to the observations. Overall, this work shows that while non-spherical particles show promise, selecting and modeling a proper ice particle parameterization can be difficult and additional in situ measurements are needed to define and validate appropriate parameterizations. This work is important for developing Global Precipitation Measurement (GPM) mission satellite algorithms for the retrieval of ice characteristics both above the melting layer, as in Hurricane Erin, and for ice particles that reach the surface as falling snow.

Author

Hurricanes; Ice Clouds; Precipitation (Meteorology); Brightness Temperature; In Situ Measurement; Precipitation Measurement; Radiometers

20070035758 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Spectral Retrieval of Latent Heating Profiles from TRMM PR data, Part 3, Moistening Estimates over Tropical Ocean Regions

Shige, S.; Takayabu, Y.; Tao, W.-K.; [2007]; 61 pp.; In English; Original contains black and white illustrations; Copyright; Avail.: CASI: [A04](#), Hardcopy

The global hydrological cycle is central to the Earth's climate system, with rainfall and the physics of precipitation

formation acting as the key links in the cycle. Two-thirds of global rainfall occurs in the tropics with the associated latent heating (LH) accounting for three-fourths of the total heat energy available to the Earth's atmosphere. In the last decade, it has been established that standard products of LH from satellite measurements, particularly TRMM measurements, would be a valuable resource for scientific research and applications. Such products would enable new insights and investigations concerning the complexities of convection system life cycles, the diabatic heating controls and feedbacks related to mesosynoptic circulations and their forecasting, the relationship of tropical patterns of LH to the global circulation and climate, and strategies for improving cloud parameterizations in environmental prediction models. However, the LH and water vapor profile or budget (called the apparent moisture sink, or Q2) is closely related. This paper presented the development of an algorithm for retrieving Q2 using 'TRMM precipitation radar. Since there is no direct measurement of LH and Q2, the validation of algorithm usually applies a method called consistency check. Consistency checking involving Cloud Resolving Model (CRM)-generated LH and Q2 profiles and algorithm-reconstructed is a useful step in evaluating the performance of a given algorithm. In this process, the CRM simulation of a time-dependent precipitation process (multiple-day time series) is used to obtain the required input parameters for a given algorithm. The algorithm is then used to reconstitute the heating and moisture profiles that the CRM simulation originally produced, and finally both sets of conformal estimates (model and algorithm) are compared each other. The results indicate that discrepancies between the reconstructed and CRM-simulated profiles for Q2, especially at low levels, are larger than those for latent heat. Larger discrepancies in Q2 at low levels are due to moistening for non-precipitating region that algorithm cannot reconstruct. Nevertheless, the algorithm-reconstructed total Q2 profiles are in good agreement with the CRM-simulated ones.

Author

Hydrological Cycle; Clouds (Meteorology); Atmospheric Models; Satellite Observation; Precipitation (Meteorology); Latent Heat; TRMM Satellite; Meteorological Radar; Rain

20070035760 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA; NASA Goddard Space Flight Center, Greenbelt, MD, USA

Validation of the Aura Microwave Limb Sounder Temperature and Geopotential Height Measurements

Schwartz, M. J.; Lambert, A.; Manney, G. L.; Read, W. G.; Livesey, N. J.; Froidevaux, L.; Ao, C. O.; Bernath, P. F.; Boone, C. D.; Cofield, R. E.; Daffer, W. H.; Drouin, B. J.; Fetzer, E. J.; Fuller, R. A.; Jarnot, R. F.; Jiang, J. H.; Jiang, Y. B.; Knosp, B. W.; Krueger, K.; Li, J.-L. F.; Mlynarczyk, M. G.; Pawson, S.; Russell, J. M., III; Santee, M. L.; Snyder, W. V.; [2007]; 39 pp.; In English; Original contains color illustrations; Copyright; Avail.: CASI: [A03](#), Hardcopy

This paper describes the retrievals algorithm used to determine temperature and height from radiance measurements by the Microwave Limb Sounder on EOS Aura. MLS is a 'limb-scanning' instrument, meaning that it views the atmosphere along paths that do not intersect the surface - it actually looks forwards from the Aura satellite. This means that the temperature retrievals are for a 'profile' of the atmosphere somewhat ahead of the satellite. Because of the need to view a finite sample of the atmosphere, the sample spans a box about 1.5km deep and several tens of kilometers in width; the optical characteristics of the atmosphere mean that the sample is representative of a tube about 200-300km long in the direction of view. The retrievals use temperature analyses from NASA's Goddard Earth Observing System, Version 5 (GEOS-5) data assimilation system as a priori states. The temperature retrievals are somewhat dependent on these a priori states, especially in the lower stratosphere. An important part of the validation of any new dataset involves comparison with other, independent datasets. A large part of this study is concerned with such comparisons, using a number of independent space-based measurements obtained using different techniques, and with meteorological analyses. The MLS temperature data are shown to have biases that vary with height, but also depend on the validation dataset. MLS data are apparently biased slightly cold relative to correlative data in the upper troposphere and slightly warm in the middle stratosphere. A warm MLS bias in the upper stratosphere may be due to a cold bias in GEOS-5 temperatures.

Author

Temperature Measurement; Microwave Sounding; Geopotential Height; Remote Sensing; Radiance; Algorithms; Earth Observing System (EOS)

20070035769 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

Spaceborne Doppler Precipitation Radar: System Configurations and Performance Analysis

Tanelli, Simone; Im, Eastwood; November 8, 2004; 9 pp.; In English; SPIE Remote Sensing of the Atmosphere, Environment, and Space, 8-12 Nov. 2007, Honolulu, HI, USA; Original contains black and white illustrations; Copyright; Avail.: Other Sources

ONLINE: <http://hdl.handle.net/2014/40483>

Knowledge of the global distribution of the vertical velocity of precipitation is important in the study of energy

transportation in the atmosphere, the climate and weather. Such knowledge can only be directly acquired with the use of spaceborne Doppler precipitation radars. Although the high relative speed of the radar with respect to the rainfall particles introduces significant broadening in the Doppler spectrum, recent studies have shown that the average vertical velocity can be measured to acceptable accuracy levels by appropriate selection of radar parameters. Furthermore, methods to correct for specific errors arising from NUBF effects and pointing uncertainties have recently been developed. In this paper we will present the results of the trade studies on the performances of a spaceborne Doppler radar with different system parameters configurations.

Author

Doppler Radar; Climate; Reliability Analysis; Rain; Accuracy; Velocity Distribution

20070035919 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

GNSS-Based Space Weather Systems Including COSMIC Ionospheric Measurements

Komjathy, Attila; Mandrake, Lukas; Wilson, Brian; Iijima, Byron; Pi, Xiaoqing; Hajj, George; Mannucci, Anthony J.; November 28, 2006; 25 pp.; In English; Fermosat-3/COSMIC Workshop, 28 Nov. - 1 Dec. 2006, Taipei, Taiwan, Province of China; Original contains color and black and white illustrations; Copyright; Avail.: Other Sources

ONLINE: <http://hdl.handle.net/2014/40321>

The presentation outline includes University Corporation for Atmospheric Research (UCAR) and Jet Propulsion Laboratory (JPL) product comparisons, assimilating ground-based global positioning satellites (GPS) and COSMIC into JPL/University of Southern California (USC) Global Assimilative Ionospheric Model (GAIM), and JPL/USC GAIM validation. The discussion of comparisons examines Abel profiles and calibrated TEC. The JPL/USC GAIM validation uses Arecibo ISR, Jason-2 VTEC, and Abel profiles.

Derived from text

Global Positioning System; Atmospheric Models; Earth Ionosphere; Remote Sensing; Electron Density (Concentration); Abel Function

20070036009 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

The Precision and Accuracy of AIRS Level 1B Radiances for Climate Studies

Hearty, Thomas J.; Gaiser, Steve; Pagano, Tom; Aumann, Hartmut; November 8, 2004; 12 pp.; In English; SPIE Asia Pacific Environmental Remote Sensing Symposium, 8 Nov. 2004, Honolulu, HI, USA; Original contains black and white illustrations; Copyright; Avail.: Other Sources

ONLINE: <http://hdl.handle.net/2014/40559>

We investigate uncertainties in the Atmospheric Infrared Sounder (AIRS) radiances based on in-flight and preflight calibration algorithms and observations. The global coverage and spectral resolution ($(\lambda)/(\Delta\lambda) \sim 1200$) of AIRS enable it to produce a data set that can be used as a climate data record over the lifetime of the instrument. Therefore, we examine the effects of the uncertainties in the calibration and the detector stability on future climate studies. The uncertainties of the parameters that go into the AIRS radiometric calibration are propagated to estimate the accuracy of the radiances and any climate data record created from AIRS measurements. The calculated radiance uncertainties are consistent with observations. Algorithm enhancements may be able to reduce the radiance uncertainties by as much as 7%. We find that the orbital variation of the gain contributes a brightness temperature bias of < 0.01 K.

Author

Radiance; Accuracy; Precision; Infrared Instruments; Climate; Brightness Temperature

20070036014 NASA Langley Research Center, Hampton, VA, USA

Contrails, Appendix 1, Part 1

Minnis, Patrick; [2003]; 8 pp.; In English; Original contains color and black and white illustrations

Contract(s)/Grant(s): 23-621-82-80; No Copyright; Avail.: CASI: A02, Hardcopy

ONLINE: <http://hdl.handle.net/2060/20070036014>

One of the most visible signs of human influence on the atmosphere is the condensation trail, or contrail, formed behind high altitude aircraft. This anthropogenic cirrus cloud can occur as a single line or in imposing geometrical formations as clusters of criss-crossing or parallel lines. Like natural cirrus clouds, contrails are composed of ice crystals and can produce the same dramatic optical displays, especially around sunrise or sunset. Persistent contrails also play a role in climate because they reflect sunlight and trap infrared radiation just like their naturally formed cousins. Thus, the presence of a contrail cluster in an otherwise clear sky can diminish the amount of solar energy reaching the surface during the daytime and increase the

amount of infrared radiation absorbed in the atmosphere at all times of day. These opposing effects can simultaneously cool the surface and warm the air within the troposphere. Currently, the overall impact appears to be a warming effect, but research is continuing to unravel the role of this phenomenon in climate change.

Derived from text

Cirrus Clouds; Climate Change; Contrails; Climatology; Man Environment Interactions; Environment Effects

20070036045 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

Modulation of the seasonal cycle in length-of-day and atmospheric angular momentum

Gross, Richard S.; Marcus, Steven L.; Dickey, Jean O.; September 2, 2001; 6 pp.; In English; International Association of Geodesy (IAG) Scientific Assembly, 2-7 Sep. 2001, Budapest, Hungary; Original contains black and white illustrations; Copyright; Avail.: Other Sources

ONLINE: <http://hdl.handle.net/2014/40555>

Global warming, by definition, changes the atmospheric temperature field. This temperature change is not expected to be uniform, either geographically, or with height in the atmosphere. By the thermal wind equation, changes in the pole-to-equator temperature gradient will cause changes in the atmospheric zonal winds. Numerous previous studies have shown that observed length-of-day (LOD) variations on time scales of a few days to a few years are largely caused by atmospheric zonal wind fluctuations. In particular, seasonal variations in LOD have been previously shown to be dominantly caused by seasonal variations in the atmospheric zonal winds. Here, observed changes in the strength of seasonal LOD and wind-driven atmospheric angular momentum signals during 1962 to 2000 are analyzed and shown to be significantly correlated with each other and with the Southern Oscillation Index.

Author

Annual Variations; Atmospheric Temperature; Wind (Meteorology); Temperature Distribution; Global Warming

20070036288 Naval Research Lab., Bay Saint Louis, MS USA

Global Ocean Prediction Using HYCOM

Metzger, E J; Hurlburt, Harley E; Wallcraft, Alan J; Cummings, James A; Chassignet, Eric P; Smedstad, Ole M; Jun 2006; 6 pp.; In English

Report No.(s): AD-A470731; NRL/PP/7320-06-6245; No Copyright; Avail.: Defense Technical Information Center (DTIC)

One important aspect of ocean model design is the choice of the vertical coordinate system. Traditional ocean models use a single coordinate type to represent the vertical, but model comparison exercises performed in Europe (DYNAMICS of North Atlantic MODELS (DYNAMO)) and in the USA (Data Assimilation and Model Evaluation Experiment (DAMEE)) have shown that none of the three main vertical coordinates presently in use (depth [z-levels], density [isopycnal layers], or terrain-following [sigma-levels]) can by itself be optimal everywhere in the ocean. The HYbrid Coordinate Ocean Model (HYCOM) (Bleck, 2002) is configured to combine all three of these vertical coordinate types. It is isopycnal in the open, stratified ocean, but uses the layered continuity equation to make a dynamically smooth transition to a terrain-following coordinate in shallow coastal regions, and to z-level coordinates in the mixed layer and/or unstratified seas. The hybrid coordinate extends the geographic range of applicability of traditional isopycnal coordinate circulation models toward shallow coastal seas and unstratified parts of the world ocean. It maintains the significant advantages of an isopycnal model in stratified regions while allowing more vertical resolution near the surface and in shallow coastal areas, hence providing a better representation of the upper ocean physics. HYCOM is designed to provide a major advance over the existing operational global ocean prediction systems, since it overcomes design limitations of the present systems as well as limitations in vertical and horizontal resolution. The result should be a more streamlined system with improved performance and an extended range of applicability (e.g., the present systems are seriously limited in shallow water and in handling the transition from deep to shallow water).

DTIC

Climatology; Coordinates; Forecasting; Ocean Currents; Ocean Models; Oceans; Vertical Orientation

20070036291 Naval Research Lab., Bay Saint Louis, MS USA

Water Masses in the Monterey Bay during the Summer of 2000

Warn-Varnas, Alex; Gangopadhyay, Avijit; Hawkins, J A; Jan 19, 2007; 21 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): N00014-03-1-0411; N00014-03-1-0206

Report No.(s): AD-A470734; NRL/JA/7320-05-5212; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Water masses in Monterey Bay are determined from the CTD casts of the Monterey Ocean Observing System (MOOS)

Upper-water-column Science Experiment (MUSE) August 2000 dataset. It is shown through cluster analysis that the MUSE 2000 CTD dataset contains 5 water masses. These five water masses are bay surface water (BSW), bay warm water (BWW), bay intermediate water (BIW), subarctic upper water (SUW), and North Pacific deep water (NPDW). The BWW is a new water mass that exists in one area and is attributed to the effects of solar heating. The volumes occupied by each of the water masses are obtained. The BIW water is the most dominant water mass and occupies 68.8% of the volume. The statistical means and standard deviations for each water parameter, including spiciness and oxygen concentration, are calculated during separate upwelling and relaxed periods. The water mass content and structure are analyzed and studied during upwelling and a relaxed period. During upwelling, along a CTD track off Pt. Ano Nuevo, the water mass Temperature-Salinity distribution tended to be organized along three branches. Off Pt. Ano Nuevo the innovative coastal observation network (ICON) model showed the formation of a cyclonic eddy during the analyzed upwelling period. In time the eddy moved southwest and became absorbed into the southerly flow during the initial phases of the following wind-relaxed period.

DTIC

Mass Distribution; Monterey Bay (CA); Ocean Currents; Summer; Upwelling Water; Water; Wind (Meteorology)

20070036456 Army Construction Engineering Research Lab., Champaign, IL USA

Laboratory Study of Wind Effect on Runup over Fringing Reefs. Report 1. Data Report

Demirbilek, Zeki; Nwogu, Okey G; Ward, Donald L; Jul 2007; 83 pp.; In English; Original contains color illustrations
Report No.(s): AD-A471044; ERDC/CHL-TR-07-4; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The report describes experimental data obtained from a wind-wave flume study conducted August-September 2006 at the University of Michigan in Ann Arbor, MI. The study objectives were two-fold: to quantify wind effects on wave runup on fringing reefs of the Pacific Island of Guam and to obtain detailed wave data along a complex reef system consisting of steep slopes and shallow areas for validating wave breaking, dissipation, wave setup and runup capabilities of a Boussinesq-type wave model. An idealized 1:64 model of a two dimensional fringing reef, representative of the reef systems along the southeast coast of island of Guam, was built in the flume. The reef cross-sectional profile consisted of a beach, a flat and wide reef section, and a reef face with composite slope. The reef profile was built from a relatively smooth and impervious plastic material (polyvinyl chloride). The wind generator and wavemaker mechanisms were located at opposite ends of the test flume. The reef cross-sectional profile consisted of a beach, a flat and wide reef section, and a reef face with composite slope. The reef profile was built from a relatively smooth and impervious plastic material (polyvinyl chloride). The wind generator and wavemaker mechanisms were located at opposite ends of the test flume. Eleven probes (gauges) collected time series surface elevation and wind speed data. Tests were performed without wind (waves-only), with wind-only, and with both waves and wind together. Data obtained in this study will be used in the calibration of numerical models to estimate wave setup and runup affecting the flooding of Pacific islands. This data report describes the experiment and data. Subsequent reports are expected to address the analyses and use of data and numerical modeling studies. General features of the experiment are summarized in the report, including description of test facility, instrumentation, test conditions, and preliminary results.

DTIC

Reefs; Wind (Meteorology); Wind Effects

20070036630 Maryland Univ. Baltimore County, Baltimore, MD, USA; NASA Goddard Space Flight Center, Greenbelt, MD, USA

General Characteristics of Stratospheric Singular Vectors

Errico, Ronald M.; Gelaro, Ronald; Novakovskaia, Elena; Todling, Ricardo; February 28, 2007; 39 pp.; In English; Original contains black and white illustrations

Contract(s)/Grant(s): MAP/04-0000-0080; No Copyright; Avail.: Other Sources

Leading singular vectors have been computed for a numerical weather prediction model that can resolve dynamical structures within the stratosphere and lower mesosphere. The norm applied at the final time is the commonly used energy norm but confined to measuring the stratosphere. These stratospheric singular vectors are described by presenting three examples. They are produced using either of two initial norms that weight perturbations within the troposphere versus stratosphere very differently. For either initial norm, singular values are typically smaller than their tropospheric counterparts and they are less geographically local. They also retain their relevance to corresponding nonlinear evolutions for longer periods and larger amplitudes. For these reasons, stratospheric SVs may be useful for explaining observed stratospheric dynamical behaviors.

Author

Mathematical Models; Mesosphere; Numerical Weather Forecasting; Stratosphere; Vectors (Mathematics); Singularity (Mathematics)

20070036634 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

Tropical Tropopause Structure and Processes as Observed with GPS Radio Occultation

delaTorre Juarez, Manuel; Schroder, Thomas M.; Ao, Chi O.; September 28, 2004; 10 pp.; In English; American Institute of Aeronautics and Astronautics (AIAA) Space 2004 Conference, 28-30 Sep. 2004, San Diego, CA, USA; Original contains color and black and white illustrations; Copyright; Avail.: Other Sources

ONLINE: <http://hdl.handle.net/2014/40536>

The vertical temperature structure of the tropical atmosphere has been explained as controlled by the combined effect of three green house gases: water vapor, carbon dioxide, and ozone. Absorption by water vapor of the light reflected off the Earth's surface would determine the temperature lapse rate in the lower troposphere up to the bottom of the Tropical Transition Layer (TTL); radiative absorption by carbon dioxide would dominate the temperature lapse rate between the bottom of the TTL and the coldest point in the upper-troposphere, the cold point tropopause (CPT), and; absorption of incoming solar radiation by ozone would control the temperature above the CPT. The TTL region can thus be very sensitive to changes in the relative abundances of these greenhouse gases. In this contribution we describe the seasonal evolution of temperature profiles in the TTL and their longitudinal structure using GPS radio occultation.

Author

Tropical Regions; Tropopause; Vertical Distribution; Water Vapor; Carbon Dioxide; Ozone; Greenhouse Effect; Global Positioning System; Atmospheric Temperature

20070036661 NASA Goddard Space Flight Center, Greenbelt, MD, USA

A Numerical Study of Hurricane Erin (2001), Part II, Shear and the Organization of Eyewall Vertical Motion

Braun, Scott A.; Wu, Liguang; January 03, 2006; 42 pp.; In English; Original contains black and white illustrations; No Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: <http://hdl.handle.net/2060/20070036661>

A high-resolution numerical simulation of Hurricane Erin (2001) is used to examine the organization of vertical motion in the eyewall and how that organization responds to a large and rapid increase in the environmental vertical wind shear and subsequent decrease in shear. During the early intensification period, prior to the onset of significant shear, the upward motion in the eyewall was concentrated in small-scale convective updrafts that formed in association with regions of concentrated vorticity (herein termed mesovortices) with no preferred formation region in the eyewall. Asymmetric flow within the eye was weak. As the shear increased, an azimuthal wavenumber 1 asymmetry in storm structure developed with updrafts tending to form on the downshear to downshear-left side of the eyewall. Continued intensification of the shear led to increasing wavenumber 1 asymmetry, large vortex tilt, and a change in eyewall structure and vertical motion organization. During this time, the eyewall structure was dominated by a vortex couplet with a cyclonic (anticyclonic) vortex on the downtilt-left (downtilt-right) side of the eyewall and strong asymmetric flow across the eye that led to strong mixing of eyewall vorticity into the eye. Upward motion was concentrated over an azimuthally broader region on the downtilt side of the eyewall, upstream of the cyclonic vortex, where low-level environmental inflow converged with the asymmetric outflow from the eye. As the shear diminished, the vortex tilt and wavenumber 1 asymmetry decreased, while the organization of updrafts trended back toward that seen during the weak shear period.

Author

Hurricanes; Vertical Motion; Numerical Analysis; Mesoscale Phenomena; Wind Shear

20070036727 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

Assessment of Open-Loop Tracking Occultation Data from COSMIC

Ao, Chi O.; Hajj, G. A.; Iijima, B. A.; Mannucci, A. J.; Meehan, T. K.; October 16, 2006; 22 pp.; In English; First Formosat-3/COSMIC Data Users Workshop, 16-18 Oct. 2006, Boulder, CO, USA; Original contains color and black and white illustrations; Copyright; Avail.: Other Sources

ONLINE: <http://hdl.handle.net/2014/40357>

An assessment of open-loop tracking occultation data from Constellation Observing System for Meteorology, Ionosphere, and Climate (COSMIC) is presented.

CASI

Climate; Meteorology; Occultation; Ionospheres; Tracking Radar; Data Acquisition

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*.

20070035133 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Exploiting the Capabilities of NASA's Giovanni System for Oceanographic Education

Acker, James G.; Petrucio, Emil; Leptoukh, Gregory; Shen, Suhung; June 04, 2007; 6 pp.; In English; European Association of Remote Sensing Laboratories (EARSeL) 2007 Annual Symposium, 4-6 Jun. 2007, Bolzano, Italy; Original contains black and white illustrations; Copyright; Avail.: CASI: [A02](#), Hardcopy

The NASA Goddard Earth Science Data and Information Services Center (GES DISC) Giovanni system [GES DISC Interactive Online Visualization ANd aNalysis Infrastructure] has significant capabilities for oceanographic education and independent research utilizing ocean color radiometry data products. Giovanni allows Web-based data discovery and basic analyses, and can be used both for guided illustration of a variety of marine processes and phenomena, and for independent research investigations. Giovanni's capabilities are particularly suited for advanced secondary school science and undergraduate (college) education. This presentation will describe a variety of ways that Giovanni can be used for oceanographic education. Auxiliary information resources that can be utilized will also be described. Several testimonies of Giovanni usage for instruction will be provided, and a recent case history of Giovanni utilization for instruction and research at the undergraduate level is highlighted.

Author

Oceanography; Information Systems; Earth Sciences; Education; Radiometers

20070035765 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Sampling Biases in MODIS and SeaWiFS Ocean Chlorophyll Data

Gregg, Watson W.; Casey, Nancy W.; [2007]; 31 pp.; In English; Original contains color and black and white illustrations; No Copyright; Avail.: CASI: [A03](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20070035765>

Although modern ocean color sensors, such as MODIS and SeaWiFS are often considered global missions, in reality it takes many days, even months, to sample the ocean surface enough to provide complete global coverage. The irregular temporal sampling of ocean color sensors can produce biases in monthly and annual mean chlorophyll estimates. We quantified the biases due to sampling using data assimilation to create a 'truth field', which we then sub-sampled using the observational patterns of MODIS and SeaWiFS. Monthly and annual mean chlorophyll estimates from these sub-sampled, incomplete daily fields were constructed and compared to monthly and annual means from the complete daily fields of the assimilation model, at a spatial resolution of 1.25deg longitude by 0.67deg latitude. The results showed that global annual mean biases were positive, reaching nearly 8% (MODIS) and >5% (SeaWiFS). For perspective the maximum interannual variability in the SeaWiFS chlorophyll record was about 3%. Annual mean sampling biases were low (<3%) in the midlatitudes (between -40deg and 40deg). Low interannual variability in the global annual mean sampling biases suggested that global scale trend analyses were valid. High latitude biases were much higher than the global annual means, up to 20% as a basin annual mean, and over 80% in some months. This was the result of the high solar zenith angle exclusion in the processing algorithms. Only data where the solar angle is <75deg are permitted, in contrast to the assimilation which samples regularly over the entire area and month. High solar zenith angles do not facilitate phytoplankton photosynthesis and consequently low chlorophyll concentrations occurring here are missed by the data sets. Ocean color sensors selectively sample in locations and times of favorable phytoplankton growth, producing overestimates of chlorophyll. The biases derived from lack of sampling in the high latitudes varied monthly, leading to artifacts in the apparent seasonal cycle from ocean color sensors. A false secondary peak in chlorophyll occurred in May-August, which resulted from lack of sampling in the Antarctic.

Author

Sea-Viewing Wide Field-of-View Sensor; MODIS (Radiometry); Ocean Surface; Chlorophylls; Bias; Variability; Oceans

20070035973 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

The 1997-1999 Abrupt Change of the Upper Ocean Temperature in the North Central Pacific

Kim, Seung-Bum; Lee, Tong; Fukumori, Ichiro; Geophysical Research Letters; November 11, 2004; Volume 31; 4 pp.; In English; Original contains color illustrations; Copyright; Avail.: Other Sources

ONLINE: <http://hdl.handle.net/2014/40518>; <http://dx.doi.org/10.1029/2004GL021142>

The abrupt warming of the north central Pacific Ocean from 1997 to 1999 is studied using an ocean data assimilation

product. During this period, the average mixed-layer temperature in the region of 170-210(deg)E, 25-40(deg)N rises by 1.8 K. The major contributors to the warming are surface heat flux (1.3 K), geostrophic advection (0.7 K), and entrainment (0.7 K). For the geostrophic advection, the contributions by the zonal, meridional, and vertical components are 0.4, -0.1 and 0.3 K, respectively. Mixing and meridional Ekman advection have cooling effect. The significance of the geostrophic advection indicates the importance of ocean dynamics in controlling the abrupt warming tendency during the 1997-99 period and the inadequacy of a slab-mixed-layer model in simulating such warming tendency.

Author

Ocean Dynamics; Ocean Temperature; Heat Flux; Advection; Entrainment

20070036008 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

Use of Multiangle Satellite Observations to Retrieve Aerosol Properties and Ocean Color

Martonchik, John V.; Diner, David; Khan, Ralph; October 14, 2005; 3 pp.; In English; 9th International Symposium on Physical Measurement and Signature in Remote Sensing, 14 Oct. 2005, Beijing, China; Original contains black and white illustrations; Copyright; Avail.: Other Sources

ONLINE: <http://hdl.handle.net/2014/40560>

A new technique is described for retrieving aerosol over ocean water and the associated ocean color using multiangle satellite observations. Unlike current satellite aerosol retrieval algorithms which only utilize observations at red wavelengths and longer, with the assumption that these wavelengths have a negligible ocean (water-leaving radiance), this new algorithm uses all available spectral bands and simultaneously retrieves both aerosol properties and the spectral ocean color. We show some results of case studies using MISR data, performed over different water conditions (coastal water, blooms, and open water).

Author

Aerosols; Satellite Observation; Water Color; Oceans; Spectral Bands

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*.

20070035062 Maryland Univ. Baltimore County, Baltimore, MD, USA; NASA Goddard Space Flight Center, Greenbelt, MD, USA

Assessment of Vegetation Stress Using Reflectance or Fluorescence Measurements

Campbell, P. K. E.; Middleton, E. M.; McMurtrey, J. E.; Corp, L. A.; Chappelle, E. W.; [2007]; 18 pp.; In English; Original contains black and white illustrations; Copyright; Avail.: Other Sources

Current methods for large-scale vegetation monitoring rely on multispectral remote sensing, which has serious limitation for the detection of vegetation stress. To contribute to the establishment of a generalized spectral approach for vegetation stress detection, this study compares the ability of high-spectral resolution reflectance (R) and fluorescence (F) foliar measurements to detect vegetation changes associated with common environmental factors affecting plant growth and productivity. To obtain a spectral dataset from a broad range of species and stress conditions, plant material from three experiments was examined, including (i) corn, nitrogen (N) deficiency/excess; (ii) soybean, elevated carbon dioxide, and ozone levels; and (iii) red maple, augmented ultraviolet irradiation. Fluorescence and R spectra (400-800 nm) were measured on the same foliar samples in conjunction with photosynthetic pigments, carbon, and N content. For separation of a wide range of treatment levels, hyperspectral (5-10 nm) R indices were superior compared with F or broadband R indices, with the derivative parameters optimal results. For the detection of changes in vegetation physiology, hyperspectral indices can provide a significant improvement over broadband indices. The relationship of treatment levels to R was linear, whereas that to F was curvilinear. Using reflectance measurements, it was not possible to identify the unstressed vegetation condition, which was accomplished in all three experiments using F indices. Large-scale monitoring of vegetation condition and the detection of vegetation stress could be improved by using hyperspectral R and F information, a possible strategy for future remote sensing missions.

Author

Vegetation Growth; Fluorescence; Reflectance; Remote Sensing; Ultraviolet Radiation; Plant Physiology; Plant Stress

20070035156 Pennsylvania State Univ., University Park, PA USA

An New in Vitro Model of Breast Cancer Metastasis to Bone

Mastro, Andrea M; Gay, Carol V; Vogler, Erwin; Apr 1, 2007; 21 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-06-1-0432

Report No.(s): AD-A470050; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470050>

Human (hFOB 1.19) and murine (MC3T3-E1) osteoblasts grew for extended periods (up to 10 months) in a specialized bioreactor. Over time the cells formed multilayers and a collagenous matrix with mineralized nodules and small chips of bone. The number of cell layers in the bone-like tissue peaked at about 30 to 60 days and then declined. This change was reflected in the cell morphology. With time, the osteoblasts transitioned from multilayer cuboidal cells to flat osteocyte-like cells. We characterized the response of MC3T3-E1 bone-like tissue at various stages of maturity to metastatic human MDA-MB-231 breast cancer cells using a variety of approaches. The cancer cells attached, grew, and penetrated the matrix. Within 2 days of coculture, the cancer cells replicated and organized into linear files. Close inspection of both 2D optical sections and 3D reconstructions revealed concomitant remodeling of the tissue. Over 3 days of co-culture, cuboidal osteoblasts became elongated and aligned themselves with cancer cells. The osteoblasts responded with production of IL-6, a characteristic osteoblast inflammatory stress cytokine. These data support our idea that the bioreactor will serve as a useful in vitro model to study the interaction of metastatic breast cancer cells and osteoblasts.

DTIC

Bones; Breast; Cancer; In Vitro Methods and Tests; Mammary Glands; Metastasis

20070035158 Minnesota Univ., Minneapolis, MN USA

Hyaluronan Tumor Cell Interactions in Prostate Cancer Growth and Survival

McCarthy, James B; Turley, Eva; Dec 2006; 18 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-06-1-0135

Report No.(s): AD-A470057; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470057>

Despite advances in the diagnosis and treatment of prostate cancer, the inability to inhibit metastasis represents the major cause of failure in the successful treatment of prostate cancer patients. Hyaluronan (HA), a polymeric anionic polysaccharide, is elevated within primary prostate tumors and in the circulation of prostate cancer patients, and this increase is prognostic of poor outcome. Preliminary data demonstrate that HA mediates its effects on tumor cell growth and survival by interacting with two distinct cellular receptors for HA, CD44 and Rhamm (CD168). CD44 and Rhamm share common functional characteristics, such as an ability to bind HA and to activate the Erk/MAPK signal transduction pathway, which is associated with prostate tumor progression. We hypothesize that the HA receptor Rhamm can facilitate tumor growth, invasion and metastasis by compensating for CD44 loss/reduction, particularly when the amount of HA ligand is increased, as is found in high-grade tumors. Determining the mechanisms by which pericellular HA stimulates prostate tumor growth and metastasis may lead to better therapeutics that can be used to limit the disease, allowing for the better clinical management of patients with advanced prostate cancer.

DTIC

Cancer; Cells (Biology); Prostate Gland; Survival; Tumors

20070035162 Naval Postgraduate School, Monterey, CA USA

Biological Terrorism Preparedness: Evaluating the Performance of the Early Aberration Reporting System (EARS) Syndromic Surveillance Algorithms

Dunfee, David A; Hegler, Benjamin L; Jun 2007; 145 pp.; In English; Original contains color illustrations

Report No.(s): AD-A470069; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470069>

After the terrorist attacks of September 11, 2001, questions developed over how quickly the country could respond if a bioterrorism attack were to occur. 'Syndromic surveillance' systems are a relatively new concept that is being implemented and used by public health practitioners to attempt to detect a bioterrorism attack earlier than would be possible using conventional biosurveillance methods. The idea behind using syndromic surveillance is to detect a bioterrorist attack by monitoring potential leading indicators of an outbreak such as absenteeism from work or school, over-the-counter drug sales, or emergency room counts. The Center for Disease Control and Prevention's Early Aberration Reporting System (EARS) is one syndromic surveillance system that is currently in operation around the USA. This thesis compares the performance of three syndromic surveillance detection algorithms, entitled C1, C2, and C3, that are implemented in EARS, versus the

Cumulative Sum (CUSUM) method applied to model-based prediction errors. The CUSUM performed significantly better than the EARS' methods across all of the scenarios evaluated. These scenarios consisted of various combinations of large and small background disease incidence rates, seasonal cycles from large to small (as well as no cycle), daily effects, and various levels of random daily variation. This results in the recommendation to replace the C1, C2, and C3 methods in existing syndromic surveillance systems with an appropriately implemented CUSUM method.

DTIC

Aberration; Algorithms; Detection; Public Health; Surveillance; Terrorism

20070035163 Army Medical Research Inst. of Infectious Diseases, Fort Detrick, MD USA

Experimental Transmission of West Nile Virus by Culex nigripalpus from Honduras

Mores, Christopher N; Turell, Michael J; Dohm, David J; Blow, Jamie A; Carranza, Marco T; Quintana, Miguel; Jan 2007; 7 pp.; In English

Report No.(s): AD-A470071; USAMRIID-TR-06-001; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: <http://hdl.handle.net/100.2/ADA470071>

Due to concerns regarding the geographic spread of West Nile virus (WNV) to Central America, we evaluated the potential for Honduran *Culex nigripalpus* Theobald to transmit this virus. We tested individual mosquitoes captured in Olancho Province, Honduras, in September 2003. Mosquitoes were fed upon 2- to 4-day-old chickens previously inoculated with a New York strain (Crow 397-99) of WNV. Infection rates in *Cx. nigripalpus* ranged from 81-96% after feeding on chickens with viremias between 106.3 and 107.4 plaque-forming units (PFU)/ml of blood. Development of a disseminated infection was directly correlated with holding time after the infectious blood meal, as 74% of the mosquitoes tested 20 d after the infectious blood meal had a disseminated infection as compared to 42% of the mosquitoes tested 14 d after feeding on the same viremic chicken. Nearly all (86%) of *Cx. nigripalpus* with a disseminated infection that fed on susceptible chickens transmitted virus by bite. In addition, 8 (57%) of 14 *Cx. nigripalpus* with a disseminated infection transmitted virus when tested by a capillary tube feeding assay. Based on its efficiency of viral transmission in this study and its role in the transmission of the closely related St. Louis encephalitis virus in the southeastern USA, *Cx. nigripalpus* should be considered a potentially important vector of WNV in Honduras and the rest of Central America.

DTIC

Honduras; Infectious Diseases; Insects; Viruses

20070035165 Naval Postgraduate School, Monterey, CA USA

A Comparative Analysis of Multivariate Statistical Detection Methods Applied to Syndromic Surveillance

Hu, Cecilia X; Knitt, Matthew C; Jun 2007; 95 pp.; In English

Report No.(s): AD-A470074; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470074>

Biological terrorism is a threat to the security and well-being of the USA. It is critical to detect the presence of these attacks in a timely manner so that emergency services can provide sufficient and effective responses to minimize or contain the damage inflicted. Syndromic surveillance is the process of monitoring public health-related data and applying statistical tests to determine the potential presence of a disease outbreak in the observed system. This research involved a comparative analysis of two multivariate statistical methods: the multivariate cumulative sum (MCUSUM) and the multivariate exponentially weighted moving average (MEWMA), both modified to look only for increases in disease incidence. While neither of these methods is currently in use in a biosurveillance system, they are among the most promising multivariate methods for this application. This analysis was based on a series of simulations using synthetic syndromic surveillance data that mimics various types of background disease incidence and outbreaks. The authors found that, similar to results for the univariate CUSUM and EWMA, the directionally sensitive MCUSUM and MEWMA perform very similarly.

DTIC

Detection; Diseases; Epidemiology; Multivariate Statistical Analysis; Public Health; Statistical Analysis; Surveillance

20070035173 Tennessee State Univ., Nashville, TN USA

Psychosocial and Cultural Barriers to Prostate Cancer Screening: Racial Comparisons

Hull, Pamela C; Mar 2007; 18 pp.; In English

Contract(s)/Grant(s): W81XWH-06-1-0425

Report No.(s): AD-A470085; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470085>

The goal of this project is to better understand the psychosocial and cultural factors affecting prostate cancer screening

among African American and White men. It is a community-based participatory research project, which involves participation of local community members through a community steering committee. The first phase of the project is a focus group study (Year 1). The second phase is to use the focus group results to develop a questionnaire instrument (Year 2), and the third phase is to collect survey data on African American and White men (Years 2-3). The fourth phase is to analyze the survey data, and the final phase is to use the results to develop recommendations for interventions to increase informed decision-making about prostate cancer screening among African American and White men (Year 3). This year we conducted 10 focus groups with a total sample of 74 African American and White men. The focus groups have provided rich qualitative data, which we are now transcribing and will begin analyzing as we transition to the next phase of the project in Year 2.

DTIC

Cancer; Health; Prostate Gland; Surveys

20070035174 Michigan Univ., Ann Arbor, MI USA

Regulation of TSC1/TSC2 Stability and Rheb GTP Level by Herc1

Guan, Kun-Liang; Jan 1, 2006; 7 pp.; In English

Contract(s)/Grant(s): W81XWH-05-1-0136

Report No.(s): AD-A470087; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470087>

Over the past decade, considerable progress has been made in understanding the molecular genetics of Tuberous Sclerosis (TSC), highlighted by the identification of the two tumor suppressor genes *tsc1* and *tsc2*. Mutations in either *tsc1* or *tsc2* cause the disease TSC. A surge of recent research from several labs has shown that TSC1/2 antagonizes the mTOR (mammalian target of rapamycin) signaling network, which plays a central role in the regulation of cell growth in response to growth factors, cellular energy, and nutrient levels. In TSC1 or TSC2 mutant cells, the mTOR signaling pathway, as determined by the phosphorylation of S6K (ribosomal S6 kinase) and 4EBP1 (eukaryote initiation factor 4E binding protein), is highly elevated. Recent studies have also shown that TSC2 functions as a GTPase activating protein (GAP) to stimulate GTP hydrolysis of Rheb (a Ras family GTPase), therefore, inactivating Rheb. Both genetic and biochemical studies support that Rheb is a key direct downstream target of TSC2 and plays an essential role to mediate the physiological functions of TSC1/TSC2. The main objective of this project is to investigate the function of Herc in the regulation of TSC1/TSC2 stability and Rheb GTP level.

DTIC

Genetics; Stability; Tumors

20070035176 Washington Univ., Seattle, WA USA

Genetically-Engineered Proteins For Functional Nanoorganics

Sarikaya, Mehmet; Feb 28, 2007; 25 pp.; In English

Contract(s)/Grant(s): DAAD19-01-1-0499

Report No.(s): AD-A470089; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470089>

The overarching goals in this DURINT project have been: 1. Combinatorial selection and post-selection engineering polypeptides that have specific affinity to inorganic surfaces (GEPI); 2. Understanding the nature of protein molecular binding on inorganic surfaces using experimental and theoretical tools; 3. Use these polypeptides as molecular tools to assemble and make nanostructures, and 4. To develop hybrid complex materials with nanoarchitectures, composed of peptides, polymers and nanoorganics for electronic, photonic, and magnetic applications. The accomplishments included: Selection of GEPI using phage and cell surface display protocols; Post-selection engineering for tailored binding and improved functionalities; In-silico design of Peptides; GEPI binding characteristics using FM, SPR, QCM, and AFM; Assessing chemical binding & conformation of using XPS, TOF-SIMS and ss-NMR; Development of GEPI-designer protein conjugates and assemblers/immobilizers; Conjugation of GEPI and functional monomers designed and synthesized; Modeling of molecular conformation of GEPI on solids; Permissive site analysis on DNA binding and fluorescent proteins for clones for genetic engineering; Synthesis of inorganics for control of size and composition using GEPIs; Control inorganic architecture and immobilization using GEPIs & DNA templates; Development of protein-based nanomasks, GEPI and viral based templates for nanophotonics, including potential use by the DoD applications.

DTIC

Biomimetics; Nanotechnology; Proteins

20070035183 Medicine and Dentistry Univ. of New Jersey, Newark, NJ USA

Inter-Individual Variation in the Metabolic Activation of Heterocyclic Amines and Susceptibility to Prostate Cancer

Hong, Jun-Yan; Jul 1, 2005; 43 pp.; In English

Contract(s)/Grant(s): DAMD17-02-1-0250

Report No.(s): AD-A470103; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470103>

The etiology of human prostate cancer is not well understood. Epidemiological studies suggest that exposure to carcinogenic heterocyclic amines (RCA) such as PhIP formed in high-temperature cooked meatfish is an important risk factor. The Phase 1 metabolism of PhIP in human is mainly catalyzed by CYP enzymes, which leads to the formation of 2-hydroxamino-PhIP (N-hydroxy PhIP), the carcinogenic, metabolite, and 4'-hydroxy PhIP (4'-hydroxy PhIP), the non-carcinogenic metabolite. In the present study, we established a highly sensitive LC/MS method and used it to determine the capability of human prostate tissues (n=31) in metabolizing PhIP and other carcinogenic HCA. Our results indicate that there is no significant N- hydroxylation of PhIP, IQ, MeIQ and MeIQx in human prostate microsomes. We also characterized the functional significance of 15 polymorphic variants of CYP1B1 which is a major human enzyme for PhIP metabolic activation in extrahepatic tissues. Results of our study provide important information on the understanding of inter-individual, susceptibility to prostate cancer.

DTIC

Amines; Cancer; Etiology; Heterocyclic Compounds; Metabolism; Prostate Gland

20070035185 Duke Univ., Durham, NC USA

The Role of Rad17 in DNA Damage Checkpoint Signaling and Initiation of Apoptosis in Mammary Cells

Jian, Hongyan; Jul 2005; 32 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAMD17-02-1-0369

Report No.(s): AD-A470105; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470105>

Multi-potent stem cell populations found in adult tissues have been of great interest because they serve as reservoirs for tissue renewal after trauma, disease and aging. One important type of adult stem cell derived from bone marrow is the mesenchymal stem cell (MSC), which contributes to the regeneration of mesenchymal tissues such as bone, cartilage, muscle, tendon and adipose. However, lack of knowledge at the molecular level on the regulatory mechanisms underlying the self-renewal and differentiation of MSCs has limited the potential use of MSCs in practical applications such as tissue engineering and gene therapy. In this report I describe a novel form of crosstalk between the TGF- β and Wnt signaling pathways and its functional role in regulating the proliferation and osteogenic differentiation of human MSCs. We show that TGF- β induces rapid nuclear translocation of p-catenin in MSCs in a Wnt signaling-independent fashion. TGF- β does not affect the stability of p-catenin, but requires the activity of the TGF- β type I receptor and the presence of Smad3. Functionally, this pathway is required for the stimulation of MSC proliferation and the inhibition of MSC osteogenic differentiation by TGF- β likely through the combined actions of p-catenin and Smad3 to regulate downstream target genes. These results provide evidence for a novel mode of cooperation between the TGF- β and Wnt signaling pathways in this specific cellular context, and suggest a potentially important role for this distinct signaling pathway in the control of self-renewal and differentiation of mesenchymal stem cells.

DTIC

Apoptosis; Breast; Cancer; Crack Initiation; Deoxyribonucleic Acid; Mammary Glands

20070035187 Michigan Univ., Ann Arbor, MI USA

Structure-Based Design, Synthesis and Testing of Non-Peptide, Cell-Permeable, Potent Small Molecule Smac Mimetics as a New Therapy for Prostate Cancer

Wang, Shaomeng; Mar 2005; 18 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-04-1-0213

Report No.(s): AD-A470107; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470107>

XIAP is a promising new molecular target for the design of an entirely new class of cancer therapy to improve survival and quality of life of prostate cancer patients. New therapies targeting XIAP may prove to be especially effective to overcome apoptosis-resistance of prostate cancer cells. Using a powerful computational structure-based design strategy we have designed and synthesized a new class of non-peptide small-molecule inhibitor of XIAP. The most potent compound binds to XIAP with a low nanomolar affinity and is potent in inhibition of cell growth in androgen-independent human prostate cancer

cell lines. Furthermore it is highly potent and effective in enhancing the activity of other anticancer drugs in human prostate cancer cells. Importantly, it has a low toxicity to normal cells. These compounds represent promising leads for further optimization toward our ultimate goal of developing a new class of anticancer drugs by targeting XIAP and promoting apoptosis in cancer cells.

DTIC

Cancer; Peptides; Prostate Gland; Targets; Therapy

20070035189 California Univ., Irvine, CA USA

A Functional Genomic Analysis of NF1-Associated Learning Disabilities

Tang, Shao-Jun; Feb 2007; 37 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-04-1-0261

Report No.(s): AD-A470110; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470110>

Learning disabilities severely deteriorate the life of many NF1 patients. However, the pathogenic process for NF1-associated learning disabilities has not been fully understood and an effective therapy is not available. This study was proposed to identify genes that are dysregulated in the hippocampus of the Nf1+/- mouse model by DNA microarray analysis. Characterization of these NF1-affected genes will dramatically improve our understanding of the molecular pathogenesis underlying NF1-associated learning deficits. During the third year of the project, we have focused on determining the biological functions of NF1-affected genes. In addition, we also characterized the effect of lovastatin treatment on genomic expression of the NF1 hippocampus.

DTIC

Deoxyribonucleic Acid; Disabilities; Diseases; Functional Analysis; Genes; Genetics; Genome; Hippocampus; Learning

20070035206 Beth Israel Deaconess Medical Center, Boston, MA USA

Effect of a HIF-1 Alpha Polymorphism on the Incidence and Prostate Cancer

Bubley, Glenn; Feb 2007; 27 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-05-1-0186

Report No.(s): AD-A470130; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470130>

The P582S C->T and A588T G->A polymorphisms in the Hypoxia-inducible factor-1alpha (HIF-1alpha) gene have been associated with enhanced stability of the protein and androgen-independent prostate cancer (CaP). Methods: We examined the association of these polymorphisms with CaP among 1,072 incident cases and 1,271 controls, and further explored their joint associations with various prediagnostic plasma hormone levels. Results: The A588T polymorphism was too rare to provide meaningful conclusions and the P582S polymorphism was not associated with CaP. We observed a significant interaction of the P582S genotype with insulin-like growth factor binding protein (IGFBP)-3 in modifying CaP risk such that higher IGFBP-3 levels (\geq versus $<$ median) were associated with a reduced risk only among men with the wildtype (OR, 95% CI = 0.74, 0.57-0.97; (Pinteraction) = 0.01). Conclusions: We found no association between these HIF-1alpha gene polymorphisms with CaP, but the interaction between the P582S polymorphism and the IGF axis merits further evaluation in mechanistic studies

DTIC

Cancer; Polymorphism; Prostate Gland

20070035207 Cleveland Clinic Foundation, Cleveland, OH USA

CTLA-4 Blockade-Based Immunotherapy in Prostate Cancer

Rini, Brian I; Jan 2007; 8 pp.; In English

Contract(s)/Grant(s): W81XWH-04-1-0127

Report No.(s): AD-A470131; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470131>

This research project investigated immunotherapy for prostate cancer. Specifically, we explored the use of Granulocyte Macrophage-Colony Stimulating Factor (GM-CSF) in combination with blockade of a T cell inhibitory molecule called Cytotoxic T-Lymphocyte-Associated Molecule-4 (CTLA-4). We studied repetitive dosing of an anti-CTLA-4 antibody in combination with subcutaneous GM-CSF to determine the safety of this combination. Concomitantly, peripheral blood was being collected from patients to evaluate the immune response generated. The original plan was to move this combination

therapy into a phase II trial to look at effects on PSA and other clinical endpoints in patients failing prior vaccination for prostate cancer. This is not possible for a number of reasons. The significant autoimmune toxicity observed (which appears required for an anti-tumor effect) may preclude administration of this combination in prostate cancer patients who are often elderly with comorbidities. Further, the availability of this CTLA-4 antibody is limited. Thus, the current project will end with completion of the phase I trial noted here.

DTIC

Cancer; Inhibitors; Patients; Prostate Gland

20070035208 Massachusetts Inst. of Tech., Cambridge, MA USA

Measurement of pO₂ and pH in Living Breast Tumor Models with Three-Dimensional Resolution by Multiphoton Microscopy during Combined Therapy with Herceptin

Lanning, Ryan M; Jain, Rakesh K; Apr 2007; 37 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-06-1-0436

Report No.(s): AD-A470132; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470132>

Multiphoton laser scanning microscopy (MPLSM) has proved to be an important tool in cancer research providing insight into morphologic changes in tumor vasculature, extracellular matrix components and gene expression. However, there is a lack of techniques utilizing multiphoton microscopy to study functional physiologic parameters that are important in tumor development and response to therapy. This report details the development of methods to quantify pO₂ and pH in vivo with high three-dimensional resolution (~1 micrometer³) and significant depth penetration (up to 400 micrometers) with MPLSM. The technique of phosphorescence quenching microscopy (PQM) was adapted to a multiphoton microscope to permit pO₂ measurements using the Pd-porphyrin dendrimer, OxyphorR2 as the oxygen reporter. Measurements of pH were completed using MPLSM and a novel semiconductor nanocrystal (NC)-based reversible, ratiometric pH biosensor exploiting resonance energy transfer from the nanocrystal to a pH sensitive dye.

DTIC

Breast; Cancer; Laser Applications; Mammary Glands; Microscopy; pH; Scanning; Therapy; Tumors

20070035209 Sloan-Kettering Inst. for Cancer Research, New York, NY USA

Identification of Mechanisms of Breast Cancer Metastasis Using Tissue Specific Virus Delivery

Jechlinger, Martin; Mar 2007; 11 pp.; In English

Contract(s)/Grant(s): W81XWH-05-1-0220

Report No.(s): AD-A470133; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470133>

To investigate breast cancer metastasis we propose to use a tissue-specific viral delivery system that will allow the somatic delivery of secondary lesions in the background of a tumor-inducing primary oncogene. In the first year of support we established protocols for efficient in vitro cultivation and infection of mammary gland-derived normal hyperplastic and tumorigenic cells. For the second year we started to analyze the behavior of mammary tumor cells when infected with candidate genes that are likely to promote invasion. We analyzed infected cells in mammary fat pad re-implantation assays and established a three dimensional basement membrane-based cell culture system for primary mouse mammary cells that will allow us to examine differences after infection of normal hyperplastic tumorigenic and invasive mammary cells in more detail.

DTIC

Breast; Cancer; Carcinogens; Mammary Glands; Metastasis; Tumors; Viruses

20070035210 Fox Chase Cancer Center, Philadelphia, PA USA

Developing Inhibitors of Ovarian Cancer Progression by Targeted Disruption of the Gamma-Synuclein Activated Migratory and Survival Signaling Pathways

Godwin, Andrew; Apr 2007; 33 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAMD17-03-1-0115

Report No.(s): AD-A470134; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470134>

Synucleins are a family of highly conserved small proteins that are normally expressed predominantly in neurons. Very little is known about the physiological functions of the synucleins. We have reported that γ -synuclein (also known as BCSG1) is dramatically up regulated in the vast majority (>70%) of late-stage breast and ovarian cancers (Bruening, et al., 2000). When

overexpressed, γ -synuclein significantly stimulates cell proliferation and metastasis in some breast cancer cell lines. We have shown that DNA hypomethylation is a common mechanism underlying the abnormal expression of this gene in tumor cells (Gupta et al., 2003) and hypothesize that γ -synuclein may be a proto-oncogene and that aberrant expression of this protein may contribute to the development and progression of ovarian cancer. We also found that γ -synuclein can promote cancer cell survival and inhibit stress- and chemotherapy drug-induced apoptosis by modulating MAPKs. Specifically, overexpression of γ -synuclein lead to constitutive activation of ERK1/2, and down-regulation of JNK1 in response to a host of environmental stress signals, including W, heat shock, sodium arsenite, nitric oxide and chemotherapeutic drugs (Pan, Z-2, et al., 2002). Because of its high frequency of expression in late-stage ovarian cancers, we hypothesized that γ -synuclein may be a promising target for cancer therapy.

DTIC

Cancer; Inhibitors; Ovaries; Proteins; Survival

20070035212 Virginia Commonwealth Univ., Richmond, VA USA

Sildenafil and Phosphodiesterase-5 Inhibitors to Reduce Cardiotoxicity and Enhance the Response of Breast Tumors to Doxorubicin

Gewirtz, David A; Mar 2007; 12 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-06-1-0360

Report No.(s): AD-A470139; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470139>

The overall goal of this work is to determine the basis for the differential effects of phosphodiesterase inhibitors, such as sildenafil, in terms of protecting cardiac cells and the heart from the toxicity of the antitumor drug adriamycin, while failing to protect the breast tumor cell. In the current work, we have substantiated our previous observations in the breast tumor cell and extended these findings to other chemotherapeutic drugs (taxol and cisplatin) as well as ionizing radiation. However, we have been unable to demonstrate protection from adriamycin in a different model of cardiomyocytes. This may relate to a number of factors that are currently under investigation, including the high concentration of adriamycin used for a prolonged time period as well as the possible absence of phosphodiesterase-5 as a target in these cells. We believe that a more extensive analysis of the nature of the response to sildenafil in these cardiomyocytes will provide insights as to the mechanism(s) of cytoprotection.

DTIC

Breast; Cancer; Enzyme Activity; Inhibitors; Mammary Glands; Tumors

20070035213 Colorado Univ., Aurora, CO USA

Identification of Cytoplasmic Proteins Interacting with the Mammary Cell Transforming Domain of Ese-1

Gutierrez-Hartmann, Arthur; Apr 2007; 18 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-06-1-0502

Report No.(s): AD-A470141; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470141>

The Ets family of transcription factors contains several members that are important components of the cellular pathways leading to tumorigenesis. The Ese-1 gene is an Ets member that is particularly relevant to breast cancer. Ese-1 is located on chromosome 1q32.1, in a region that is amplified in 50% of early breast cancers. Ese-1 mRNA is over-expressed in human breast ductal carcinoma in situ (DCIS). We recently discovered that Ese-1 transforms MCF-12A cells via a novel cytoplasmic mechanism in which a unique 40-amino acid (AA), serine- and aspartic acid rich (SAR) domain is necessary and sufficient for transformation. Furthermore, we reported that Ese-1 protein is abundantly expressed in the cytoplasm of human ductal carcinoma in situ (DCIS) specimens. However, identification of the cytoplasmic partners of the Ese-1 SAR motif and the precise mechanism by which cytoplasmic signaling mediated by the Ese-1 SAR motif occurs remain unknown. In this application, we propose to take advantage of this novel paradigm. Specifically, we plan to apply innovative and powerful state-of-the-art molecular yeast two-hybrid and protein biophysical methods (MALDI-TOF and LC-mass spectrometry) to identify proteins that interact with the Ese-1 SAR transformation domain. We will then validate which partners of Ese-1 are functionally relevant to breast cancer. We have made diligent progress, having identified a putative interactor, which we are validating.

DTIC

Breast; Cancer; Cytoplasm; Mammary Glands; Proteins

20070035214 Wyle Labs., Inc., Houston, TX USA

The Effects of 12 Hours of Low-Grade Hypoxia at 10,000 ft at Night in Special Operations Forces Aircraft Operations on Cognition, Night Vision, Goggle Vision and Subjective Symptoms

Ballidin, Ulf; Tutt, Ronald C; Dart, Todd S; Shitmore, Jeff; Fischer, Joseph; Harrison, Richard T; Anderson, Erica L; Smith, Jessica L; Workman, Andrew J; Pinchak, Andrea M; Jun 28, 2007; 40 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): FA8650-04-D-6472; Proj-57

Report No.(s): AD-A470142; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470142>

This study evaluated the effects of extended exposure to low-grade hypoxia on cognitive function and visual performance (unaided and night vision goggle [NVG] visual acuity). Thirty subjects were exposed to two, 12 hour exposures, one at ground level and another at 10,000 ft altitude in a hypobaric chamber. Half of the subjects performed moderate exercise. Results: Twelve hour exposure at 10,000 feet produced no significant negative impact on cognitive function, but minor negative effects on night vision goggle performance under operational lighting (starlight) conditions. The altitude exposure did not negatively affect unaided night vision performance under twilight lighting. There was a slight increase in self-reported symptoms of headache, fatigue and lack of concentration, but there was no increase in reported symptoms with the moderate exercise. The increased reports of headache at altitude may possibly indicate imminent mild acute mountain sickness.

DTIC

Cognition; Goggles; Hypoxia; Military Personnel; Night; Night Vision; Signs and Symptoms

20070035215 Texas Univ., Dallas, TX USA

Vatuximab(Trademark): Optimizing Therapeutic Strategies for Prostate Cancer Based on Dynamic MR Tumor Oximetry

Mason, Ralph P; Jan 2007; 16 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-06-1-0149

Report No.(s): AD-A470143; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470143>

Targeting the vasculature of tumors promises a new effective therapy for prostate cancer. We propose a new approach targeting the blood vessels in the tumor. Specifically, a novel antibody 3G4, which targets phosphatidylserine (PS) expressed on tumor vasculature was developed by Thorpe et al. and is being developed by Peregrine Pharmaceuticals for clinical trials. Normally, PS exclusively resides on the cytosolic leaflet of the plasma membrane. However, in tumors PS becomes externalized and provides a viable target. The agent not only targets various tumors, but also induces vascular damage and tumor regression with minimal accompanying toxicity. In developing a new therapy, critical issues include scheduling, optimal combination with other interventions to achieve synergy and early assessment of efficacy. Magnetic resonance imaging allows us to follow the induction and development of tumor vascular damage providing new insight into spatial and temporal activity and facilitating effective combination with the hypoxic cell selective cytotoxin tirapazamine. Importantly, this therapy may be effective at any stage of tumor development, and could be most effective for advanced disease. Success will confirm the potential of this new therapeutic approach to prostate cancer in man and lay the foundation for future clinical trials.

DTIC

Blood Vessels; Cancer; Oximetry; Prostate Gland; Therapy; Tumors

20070035216 McLaughlin Research Inst., Great Falls, MT USA

Early Host Responses to Prion Infection and Development of an In Vitro Bioassay

Carlson, George A; Hood, Leroy E; Mar 2007; 7 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-05-1-0584

Report No.(s): AD-A470144; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470144>

The goal of this project is to identify pathways and networks of genes and proteins perturbed by prion replication. The unusual nature of prion disease prompted a systems approach to identify networks specifically perturbed by prion infections and to determine which perturbations are essential for various aspects of the disease. We previously tracked changes in gene expression in brain and spleen for two different prion strains and five different lines of mice over their entire incubation periods. We have successfully infected CNS stem cell containing neurosphere cultures with the Rocky Mountain Laboratory (RML) prion strain. Neurosphere lines have been produced from the same mouse strains used for our in vivo studies. Differential gene and protein expression in these cells will aid in identifying genes directly involved in prion replication and

lead to the identification of markers for prion infected individuals. We also are developing neurosphere cultures as a sensitive, rapid bioassay for mouse, bovine, and human prions.

DTIC

Bioassay; Central Nervous System; In Vitro Methods and Tests; Infectious Diseases; Stem Cells

20070035217 Army Medical Research Inst. of Infectious Diseases, Fort Detrick, MD USA

Multiple Asparagine Deamidation of Bacillus anthracis Protective Antigen Causes Charge Isoforms Whose Complexity Correlates with Reduced Biological Activity

Powell, Bradford S; Enama, Jeffrey T; Ribot, Wilson J; Webster, Wendy; Little, Stephen; Hoover, Timothy; Adamovicz, Jeffrey J; Andrews, Gerard P; Jan 2007; 26 pp.; In English

Contract(s)/Grant(s): DAMD17-98-D-0029

Report No.(s): AD-A470145; TR-06-120; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470145>

Protective antigen is essential to the pathology of Bacillus anthracis and is the proposed immunogen for an improved human anthrax vaccine. Known since discovery to comprise differentially charged isoforms, the cause of heterogeneity has eluded specific structural definition until now. Recombinant protective antigen (PA) contains similar isoforms which appear early in fermentation and are mostly removed through purification. By liquid chromatography-tandem mass spectrometry sequencing of the entire protein and inspection of spectral data for amino acid modifications, pharmaceutical grade rPA contained measurable deamidation at 7 of its 68 asparagine residues. A direct association between isoform complexity and percent deamidation was observed such that each decreased with purity and increased with protein aging. Position N537 consistently showed the highest level of modification, although its predicted rate of deamidation ranked 10th by theoretical calculation, and other asparagines of higher predicted rates were observed to be unmodified. rPA with more isoforms and greater deamidation displayed lower activities for furin cleavage, heptamerization, and holotoxin formation. Lethal factor-mediated macrophage toxicity correlated inversely with rPA deamidation. The described method measures deamidation without comparison to theoretical isotopic distributions, algorithmic predictions of reactivity, or differentially treated samples, and is broadly applicable to the characterization of other deamidated proteins.

DTIC

Activity (Biology); Antigens; Bacillus

20070035218 Parkinson's Inst., Sunnyvale, CA USA

Polychlorinated Biphenyls, Organochlorines & PD Risk: A Case Control Study in Alaska

Tanner, Caroline M; May 2007; 17 pp.; In English

Contract(s)/Grant(s): W81XWH-04-1-0490

Report No.(s): AD-A470146; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470146>

The intent of this research is to conduct a case control study of Parkinson's Disease (PD) among Alaska Natives to determine the association of exposure to polychlorinated biphenyl (PCBs) residues, organochlorine pesticides and methylmercury with PD. The hypothesis is that increased exposure to these compounds will be associated with an increased risk of PD. Exposure will be determined by direct measurement of serum levels, as these compounds are persistent in body tissues. In addition, lifelong exposure will be estimated by structured interview, including a dietary history with specific attention to intake of fish, marine mammals and wild game, known sources of bioconcentration of these environmentally persistent compounds. The project will be conducted in two phases. Phase 1 is a developmental period and is currently ongoing. During this time, the specific aspects of the study design are being established, detailed protocols are being developed, and the necessary approvals for the research are being obtained. Once Phase 1 is complete, Phase 2 will be initiated. During Phase 2 the study will be conducted.

DTIC

Diseases; Polychlorinated Biphenyls

20070035219 Children's Hospital, Boston, MA USA

Development of Peptide Inhibitors of Rehb Signaling Pathway

Sahin, Mustafa; Jan 2006; 6 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-05-1-0165

Report No.(s): AD-A470147; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470147>

We aim to develop protein therapeutics that neutralize growth factors that activate EGF receptor family members in breast

cancer. Rather than targeting receptors themselves (as do Herceptin, Iressa, etc), we propose to target the activating ligands. Our model is Argos from *Drosophila*, which we showed naturally inhibits EGF receptor signaling in fruit flies by inactivating the ligand. We hope to effectively humanize Argos - making it bind human EGFR ligands and/or to use human protein scaffolds for this. In the past year, we crystallized a complex between the minimal functional fragment of Argos and its target (Spitz), and are about to complete structure determination which will provide critical information for therapeutic design. We also established an experimental approach for screening libraries of Argos variants for those that bind human EGF-like ligands (our therapeutic aim). This approach employs yeast surface (rather than phage) display. We are now poised to combine our technical position and new structural information to identify Argos (and Dkk) variants that bind human EGFs and represent starting points for developing new therapeutics.

DTIC

Breast; Cancer; Inhibitors; Mammary Glands; Peptides

20070035220 Oregon Health Sciences Univ., Portland, OR USA

Fish Oil Supplementation and Fatty Acid Synthase Expression in the Prostate: A Randomized Controlled Trial

Shannon, Jackilen; Mar 2007; 7 pp.; In English

Contract(s)/Grant(s): W81XWH-04-1-0296

Report No.(s): AD-A470148; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470148>

We are conducting a double-blind, placebo-controlled, randomized intervention study to evaluate the effects of Fish Oil (FO) supplementation use on markers of lipid metabolism in prostate tissue samples. The primary endpoints of this trial are fatty acid synthase expression, caveolin-1 expression, changes in lipid raft fractions in the plasma membrane and cell proliferation (KI-87 expression) in benign, pre-neoplastic and neoplastic prostate tissue. The secondary endpoints include measuring the expression of SREBP-1, a transcription factor for fatty acid concentration and change in PSA. Subjects are men from the Portland VA Medical Center (PVAMC), the Oregon Health and Science University (OHSU) and Kaiser Permanente Northwest (KPNW) urology clinics who are scheduled for a repeat biopsy. These men will have had an initial negative biopsy yet are still considered at high risk due to continued elevated prostatic specific antigen (PSA > 4 micrograms/df), are positive for PIN, have suspicious findings by DRE or TRUS, or other clinical finding. Approximately 5 men per month over 24 months will be recruited and randomized to receive three months of either fish oil capsules (treatment 1) or olive oil (placebo) capsules (treatment 2). Potential confounding variables are assessed through completion of a comprehensive diet history questionnaire and risk factor questionnaire, assessment of pre and post-treatment PSA and surveillance of medication and supplement use. Compliance will be assessed using pill count and evaluation of RBC fatty acid concentrations. While this study population is limited to men at high risk of disease, the results may be more broadly generalizable to any man considered at risk of prostate cancer due to standard clinical indicators such as a PSA > 4 micrograms/ml.

DTIC

Cancer; Fatty Acids; Fishes; Oils; Prostate Gland

20070035222 Pennsylvania Univ., Philadelphia, PA USA

Notch Signaling and Schwann Cell Transformation: Development of a Model System and Application to Human MPNSTs

Kadesch, Tom; Mar 2007; 10 pp.; In English

Contract(s)/Grant(s): W81XWH-04-1-0209

Report No.(s): AD-A470150; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470150>

This is an annual report that presents data obtained during the grant's third year of funding. The grant addresses the potential role of Notch signaling in the malignant transformation of neurofibromas to MPNSTs in patients with NF1. Our previous work has shown that constitutive expression of Notch can transform rat Schwann cells and that at least on MPNST-derived human Schwann cell line (of three examined) signals via Notch. This report includes novel results pertaining to two Tasks of the Statement of Work, including our observations 1) that the Notch targets Hes5 and c-Myc alone are unable to mimic the constitutive form of Notch, NICD, to effect transformation and 2) that NICD is NOT sufficient to transform primary Schwann cells. This latter observation is in stark disagreement with our earlier results. Accordingly, we have added a new Task that will address this discrepancy and elucidate the specific pathways that NICD alters in Schwann cells.

DTIC

Blood Cells; Models; Notch Sensitivity; Notches

20070035223 Michigan Univ., Ann Arbor, MI USA

The Role of the ADAM-15 Disintegrin in E-Cadherin Proteolysis and Prostate Cancer Metastasis

Day, Mark L; Feb 2007; 6 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-04-1-0244

Report No.(s): AD-A470151; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470151>

Proteolysis of E-cadherin was rigorously studied a decade ago with specific attention focused on metalloproteinase activity that cleaved E-cadherin in the extracellular domain and generated an 80kDa (E-cad 80) fragment that was shown to disrupt epithelial cell-cell adhesion. This finding was of particular interest due to the fact that E-cad 80 was increased in the serum of cancer patients. Several of these studies demonstrated significant elevations in the serum of patients with gastric, hepatocellular, lung and breast cancer. Although several specific metalloproteinases were shown to cleave E-cadherin to the 80kDa species in vitro, these enzymes were not elevated in metastatic prostate cancer and were not tested under physiologic conditions. Through the use of cDNA microarray this laboratory identified a membrane bound, disintegrin metalloproteinase (ADAM-15) that is specifically upregulated at both the transcriptional and translational level in metastatic prostate cancer. Based on these observations, we hypothesize that the truncation and inactivation of E-cadherin is mediated by the ADAM-15 disintegrin in metastatic prostate cancer. The primary goal of this proposal is to demonstrate that ADAM-15 truncates E-cadherin in prostate epithelial cells, and that this activity promotes the malignant transformation of these cells.

DTIC

Cancer; Metastasis; Prostate Gland

20070035238 Oregon State Univ., Corvallis, OR USA

Development of Effective Aerobic Cometabolic Systems for the In Situ Transformation of Problematic Chlorinated Solvent Mixtures

Semprini, Lewis; Dolan, Mark E; Hopkins, Gary D; McCarty, Perry L; Feb 2005; 425 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): Proj-ER-1127

Report No.(s): AD-A470177; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470177>

Many sites in the DoD and DOE complex are contaminated with chlorinated solvent mixtures. Passive in-situ treatment via aerobic cometabolism is one means of potentially restoring the contaminated aquifers. The goal of the project was to develop a cometabolic culture that has potential for bioaugmentation and to evaluate its performance under laboratory conditions and under in-situ conditions in field demonstrations. The specific objectives of this study were to: 1) develop a butane utilizing culture for bioaugmentation in laboratory and field experiments; 2) characterize the bioaugmentation culture using molecular methods, including a clone library, sequencing, and PCR based methods; 3) develop kinetic information for substrate utilization and the transformation of the CAH mixtures; 4) develop molecular based methods for tracking the cultures that were bioaugmented and biostimulated in laboratory and field studies; 5) conduct laboratory microcosm and continuous flow column studies to evaluate the performance of the bioaugmented culture under geochemical conditions mimicking those present at the field site; 6) conduct field demonstrations to evaluate the bioaugmentation approach and to determine the effectiveness in treating problematic mixtures of 1,1,1-TCA, 1,1-DCE, and 1,1-DCA using butane as cometabolic substrate, and compare the results to those achieved by indigenous butane-utilizers; 7) track microbial community changes and quantify members of the bioaugmented culture in situ using molecular based methods; 8) simulate the results of laboratory and field studies using a transport code for these cometabolic transformations.

DTIC

Aerobes; Biodegradation; Butanes; Chlorination; Chlorine Compounds; Ethane; Pollution Control; Soil Pollution; Solvents; Water Pollution

20070035241 Washington Univ., Seattle, WA USA

Patient Safety Center Organization

Sinanani, Mika N; Rosen, Jacob; Satava, Richard; Acker, Alice; Jun 2007; 35 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-05-2-0056

Report No.(s): AD-A470183; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470183>

With patient safety and improved outcomes as its focus, the Institute for Surgical and Interventional Simulation (ISIS),

is dedicated to the training of medical professionals in technical and procedural skills, and research and development of emerging simulation technologies and educational strategies. ISIS is a collaborative institute of the University of Washington School of Medicine. It connects fifteen departments within the School of Medicine, the School of Nursing, the School of Dentistry, the Biorobotics Laboratory, the Human Interface Technology Lab, and the Center for Videoendoscopic Surgery. ISIS has active MOUs with other simulation centers at University of British Columbia, Oregon Health and Sciences University, and Madigan Army Medical Center, and a presence in Washington, Wyoming, Alaska, Montana, and Idaho. This model has applicability in civilian and military settings, as the collaboration with Madigan Army Medical Center (Andersen Simulation Center) demonstrates.

DTIC

Patients; Project Management; Safety; Surgeons; Training Devices

20070035249 Washington Univ., Saint Louis, MO USA

HER2/neu Antisense Therapeutics in Human Breast Cancer

Drebin, Jeffrey A; Aug 2002; 31 pp.; In English

Contract(s)/Grant(s): DAMD17-99-1-9436

Report No.(s): AD-A470204; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470204>

In order to define mechanisms by which HER2/neu overexpression drives breast cancer cell growth and chemoresistance, antisense oligodeoxynucleotides (ODNs) have been used to down-regulate HER2/neu expression in human breast cancer cells. Such antisense ODNs suppress HER2/neu mRNA and protein expression in a dose-dependent, sequence-specific manner. Antisense ODN-mediated down-regulation of HER2/neu expression in HER2/neu- overexpressing breast cancer cells inhibits cell cycle progression in G₀/G₁ and results in apoptotic cell death. In tissue culture studies, combined treatment of HER2/neu overexpressing breast cancer cells with HER2/neu antisense ODNs and conventional chemotherapeutic agents results in synergistic inhibition of cell growth and activation of apoptosis. These studies have been extended to demonstrate synergistic antitumor effects following systemic treatment with HER2/neu antisense ODNs and chemotherapeutic agents in breast cancer xenografts in nude mice.

DTIC

Breast; Cancer; Chemotherapy; Drugs; Mammary Glands

20070035264 Moffitt (H. Lee) Cancer Research Inst., Tampa, FL USA

Project INSPIRE-HBCU Undergraduate Collaborative Summer Training Program to Inspire Students in Prostate Cancer Research

Kumar, Nagi; Feb 2007; 103 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-06-1-0295

Report No.(s): AD-A470231; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470231>

The overall goal of Project INSPIRE is to provide continuum of opportunities including didactic and meaningful research experience and training in basic, biomedical, clinical and/or population sciences research for promising undergraduate students enrolled at Florida A & M University (FAMU), who are at an important career-decision-making point, in a host institution such as the Moffitt Cancer Center (MCC), with an established record of achievement in prostate cancer research, that will lead to attracting this group into careers that focus on prostate cancer research. The objectives outlined for this project will be completed in three years. As proposed, we recruited 3 students from FAMU during the summer of 2006, who were matched with their mentors and all completed the program as proposed. Four pilot projects completed by the interns in the program and research reports and 7 scholarly papers (1 to be presented at a National meeting) have been presented at scientific meetings. All 4 students have demonstrated interest in graduate study to continue their work with prostate cancer.

DTIC

Cancer; Education; Medical Science; Prostate Gland; Students; Summer

20070035265 Stevens Inst. of Tech., Hoboken, NJ USA

Test Bed Development for Detection and Diagnosis of Prostate Cancer via Internet and Wireless Communication Networks

Yao, Yu-Dong; Man, Hong; Meng, Yan; Apr 2006; 14 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-05-1-0218

Report No.(s): AD-A470232; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470232>

In our research and training program (HBCU Undergraduate Collaborative Summer Training), we address detection and diagnosis of prostate cancer in two technology and application aspects, (a) remote detection and diagnosis through Internet and wireless networks and (b) computer-aided detection and diagnosis. With remote detection and diagnosis, we will provide prostate cancer screenings to men in rural regions and developing countries. With computer-aided detection and diagnosis, we will develop techniques to reduce the costs of telepathology for prostate cancer detection and diagnosis, both in terms of transmission costs and online reading costs. Thus with remote and computer-aided prostate cancer detection and diagnosis, it will have the advantage of higher penetration of men for cancer screening.

DTIC

Cancer; Communication Networks; Diagnosis; Internets; Prostate Gland; Test Stands; Wireless Communication

20070035273 Roswell Park Memorial Inst., Buffalo, NY USA

CTL-Tumor Cell Interaction: The Generation of Molecular Probes Capable of Monitoring the HLA-A*0201-HER-2/neu Peptide Complex

Ko, Eric C; Mar 1, 2007; 10 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-04-1-0372

Report No.(s): AD-A470245; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470245>

The overall goal of this project is to probe the CTL - tumor cell interaction by generating scFv probes that are able to recognize the HLA-A*0201-HER-2/neu369-377 peptide complex. In the second 12-month funding period (Feb 2005 - Feb 2006) scFv 2.3.5-58-53 was isolated following site-directed mutagenesis in the VL CDR3 and VL CDR1 of HLA-A*0201-HER-2/neu369-377 complex-specific scFv 2.3.5. In the 12-month period covered by this report (Feb 2006 - Feb 2007), I aimed to further improve the recognition of HLA-A*0201-HER-2/neu369-377 complexes by scFv 2.3.5-58-53. To this end an scFv-Fc construct was utilized in an attempt to improve the avidity of the scFv for HLA-A*0201 :HER-2/neu369-377 complexes expressed on tumor cells. Although scFv 2.3.5-58-53-Fc demonstrated modestly enhanced reactivity with HER-2/neu369-377 peptide-pulsed T2 cells when compared with scFv 2.3.5-58-53 it did not exhibit enhanced reactivity with HLA-A2+HER-2/neu+ tumor cells PCA-30 and MDA-MB-231. We are actively investigating several possibilities that may account for this discrepancy.

DTIC

Antigens; Breast; Cancer; Cells (Biology); Mammary Glands; Peptides; Tumors

20070035455 Washington Univ., Saint Louis, MO USA

The Role of a Novel Topological Form of the Prion Protein in Prion Disease

Stewart, Richard S; Jul 2006; 7 pp.; In English

Contract(s)/Grant(s): DAMD17-03-1-0531

Report No.(s): AD-A470272; No Copyright; Avail.: Defense Technical Information Center (DTIC)

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 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 used this fact to determine which portions of the PrP molecule interact with CtmPrP to induce toxicity. We have also addressed the role of the Bax protein in CtmPrP-mediated neurological disease. We find that Bax is not required for the disease to develop. We have also begun to examine whether CtmPrP can be studied in a more genetically tractable system, the Baker's yeast *Saccharomyces Cerevisiae*.

DTIC

Diseases; Proteins

20070035456 California Univ., Irvine, CA USA

Genetic Epidemiology of Prostate Cancer

Neuhausen, Susan L; Mar 1, 2007; 8 pp.; In English

Contract(s)/Grant(s): DAMD17-01-1-0112

Report No.(s): AD-A470273; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Prostate cancer results from complex interactions among genetic, endocrine, and environmental factors. Understanding genetic risk factors that contribute to the occurrence of prostate cancer is crucial to design both preventative and therapeutic strategies and to identify at-risk individuals. Plausible candidates for susceptibility genes for prostate cancer risk include genes involved in insulin-like growth factor signaling, androgen signaling, and in immune response. We hypothesized that genetic variation in genes in these pathways was associated with prostate cancer risk. We studied 199 incident prostate cancer cases and 263 age-matched controls. Genotyping was performed for 59 polymorphisms in 18 genes and statistical analyses performed to look at their associations with prostate cancer risk and aggressiveness. As previously reported, the IRS1 G972R GR/RR genotypes (rs1801278) were associated with a significant 2.7-fold increased risk for prostate cancer (95% CI 1.5-4.9, $p=0.0007$). Other significant results were SNP rs2139924 in IGF1R with a 2.6-fold increased risk (95% CI 1.1-6.5) and rs361072 in PI3KCB with a 1.6 fold increased risk (95% CI 1.03-1.66). These results support a role of the insulin-like growth factor pathway in the etiology of prostate cancer. These results need to be replicated in multiple, larger studies.

DTIC

Cancer; Epidemiology; Genes; Genetics; Insulin; Prostate Gland

20070035459 Baylor Coll. of Medicine, Houston, TX USA

Prairie View A&M/Baylor College of Medicine SMART Summer Undergraduate Prostate Cancer Research Project

Weigel, Nancy L; Slaughter, B G; Apr 1, 2007; 10 pp.; In English

Contract(s)/Grant(s): W81XWH-06-1-0391

Report No.(s): AD-A470277; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The goal of this project is to encourage undergraduates to enter careers in prostate cancer research. This project involves BCM faculty presentations at Prairie View A & M University and a 9 week summer prostate cancer research experience at BCM for 5 undergraduates/year from PVAMU (3 participated in 2006; 6 or 7 will be recruited for 2007.) Participants attended a weekly research discussion group focused on prostate cancer. Students make PowerPoint presentations on their work at the end of the program. The participants are co-registered in the SMART Program at Baylor College of Medicine and have access to elements of the SMART Program including an interdisciplinary seminar series, career development activities and career counseling and the SMART GRE Prep Course. Three students participated in the 2006 program. One student confirmed that a derivative of vitamin D reduced cell growth, one that the thyroid and estrogen receptors, but not the androgen receptor interact with a histone deacetylase. One student determined which molecules are involved in inflammation in prostate stromal cells. Student made five presentations. Participants reported significant gains in knowledge and skills. One participant was accepted by two prestigious Ph.D. programs, one is working as a technician and applying for post-bac programs to enhance her preparation for Ph.D. study and one will apply to medical school, but retains an interest in participating in prostate cancer research.

DTIC

Cancer; Grasslands; Medical Science; Prostate Gland; Students; Summer; Universities

20070035460 Iowa Univ., Iowa City, IA USA

Prostate Cancer Research Training Program

Lubaroff, David M; Feb 1, 2007; 7 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-06-1-0266

Report No.(s): AD-A470278; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The HBCU Summer Research Training Program accepted six students from Lincoln University for the eight week session in the summer of 2006. Five of the students were supported by the DOD grant and an additional student was supported by a collaborating faculty member at the University of Iowa. Each student was assigned to a laboratory of a participating mentor and also paired with a member of the mentor's laboratory. This laboratory member assisted with day to day aspects of the research project. During the summer the students worked diligently on their research project, participated in meetings of the mentor's laboratory, attended workshops and seminars associated with our and other summer programs, and attended a special course in prostate cancer. We integrated the Lincoln students into social programs held throughout the campus for summer interns and they attended and participated in the CIC Conference at the University of Illinois. At the end of the summer session the students presented a poster of the research results from the summer experience. They also presented the results of their

research in the fall at Lincoln University and many presented at a national meeting in Florida during the fall/winter of 2006. All of the students have applied to graduate programs for the fall of 2007.

DTIC

Cancer; Education; Medical Science; Prostate Gland; Students

20070035465 Syracuse Univ., NY USA

Enhancing Quality of Life for Breast Cancer Patients with Bone Metastases

Arrington, Sarah A; Allen, Matthew J; Damron, Timothy A; Mann, Kenneth A; Mar 1, 2007; 28 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-06-1-0435

Report No.(s): AD-A470284; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The skeleton is the most common site of metastasis for women with advanced stage breast cancer (5, 8, 22). Severe osteolysis that is often associated with this stage of the disease can lead to skeletal related events such as pathological fracture severe bone pain and hypocalcaemia. The current standard of care for treating osteolytic bone metastases includes palliating bone pain through radiation therapy and blocking ongoing osteoclastic bone resorption with a bisphosphonate. Results from clinical trials indicate that anywhere from 6 to 26% of metastatic bone lesions treated with radiation therapy will go on to develop pathological fractures (11 23). Recent clinical data has shown that zoledronic acid a third generation bisphosphonate decreased the number of skeletal related events by 39% compared to placebo (1 2). Clinicians recognize that prevention of skeletal complications considerably improves the quality of life for these patients (4); and although bisphosphonates can decrease the chances of a patient developing a skeletal complication many are still at risk. In an effort to address this issue we hypothesized that the combination of an anabolic agent parathyroid hormone (PTH 1-34) in conjunction with a bisphosphonate (zoledronic acid ZA) and radiation therapy (RTX) for the treatment of metastatic bone lesion from breast cancer would stimulate new bone formation improve mechanical properties and thus decrease the risk of subsequent pathological fractures.

DTIC

Bones; Breast; Cancer; Mammary Glands; Metastasis; Patients

20070035466 Yale Univ., New Haven, CT USA

Met Nuclear Localization and Signaling in Breast Cancer

Moulis, Sharon P; May 1, 2007; 23 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-04-1-0438

Report No.(s): AD-A470285; No Copyright; Avail.: Defense Technical Information Center (DTIC)

To explore the effects of exercise training on tumor vascularity and response to neoadjuvant therapy in operable breast cancer in a phase I-II randomized design. Method: Using a two-armed prospective randomized design potential participants will be identified and screened for eligibility via medical record review of patients scheduled for their primary neoadjuvant chemotherapy treatment consultation at DUMC. Following the successful completion of all baseline assessments participants will be randomly assigned to an exercise or control group. Participants assigned to combined exercise training and chemotherapy will perform an individualized exercise training program consisting of three cycle ergometry sessions per week at approximately 60-80% of VO₂peak on nonconsecutive days for the duration of neoadjuvant chemotherapy (approximately 12 weeks). Most Significant Research Finding During Reporting Period: As per our statement of work human ethical approval was obtained (Task 1); all exercise testing 1 training procedures and clinical protocols were clarified (Task 2) and data collection has been initiated (Task 3). To date all 3 patients in phase I of the study have been enrolled and no dose-limiting toxicities have been identified with acceptable exercise adherence (>60%) thus phase II has been initiated.

DTIC

Breast; Cancer; Mammary Glands; Position (Location)

20070035472 Albany Medical Coll., NY USA

Identification of a Potent Apoptotic Peptide Produced by Fibroblasts; Studies Towards the Design of a Novel Agent for Breast Cancer Therapy

Petti, Lisa M; Sep 1, 2006; 11 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-04-1-0764

Report No.(s): AD-A470295; No Copyright; Avail.: Defense Technical Information Center (DTIC)

We previously showed that constitutive activation of the platelet-derived growth factor beta receptor (PDGFR) in mortal

human fibroblasts (HDFs) by the bovine papillomavirus E5 or the v-Sis oncoprotein induces partial transformation of these cells. However, two weeks after they reach their peak density E5- and v-Sis-expressing HDFs secrete a small, hydrophilic peptide that induces massive apoptosis in an autocrine manner. Specifically, this peptide induces a type of caspase-independent, Bcl-2-resistant apoptosis by promoting mitochondrial dysfunction, which results in the release of the apoptotic mitochondrial protein AIF into the cytosol and its subsequent translocation to the nucleus. We hypothesize that as a negative feedback response to sustained PDGFR signaling, HDFs release a small, hydrophilic peptide that induces apoptosis by activating or sensitizing pro-apoptotic Bcl-2-related proteins such as Bax, which in turn promote mitochondrial dysfunction. The primary goal of this project is to identify this apoptotic peptide produced by partially transformed HDFs. Since this peptide can induce apoptosis of a number of different tumor cell lines including MCF-7 and MDA human breast carcinoma cells, once identified it could serve as the forerunner of a novel anti-breast cancer agent. Our evidence suggests that this peptide is <3 kDa, negatively charged, and pH sensitive. We recently obtained evidence to suggest that the peptide is a degradation product of an extracellular matrix protein. Moreover, we identified a peptide competitive inhibitor of the apoptotic peptide.

DTIC

Apoptosis; Breast; Cancer; Fibroblasts; Mammary Glands; Peptides; Therapy

20070035474 Georgetown Univ., Washington, DC USA

The Role of ABC Proteins in Drug-Resistant Breast Cancer Cells

Lekostaj, Jacqueline K; Apr 1, 2007; 11 pp.; In English

Contract(s)/Grant(s): W81XWH-06-1-0454

Report No.(s): AD-A470298; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This predoctoral training grant supported by the Department of Defense Breast Cancer Research Program (BCRP) of the Office of the Congressionally Directed Medical Research Programs (CDMRP) aims to study the possible role of ABC transporters in altered apoptotic signal transduction in drug sensitive and resistant cells by a combination of molecular biological biochemical and biophysical methods. The first year of the funding period was spent learning basic molecular biology techniques while working with a model system. The plasmodial homologue of human Pgp PfMDR1 was heterologously expressed in yeast and its function in response to drugs measured in terms of ATPase activity. The data from this project have already led to a quality journal publication (with more forthcoming) and the knowledge and skills I have gained will undoubtedly be extremely valuable in future endeavors with human Pgp. Preparations in terms of mammalian cell culture and microscopy methodology have been made for the start of actual Pgp research and the timetable as outlined in the original grant proposal is still intact.

DTIC

Breast; Cancer; Drugs; Mammary Glands; Proteins

20070035475 Chicago Univ., Chicago, IL USA

Optimization of Tomosynthesis Imaging for Improved Mass and Microcalcification Detection in the Breast

Xia, Dan; Apr 2007; 38 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-06-1-0431

Report No.(s): AD-A470299; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Although considerable progress has been made for the breast tomosynthesis, there are still some issues should be addressed before it becomes suitable for routine clinical use: (1) development of accurate and efficient algorithms for reconstructing 3D breast images from tomosynthesis data, (2) the effect of various physical factors on image quality. During the first year of this research, we have implemented and investigated the TV-based algorithm for image reconstruction in breast tomosynthesis, and investigated the convergence property of the TV-based algorithm under different data conditions and different constraint parameters. We have also conducted numerical studies to investigate the image reconstruction by use of the TV-based algorithm and the existing EM and ART algorithms for different imaging configurations in breast tomosynthesis. Furthermore, we have investigated some physical factors such as cone-beam data noise and non-isotropic spatial resolution on tomosynthesis images.

DTIC

Breast; Cancer; Computer Aided Tomography; Detection; Imaging Techniques; Mammary Glands

20070035477 Georgetown Univ., Washington, DC USA

The Role of Nuclear Receptor Coactivator AIB1 in Growth Factor-Mediated Mammary Tumorigenesis

Fereshteh, Mark P; Mar 1, 2007; 13 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-06-1-0350

Report No.(s): AD-A470301; No Copyright; Avail.: Defense Technical Information Center (DTIC)

AIB1 (Amplified In Breast Cancer 1) is a nuclear receptor coactivator whose gene is amplified in 5-10% of breast cancers and both the mRNA and protein are overexpressed in ~30% of breast tumors. In vitro studies show that AIB1 plays a significant role in estrogen and IGF-1-induced cell proliferation. Germline knockout of the AIB1 gene leads to reduced somatic growth, abnormal reproductive function and reduced mammary gland development. Knockout of AIB1 expression also abrogates Ras-induced tumorigenesis. Furthermore, patients with tumors expressing high levels of the growth factor HER2/Neu in addition to AIB1 often develop anti-estrogen resistance to tamoxifen therapy. These findings imply that AIB1 plays a fundamental role in the development of hormone-independent breast cancer through growth factor mediated pathways. Nonetheless, the underlying mechanism of AIB1 regulation of growth factor mediated mammary neoplasia is unknown. In this investigation, I will utilize the MMTV-Neu mouse model (develop mammary gland tumors in 7-9 months) to elucidate the specific role of AIB1 in growth factor-induced mammary tumorigenesis.

DTIC

Breast; Cancer; Mammary Glands

20070035483 Georgia Tech Research Inst., Atlanta, GA USA

Reactive Conversion of Bioclastic Nanostructures

Sandhage, Kenneth H; Jul 2007; 8 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): FA9550-04-1-0404; Proj-E-18-C19/R5446

Report No.(s): AD-A470311; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Numerous examples can be found in nature of micro-organisms that assemble oxide nanoparticles into rigid (bioclastic) microstructures with intricate, but well-controlled 3-D shapes and fine (nanoscale) features. Because such self-assembly is under genetic control, a given micro-organism can generate bioclastic replicas with a high degree of fidelity upon biological reproduction. Continuous reproduction (repeated doubling) of such micro-organisms can yield enormous numbers of identically-shaped bioclastic structures. Such genetically-precise and massively-parallel self-assembly is a high-attractive means of generating large quantities of ceramic particles with complex and well-defined shapes. However, natural bioclastic compositions (amorphous SiO₂, CaCO₃) are not well-suited for high-temperature applications. This research is focused on the shape-preserving chemical conversion of natural, bioclastic structures into alumina and other refractory ceramics.

DTIC

Nanostructures (Devices); Reaction Kinetics; Reactivity

20070035489 Woods Hole Oceanographic Inst., MA USA

The Marine Biogeochemistry of Zinc Isotopes

John, Seth G; Jun 2007; 144 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): OCE-0002273; OCE-0326689

Report No.(s): AD-A470320; MIT/WHOI-2007-08; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Zinc (Zn) stable isotopes can record information about important oceanographic processes. This thesis presents data on Zn isotopes in anthropogenic materials, hydrothermal fluids and minerals, cultured marine phytoplankton, natural plankton, and seawater. By measuring Zn isotopes in a diverse array of marine samples, we hope to understand how Zn isotopes are fractionated in the oceans and how Zn isotopes may be used as tracers of marine biogeochemical processes.

DTIC

Biochemistry; Biogeochemistry; Geochemistry; Isotopes; Zinc; Zinc Isotopes

20070035491 Woods Hole Oceanographic Inst., MA USA

Approaches for Assessing the Presence and Impact of Thyroid Hormone Disrupting Chemicals in Delphinid Cetaceans

Montie, Eric W; Sep 2006; 306 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): U-91616101-2; WC1330-02SE0257

Report No.(s): AD-A470323; MIT/WHOI-2006-18; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Cetacean blubber is a primary site for lipid storage, which the animal utilizes during periods of energetic stress. It is important to understand how the blubber responds to factors such as ontogeny, water temperature, reproductive status, and

nutritional state because blubber is also the primary bioaccumulation site for persistent organic pollutants (POPs) such as polychlorinated biphenyls (PCBs). During periods of lipid mobilization such as lactation, PCBs from the blubber are mobilized into the circulatory system and may cause toxic effects. One particular toxic mechanism may include the induction of cytochrome P450 enzymes in the integument and liver, which could enhance the biotransformation of PCBs to hydroxylated metabolites (OH-PCBs). OH-PCBs may then interfere with thyroid hormone dependent neurodevelopment. The goals of these studies were to investigate the relationships between lipid dynamics and PCB effects and to devise a quantitative approach to assess neurodevelopment in delphinid cetaceans. Blubber morphology, cytochrome P450 1A1 (CYP1A1) expression in the skin-blubber biopsy, blubber and plasma PCBs, and plasma OH-PCBs were assessed in bottlenose dolphins (*Tursiops truncatus*). In addition, magnetic resonance (MR) images of the post-mortem brain in situ were obtained from Atlantic white-sided dolphin (*Lagenorhynchus acutus*) specimens.

DTIC

Disrupting; Dolphins; Hormones; Lipids; Thyroid Gland

20070035496 Hutchinson (Fred) Cancer Research Center, Seattle, WA USA

An Epidemiologic Study of Genetic Variation in Hormonal Pathways in Relation to the Effect of Hormone Replacement Therapy on Breast Cancer Risk

Reding, Kerry; Apr 1, 2007; 8 pp.; In English

Contract(s)/Grant(s): W81XWH-06-1-0312

Report No.(s): AD-A470329; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Genetic variation in the catechol estrogen (CE) metabolism pathway may modify the effect of combine hormone therapy (CHT). In a population-based case-control study of breast cancer in women aged 88-79, 891 cases and 878 controls were genotyped for functional single nucleotide polymorphisms (SNPs) in the CYP1B1, COMT, GSTT1, GSTM1, and GSTP1 genes. Women who carried at least one copy of the A allele in the GSTP1 gene (108 Ile; rs1695) had a 1.4-fold increased risk of breast cancer compared to those who were homozygous for the 0 allele (98% Confidence Interval (CI) 1.1-1.9); women homozygous with the T allele in the CYP1B1*2 gene (119 Ser; rs1056827) were at 1.8 (95% CI:1.2-2.6) times the risk of those carrying at least one copy of the G allele; no other single genes demonstrated significant associations nor did those single genes have a significant interaction with CHT. In a multi-gene model limited to genes with single gene effects (CYP1B1*2 and GSTP1), the risk of breast cancer increased as the number of high risk genotypes increased (OR =1.6 [95% CI: 1.01-2.3] for 1 vs. 0 high risk genotypes; OR = 2.8 [95% CI:1.8-8.2] 2 vs. 0 high risk genotypes). This association was heightened among current, long-term (80+ months) CHT users, (OR = 7.4 [95% CI 1.9-28.1] for 1-2 vs. 0 high risk genotypes), while in non-users of CHT, the association was attenuated (OR = 1.3 [98% CI 0.8-2.1] for 1-2 vs. 0 high risk genotypes). These results suggest the risk of breast cancer among CHT users is modified by genetic variation in the catechol estrogen metabolism pathway.

DTIC

Breast; Cancer; Epidemiology; Genetics; Hormones; Mammary Glands; Replacing; Risk; Therapy

20070035508 General Accounting Office, Washington, DC USA

Influenza Pandemic: DOD Combatant Commands' Preparedness Efforts Could Benefit from More Clearly Defined Roles, Resources, and Risk Mitigation

D'Agostino, Davi M; Pross, Mark A; Ditto, Susan; Gore, Nicole; Hirschfeld, Simon; Johnson, Aaron; Murrish, Hilary; Jun 2007; 61 pp.; In English

Report No.(s): AD-A470342; GAO-07-696; No Copyright; Avail.: Defense Technical Information Center (DTIC)

COCOMs have taken numerous management and operational actions to prepare for an influenza pandemic, and the COCOMs' efforts are evolving. Each of DOD's nine COCOMs has established or intends to establish a working group to prepare for an influenza pandemic. Additionally, eight of the nine COCOMs have developed or are developing a pandemic influenza plan. Half of the COCOMs have conducted exercises to test their pandemic influenza plans and several are taking steps to address lessons learned. Five of the nine COCOMs have started to use various media, training programs, and outreach events to inform their personnel about pandemic influenza. Each of the geographic COCOMs has worked or plans to work with nations in its area of responsibility to raise awareness about and assess capabilities or responding to avian and pandemic influenza.

DTIC

Influenza; Maintainability; Risk

20070035510 Vanderbilt Univ., Nashville, TN USA

Maintenance of Genome Stability and Breast Cancer: Molecular Analysis of DNA Damage-Activated Kinases

Ball, Heather L; Ehrhardt, Mark; Mordes, Daniel; Cortez, David; Mar 2007; 50 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-06-1-0352

Report No.(s): AD-A470345; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The ATR (ATM and Rad3-Related) kinase is essential to maintain genomic integrity. ATR is recruited to DNA lesions in part through its association with ATR-interacting protein (ATRIP), which in turn interacts with the single-stranded DNA binding protein RPA (Replication Protein A). In this study, a conserved checkpoint protein recruitment domain (CRD) in ATRIP orthologs has been identified by biochemical mapping of the RPA binding site in combination with NMR, mutagenesis and computational modeling. Mutations in the CRD of the yeast ATRIP ortholog Ddc2 disrupt the Ddc2-RPA interaction, prevent proper localization of Ddc2 to DNA breaks, sensitize yeast to DNA damaging agents, and partially compromise checkpoint signaling. These data demonstrate that the CRD is critical for localization and optimal DNA damage responses. However, the stimulation of ATR kinase activity by binding of TopBP1 to ATRIP-ATR can occur independently of the interaction of ATRIP with RPA. Our results support a multi-step model for ATR activation that requires separable localization and activation functions of ATRIP.

DTIC

Breast; Cancer; Damage; Deoxyribonucleic Acid; Genome; Maintenance; Mammary Glands; Stability Tests

20070035519 Jackson State Univ., Jackson, MS USA

Methods and Applications of Computational Chemistry

Jul 4, 2007; 107 pp.; In English; Original contains color illustrations

Report No.(s): AD-A470358; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Conference papers on the subjects of computational chemistry, molecular biology, molecular structure, crystallography, and single crystals (abstracts only).

DTIC

Abstracts; Computational Chemistry; Molecular Biology; Single Crystals

20070035571 Defense Threat Reduction Agency, Fort Belvoir, VA USA

Mitigation of Threats to the Continuation of Marine Recruit Training Posed by a Category 4/5 Influenza Pandemic

DiGiovanni, Cleto; Monto, Arnold S; Malone, John D; Jan 29, 2007; 21 pp.; In English

Contract(s)/Grant(s): HDTRA1-O5-D-0003; MIPR06-2633

Report No.(s): AD-A470468; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The challenges to continuity of recruit training during a Category 4/5 influenza pandemic are so formidable, and the non-pharmaceutical interventions to counter them so limited, complicated, and prone to error in implementation that we reluctantly conclude that the most sensible course, in the absence of an effective vaccine or reliable and safe antiviral prophylaxis, may be to rely on personnel actions other than recruit input to maintain force levels during a pandemic this severe.

DTIC

Education; Health; Influenza

20070035573 Army Medical Research Inst. of Infectious Diseases, Fort Detrick, MD USA

Temporal Analysis of Andes Virus and Sin Nombre Virus Infections of Syrian Hamsters

Wahl-Jensen, Victoria; Chapman, Jennifer; Asher, Ludmila; Fisher, Robert; Zimmerman, Michael; Larsen, Tom; Hoop, Jay W; May 2007; 16 pp.; In English; Original contains color illustrations

Report No.(s): AD-A470471; TR-06-136; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Andes virus (ANDV) and Sin Nombre virus (SNV) are rodent-borne hantaviruses that cause a highly lethal hemorrhagic fever in humans known as hantavirus pulmonary syndrome (HPS) and the pathogenesis is not understood. Syrian hamsters infected with ANDV but not SNV, develop a highly lethal disease that closely resembles HPS in humans. Here, we performed a temporal pathogenesis study comparing ANDV and SNV infections in hamsters. SNV was not pathogenic and viremia was not detected despite the fact that all animals were infected, ANDV was uniformly lethal with a mean time to death of 11 days. The first pathology detected was lymphocyte apoptosis starting on day 4. Animals were viremic and viral antigen was first observed in multiple organs by days 6 and 8, respectively. Levels of infectious virus in the blood increased 4 to 5 logs between days 6 and 9. Pulmonary edema was first detected ultrastructurally on day 6. Ultrastructural analysis of lung tissues

revealed the presence of large inclusion bodies and substantial numbers of vacuoles within infected endothelial cells. Paraendothelial gaps were not observed, suggesting that fluid leakage was transcellular and directly attributable to infecting virus. Taken together, these data imply that HPS treatment strategies aimed at preventing virus replication and dissemination will have the greatest probability of success if administered before the viremic phase; however, because vascular leakage is associated with infected endothelial cells, a therapeutic strategy targeting viral replication might be effective even at later times (e.g., after disease onset).

DTIC

Andes Mountains (South America); Fever; Hamsters; Hemorrhages; Infectious Diseases; Viral Diseases; Viruses

20070035575 Air Force Research Lab., Brooks AFB, TX USA

Testing the Viability of Stored Frozen Serum Samples from the Air Force Health Study using Human Multi-Analyte Profiles (MAP(Trademark))

Pavuk, Marian; Sep 2006; 16 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): Proj-2276

Report No.(s): AD-A470474; AFRL-HE-BR-TR-2007-0015; No Copyright; Avail.: Defense Technical Information Center (DTIC)

We assessed whether the Air Force Health Study (AFHS) frozen samples were viable for use in future studies using the Rules Based Medicine (RBM) Multi-Analyte Profiles (MAPtm) technologies applied to assay specific biochemical parameters. We randomly chose five AFHS veterans who participated at the 1982, 1985, 1987, 1992, and 1997 physical examinations and had multiple serum samples stored. One sample per examination per participant was selected for a total of 25 serum samples analyzed by MAP. MAPs are high-density, quantitative immunoassays panels that allowed each serum specimen to be analyzed for 78 specific serum antigens, 43 autoimmune serologies and 56 infectious disease serologies for a total of 177 analytes in one complex analytical procedure using 100 microliters of sera. Overall, 96% of analytes provided measurable results and 83% (147 of 177) of analytes showed complete results for all five veterans for all five examinations. There was no indication that older samples were less well preserved than more recent ones. Comparison of quantitative result of 16 analytes measured at both the AFHS examinations and by the RBM human MAP panel found good correlations and agreement between the assays in stored frozen serum samples. Biochemical integrity of the samples appears to be well preserved and sensitive immunoassay based analyses were successfully performed.

DTIC

Evaluation; Health; Herbicides; Immunoassay; Serums; System Effectiveness; Viability; Vietnam; Warfare

20070035587 Army Medical Research Inst. of Infectious Diseases, Fort Detrick, MD USA

Global Surveillance of Emerging Influenza Virus Genotypes by Mass Spectrometry

Sampath, Rangarajan; Russell, Kevin L; Massire, Christian; Eshoo, Mark W; Harpin, Vanessa; Blyn, Lawrence B; Melton, Rachael; Ivy, Cristin; Pennella, Thuy; Li, Feng; May 30, 2007; 11 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): R01-CI-000099; IUC1A1067232-01

Report No.(s): AD-A470502; TR-07-010; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Effective influenza surveillance requires new methods capable of rapid and inexpensive genomic analysis of evolving viral species for pandemic preparedness, to understand the evolution of circulating viral species, and for vaccine strain selection. We have developed one such approach based on previously described broad-range reverse transcription PCR/electrospray ionization mass spectrometry (RT-PCR/ESI-MS) technology. Methods and Principal Findings: Analysis of base compositions of RT-PCR amplicons from influenza core gene segments (PB 1, PB2, PA, M, NS, NP) are used to provide sub-species identification and infer influenza virus Hemagglutinin (HA) N subtypes. Using this approach, we detected and correctly identified 92 mammalian and avian influenza isolates, representing 30 different HA N types, including 29 avian H5N1 isolates. Further, direct analysis of 656 human clinical respiratory specimens collected over a seven-year period (1999-2006) showed correct identification of the viral species and subtypes (>97% sensitivity and specificity). Base composition derived clusters inferred from this analysis showed 100% concordance to previously established clades. Ongoing surveillance of samples from the recent influenza virus seasons (2005-2006) showed evidence for emergence and establishment of new genotypes of circulating H3N2 strains worldwide. Mixed viral quasispecies were found in approximately 1% of these recent samples providing a view into viral evolution. Conclusion/Significance: Thus, rapid RT-PCR/ESI-MS analysis can be used to simultaneously identify all species of influenza viruses with clade-level resolution, identify mixed viral populations and monitor global spread and emergence of novel viral genotypes. This high throughput method promises to become an integral component of influenza surveillance.

DTIC

Genome; Influenza; Mass Spectroscopy; Surveillance; Viruses

20070035593 New York Hospital-Cornell Medical Center, New York, NY USA

The Role of Lecithin: Retinol Acyltransferase (LRAT)-Mediated Esterification of Vitamin A in Regulating Human Breast Cancer Cell Proliferation and Differentiation

Su, Dan; Gudas, Lorraine J; Apr 2007; 12 pp.; In English

Contract(s)/Grant(s): W81XWH-04-1-0440

Report No.(s): AD-A470510; No Copyright; Avail.: Defense Technical Information Center (DTIC)

To understand the molecular mechanisms that mediate Lecithin:Retinol Acyltransferase (LRAT) transcription by Retinoic Acid (RA) in normal human mammary epithelial cells versus breast carcinoma cells, the authors isolated and characterized the promoter region of the human LRAT gene and tested its activity in normal mammary epithelial cells versus human breast carcinoma cells. Meanwhile, to determine if retinoic acid response gamma (RAR gamma) is involved in the regulation of LRAT gene expression, they tested LRAT mRNA levels in Wt and RAR gamma -/- F9 cells, an epithelial type of cell, which can synthesize retinyl esters. The RT-PCR analysis indicated that LRAT expression was lost in the MDA-MB-231 breast cancer cells. Surprisingly, they did not observe an RA-associated increase in LRAT mRNA levels in the HMEC cell line in culture. By using the MatInspector V2.2 computer program, they identified two conserved half-sites separated by four nucleotides (DR-4), as well as a DR-5 RARE in the 5' flanking region of the LRAT promoter region. They isolated the 2.3-kb 5'-flanking region of the human LRAT gene. The luciferase activity of this promoter region in MDA-MB-231 cells was one-sixth of that in HMEC cells at 48 hours, suggesting that this region harbors cis-elements contributing to the loss of LRAT expression in human breast cancer cells. RA treatment increases LRAT mRNA levels in F9 Wt cells at late times (72 hours). There was no apparent difference in the LRAT mRNA levels detected between the F9 Wt cells and F9 RAR gamma -/- cells, indicating that RAR gamma is not involved in the transcriptional regulation of the human LRAT gene.

DTIC

Breast; Cancer; Cells (Biology); Epithelium; Gene Expression; Genes; Mammary Glands; Regeneration (Physiology); Retinene; Tumors

20070035599 North Carolina Agricultural and Technical State Univ., Greensboro, NC USA

The Burden of Disability among Active Duty Air Force Members

Seong, Younho; Watkins, Meisha; Sep 2006; 122 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): FA8650-05-1-6643; Proj-7184

Report No.(s): AD-A470517; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The objectives of this literature review were to examine the available statistics pertaining to disability within the USA Air Force (USAF); to identify prominent types of injuries faced by active duty personnel, including their classification, which result in disability discharge; and to make recommendations for strategies that policy makers can use to combat this issue. This report describes the current state of the burden of disability among active duty Air Force members. The report describes the types of injuries that active duty service members sustain, and the subsequent disabilities that frequently result. Many service members are discharged from active service, and Department of Defense disability costs continue to rise at an alarming rate. The authors' ongoing and future work in disability prevention will utilize the information contained in this report. An annotated bibliography of the journal articles reviewed for this study is included.

DTIC

Armed Forces (United States); Classifications; Disabilities; Diseases; Disorders; Injuries; Mental Health; Military Personnel; Physiological Effects

20070035608 Air Force Research Lab., Brooks AFB, TX USA

Hypertension and 2,3,7,8-Tetrachlorodibenzo-p-dioxin in Air Force Veterans of the Vietnam War

Dwyer, James H; Jackson, William G; Michalek, Joel E; Jun 2006; 52 pp.; In English

Contract(s)/Grant(s): Proj-2276YA01

Report No.(s): AD-A470533; AFRL-HE-BR-TR-2006-0017; No Copyright; Avail.: Defense Technical Information Center (DTIC)

We studied the risk of hypertension and exposure to 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD) in veterans of Operation Ranch Hand, the Air Force unit responsible for the serial spraying of Agent Orange and other TCDD-contaminated herbicide in Vietnam. We included a Comparison group of other Air Force veterans who flew or serviced C-130 cargo aircraft in Southeast Asia during the same calendar period that the Ranch Hand unit was active in Vietnam (1962-1971) but were not involved with spraying herbicides. We measured TCDD serum level in 1987, 1992, and 1997. There was no overall increase in the risk of hypertension in the Ranch Hand cohort, however, within both cohorts, the risk of hypertension was markedly increased with TCDD. Relative to the bottom category of serum TCDD in the Comparison cohort, the relative risk of

hypertension in the highest TCDD category in the Comparison group was 1.66 (95% CI 1.04 to 2.67) and 1.33 (1.02 to 1.74) in the highest TCDD category in the Ranch Hand group. an analysis of a questionnaire-based index of skin exposure to herbicides among Ranch Hand enlisted personnel revealed an increasing trend ($p=0.002$) of hypertension risk with increasing skin exposure. While the lack of an overall between-group difference in hypertension risk suggested that TCDD was not a risk factor for hypertension, these within-group associations suggested that mechanisms relating TCDD uptake and clearance were associated with body weight and the pathophysiology of hypertension.

DTIC

Herbicides; Hypertension; Vietnam; Warfare

20070035611 Air Force Research Lab., Brooks AFB, TX USA

Wavelength Dependence of Ocular Damage Thresholds in the Near-IR to Far-IR Transition Region: Proposed Revisions to MPEs

Zulich, Joseph A; Lund, David J; Stuck, Brice E; Jul 1, 2005; 14 pp.; In English

Contract(s)/Grant(s): F41624-02-D-7003; Proj-2312

Report No.(s): AD-A470540; AFRL-HE-BR-JA-2005-0033; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This report summarizes the results of a series of IR laser-induced ocular damage studies conducted over the past decade. The studies examined retinal, lens, and corneal effects of laser exposures in the near-IR to far-IR transition region (wavelengths from 1.3- 1.4 μ m with exposure durations ranging from Q-switched to cw). The corneal and retinal damage thresholds are tabulated for all pulsewidth regimes and the wavelength dependence of the IR thresholds is discussed and contrasted to laser safety standard maximum permissible exposure (MPE) limits. The analysis suggests that the current laser standard MPEs could be beneficially revised to: (1) relax the IR MPEs over wavelength ranges where unusually high safety margins may unintentionally hinder applications of recently developed military and telecommunications laser systems; (2) replace step-function discontinuities in the IR MPEs by continuously varying analytical functions of wavelength and pulsewidth which more closely follow the trends of the experimental retinal and corneal ED50 threshold data; and (3) result in an overall simplification of the safety standard MPEs over the wavelength range from 1.2 μ m to 2.6 μ m. A specific proposal for amending the IR MPEs over this wavelength range is presented.

DTIC

Damage Assessment; Eye (Anatomy); Far Infrared Radiation; Laser Applications; Laser Damage; Near Infrared Radiation; Retina; Yield Point

20070035840 Organisatie voor Toegepast Natuurwetenschappelijk Onderzoek, Rijswijk, Netherlands

Bio Aerosol Test Chamber: Development of Protocols

Broekhuijsen, M. P.; July 20, 2007; 2 pp.; In English; Original contains color illustrations

Report No.(s): TD2007-0143; TNO-DV 2007 A297; Copyright; Avail.: Other Sources

A newly installed test chamber for bio-aerosols was evaluated using three different simulants for biological warfare agents. The three simulants were *Bacillus globigii* (spores), *Erwinia herbicola*, and MS2 virus. With all thee. aerosols in the range of 5-100 ACPLA were generated and maintained for up to 6 hours.

Author

Aerosols; Spores; Test Chambers; Microorganisms

20070035927 Organisatie voor Toegepast Natuurwetenschappelijk Onderzoek, Rijswijk, Netherlands

Boosting Immune Responses against Bacterial Pathogens: In Vitro Analysis of Immunomodulators

vanderKleij, D.; July 2007; 2 pp.; In English

Report No.(s): TD2007-0132; TNO-DV 2007 A266; Copyright; Avail.: Other Sources

The threat of the use of biological weapons, including bacteria, has increased. Bacterial resistance to antibiotics increasingly becomes a problem. Vaccination of military personnel against biothreat agents may be an option, however there is a broad range of biothreat agents, which may become even broader as a result of genetic engineering. Moreover, vaccination against multiple agents may cause undesired effects. A more generic approach to prevent the effects of a broad spectrum of bacteria via immunomodulation seems more effective. Three potential broad-spectrum therapeutics (MPL, MDP and ssPolyU) and their combinations were tested in an in vitro dendritic cell culture system, since dendritic cells play a central role in the development of immune responses. All combinations of modulators (but not all single modulators) enhanced DC activation, combinations with MDP acted synergistically. MDP and ssPolyU in addition enhanced the T cell polarizing capacity of DC

into a response that is suitable for the combat of intracellular infections. The effects of the modulators varied when combined with different pathogens were used. The effects of MDP and ssPolyU will be studied further in an in vivo mouse infection model.

Author

Biological Weapons; Infectious Diseases; Physiological Responses; Immune Systems; Immunology; Physiological Defenses

20070036060 Burnham Inst., La Jolla, CA USA

Targeting Therapy Resistant Tumor Vessels

Ruoslahti, Erkki; May 1, 2007; 35 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-06-1-0482

Report No.(s): AD-A470574; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470574>

Anti-angiogenic therapy appears to eliminate immature blood vessels. This paradoxically leads to improvement of tumor blood supply, as the structure and function of mature tumor blood vessels, not specific for anti-angiogenic effect, is normalized. This is a serious limitation to the anti-angiogenic therapy. The goal of this project is to specifically distinguish these 'normalized' therapy resistant vessels in breast cancer from those sensitive to anti-angiogenic treatment. To achieve this, we have developed tumor models for vascular normalization and are using in vivo phage display and isolation of peptides that specifically home to normalized tumor vessels resistant to anti-angiogenic therapy. The results obtained in this study will enable specific targeting and thus treatment of breast cancer vessels not responding to standard anti-angiogenic therapy.

DTIC

Angiogenesis; Breast; Cancer; Mammary Glands; Peptides; Prevention; Therapy; Tumors

20070036061 Alabama Univ., Birmingham, AL USA

Breast Cancer Microvesicles as a Novel Plasma Biomarker and Therapeutic Target (IDEA)

Harris, Kevin W; Apr 1, 2007; 11 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-06-1-0420

Report No.(s): AD-A470575; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470575>

We propose to study the ability of quantitation of breast cancer tumor microvesicles (MV) to predict clinical outcomes in breast cancer patients. We also propose that treatment of HER2+ breast cancer patients with trastuzumab results in clearing of tumor MV from the blood. In order to achieve these aims, a precise and robust clinical assay is required. Flow cytometry, as originally proposed, and as used by numerous investigators, is inadequate for this task. Thus we have developed a novel bead capture procedure to isolate and analyze tumor MV from breast cancer patients. Anti-MUC1 coated beads are used to bind and isolate tumor MV from patient plasma. We have characterized these MUC-1 tumor MV and verified the specificity of the capture. The isolated tumor MV will be assayed by commercial ELISA for MUC1, tissue factor, MMPs, and uPA. We have an active IRB approved protocol and have begun to collect patient samples for this purpose.

DTIC

Biomarkers; Biometrics; Blood; Breast; Cancer; Clinical Medicine; Mammary Glands; Plasmas (Physics); Targets; Therapy

20070036062 Texas Univ., Austin, TX USA

Genome-Wide Chromosomal Targets of Oncogenic Transcription Factors

Lyer, Vishwanath R; Apr 1, 2007; 12 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-04-1-0472

Report No.(s): AD-A470576; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470576>

We originally proposed to develop a new genomic method named STAGE (Sequence Tag Analysis of Genomic Enrichment) to identify the direct downstream targets of transcription factors that are important in breast cancer. STAGE was based on high throughput sequencing of concatamerized tags derived from DNA associated with transcription factors isolated by chromatin immunoprecipitation. Over the last year, we have significantly improved the efficiency of our methodology by modifying the initial method to take advantage of new developments in sequencing technology. We first used a bead-based, pyrosequencing method developed by 454/Roche to identify the targets of STAT1. We developed new methods to score target genes and independently verified targets using quantitative real time PCR. Secondly, we have adapted our approach to use even more high-throughput sequencing technology developed by Solexa to identify the targets of c-Myc, by sequencing

millions of tags. We will also use Solexa sequencing to improve the coverage of E2F4 targets by significantly deeper sequencing.

DTIC

Breast; Cancer; Carcinogens; Chromosomes; Deoxyribonucleic Acid; Genome; Mammary Glands; Precipitation (Chemistry); Targets; Tumors

20070036063 Yale Univ., New Haven, CT USA

Quantitative in situ Assessment of the Somatostatin Receptor in Breast Cancer to Assess Response to Targeted Therapy with 111-in-Pentetreotide

Chung, Gina G; Rimm, David; May 1, 2007; 11 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-04-1-0277

Report No.(s): AD-A470577; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470577>

Somatostatin (SST) is a peptide hormone implicated in the growth and progression of cancers and SSTR2 is the predominant receptor subtype expressed in breast cancer. We hope to study the pattern of expression and clinical significance of SSTR2 levels in breast cancer. We have developed an algorithm called AQUA that can assess protein expression on tissue microarrays (TMA) based on molecular co-localization techniques. Our results show that SSTR2 is localized predominantly to the malignant cells although also in vessel/lymphatic elements. Although expression was not significantly correlated with survival on our TMA, it did appear to be overexpressed compared with benign breast tissue. A vessel compartment has been developed using a multiplexing protocol for co-localization of SSTR2 to tumor and endothelium concurrently. Cell line controls have also been developed as a normalization feature and ELISA assays have been more successful as reference protein measurements. Whole sections of breast cancer are currently being evaluated for SSTR2 expression and preliminary data are presented.

DTIC

Breast; Cancer; Hormones; Lymphatic System; Mammary Glands; Proteins; Quantitative Analysis; Therapy

20070036064 Indiana Univ., Indianapolis, IN USA

Selenium Potentiates Chemotherapeutic Selectivity: Improving Efficacy and Reducing Toxicity

Fisher, Joshua L; Apr 2007; 15 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-06-1-0504

Report No.(s): AD-A470578; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470578>

The goal of the research is to evaluate the contribution of DNA repair to the protective effects of selenium in the context of chemotherapy. Specifically, the aims are to determine whether selenium-induced protection from DNA-damaging chemotherapeutics in vivo corresponds to reduced myelosuppression. Second, determine if selenium induced protection from chemotherapeutic toxicity corresponds to elevated DNA repair in vivo.

DTIC

Bone Marrow; Chemotherapy; Deoxyribonucleic Acid; Drugs; Selenium; Toxicity

20070036065 Texas Univ., Dallas, TX USA

Breast Tumor Detection and Treatment Using Tarvacin Labeled with Arsenic Radionuclides

Mason, Ralph P; Apr 2007; 18 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-06-1-0475

Report No.(s): AD-A470579; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470579>

We will generate a novel approach for detection and therapy of advanced breast cancer based on three fundamentally novel discoveries and concepts. The first critical component exploits a novel antibody, which targets phosphatidylserine (PS), expressed on tumor vasculature. In collaboration with Peregrine Pharmaceuticals, this agent has been chimerized and is being developed for clinical trials as bavituximab (formerly TM). Normally, exclusively resides on the cytosolic leaflet of the plasma membrane, but in tumors PS becomes externalized providing a viable target. The agent not only targets various tumors, but also induces vascular damage and tumor regression with minimal accompanying toxicity. The second component is the identification of diverse arsenic radionuclides suitable for imaging based on PET and radio immunotherapy together with new means of isolating the radionuclides. Importantly, the antibodies can be effectively labeled forming viable products of high

specific radiochemical and biological activity. Thirdly, our program brings together pharmacological and radiochemical expertise to facilitate collaboration, progress, and synergy. This project will develop a single agent (bavituximab) for tumor detection, dosimetry, and therapy based on differential properties of arsenic radionuclides, but exploiting a single chemistry. DTIC

Arsenic; Breast; Cancer; Detection; Mammary Glands; Radioactive Isotopes; Tumors

20070036066 Arizona Univ., Tucson, AZ USA

Effect of MUC1 Expression on EGFR Endocytosis and Degradation in Human Breast Cancer Cell Lines

El Bejjani, Rachid M; Apr 2007; 35 pp.; In English

Contract(s)/Grant(s): W81XWH-06-1-0464

Report No.(s): AD-A470580; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470580>

ErbB receptors are key regulators of cell survival and growth in normal and transformed tissues. The oncogenic glycoprotein MUC1 is a binding partner and substrate for erbB1 and MUC1 expression can potentiate erbB-dependent signal transduction. After receptor activation, erbB1 is typically downregulated via an endocytic pathway that results in receptor degradation or recycling. We report here that MUC1 expression inhibits the degradation of ligand-activated erbB1. Through the use of both RNAi-mediated knock down and overexpression constructs of MUC1, we show that MUC1 expression inhibits erbB1 degradation after ligand treatment in breast epithelial cells. This MUC1-mediated protection against erbB1 degradation can increase total cellular pools of erbB1 over time. Biotinylation of surface proteins demonstrates that cell surface associated erbB1 receptor is protected by MUC1 against ligand-induced degradation, although this is accompanied by an increase in erbB1 internalization. The MUC1-mediated protection against degradation occurs with a decrease in EGF-stimulated ubiquitination of erbB1, and an increase in erbB1 recycling. These data indicate that MUC1 expression is a potent regulator of erbB1 receptor stability upon activation and may promote transformation through the inhibition of erbB1 degradation.

DTIC

Breast; Cancer; Degradation; Epithelium; Mammary Glands

20070036067 California Univ., Irvine, CA USA

SXR, A Novel Target for Breast Cancer Therapeutics

Verma, Suman; Apr 2007; 18 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-06-1-0453

Report No.(s): AD-A470581; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470581>

Anti-estrogens such as tamoxifen are important therapeutic agents in the treatment and chemoprevention of breast cancers. Other compounds such as phytoestrogens, fatty acid amides such as anandamide and retinoid X receptor agonists are also effective against breast cancer in cell lines and in animal models. Because these compounds are structurally unrelated, it has not been appreciated that they might act through a common mechanism. All of these compounds share the ability to activate a heterodimer of the steroid and xenobiotic receptor (SXR) and retinoid X receptor (RXR). Our hypothesis is that SXR serves as a common molecular target for some of the anti-proliferative effects of these compounds and that activation of SXR is itself anti-proliferative. To this end, we have found that activation of SXR leads to apoptosis and G1 cell cycle arrest through a p53 dependent pathway in estrogen receptor positive MCF7 breast cancer cells. In this period of study, we have confirmed our initial results in another ER+ breast cancer cell line ZR-75-1. We have also been able to provide further support for our hypothesis by showing that activation of SXR not only causes increase in p53 mRNA, but also causes stabilization and accumulation of p53 protein in MCF7 cells. So far, we have been able to significantly knock down SXR in MCF-7 cells by using siRNA and we are currently performing the loss of function studies in these cells and optimizing the siRNA transfection conditions in ER- breast cancer cell lines.

DTIC

Amides; Breast; Cancer; Fatty Acids; Mammary Glands; Targets

20070036068 Harvard Medical School, Boston, MA USA

BRCA1 Protein Complexes: Dynamic Changes and Functions Important in Breast Cancer

Horwitz, Andrew; Apr 2007; 25 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-04-1-0371

Report No.(s): AD-A470582; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470582>

In this final report, I summarize the major accomplishments achieved during my three-year award period. Initial

experiments focused on purification of endogenous BRCA1 complexes; however, the most fruitful work has occurred in characterizing the function of such BRCA1 complexes. I describe here distinct mechanisms for transcriptional stimulation and repression. These activities recapitulate the in vivo transcriptional functions of BRCA1.

DTIC

Breast; Cancer; Genes; Mammary Glands; Proteins

20070036069 New Mexico Univ., Albuquerque, NM USA

The Role of CXCR4 and Arrestins in Breast Cancer Signaling and Apoptosis

Wagener, Brant M; Feb 2007; 167 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-04-1-0251

Report No.(s): AD-A470583; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470583>

This work focuses on how arrestin regulates trafficking and signaling of the N-formyl peptide receptor (FPR), a G protein-coupled receptor (GPCR). GPCRs are involved in almost all physiologic processes and numerous pathologic processes. There is an intimate relationship between GPCR trafficking and signaling that controls many cellular processes. However, the protein-protein interactions that control post-endocytic trafficking and signaling of GPCRs are poorly understood. Our previous reports demonstrated that three events take place upon FPR activation in the absence of arrestins: accumulation of FPR in the perinuclear recycling endosome, lack of FPR recycling and apoptosis. All of these phenotypes were rescued by reintroduction of arrestin-2 cDNA. We therefore hypothesized that 1) FPR trafficking and signaling defects were linked and causal and 2) specific regions of arrestin-2 regulate normal FPR trafficking and signaling. To address these hypotheses, we generated mutants of arrestin-2 that were previously described or changed regions of similar amino acids to alanine. We then screened these mutants for the ability to rescue FPR-mediated apoptosis. Subsequently, we examined the role of these arrestin mutants in FPR trafficking. We found that two arrestin-2 mutants demonstrated altered binding to adaptor protein (AP)-2. Furthermore, FPR recycling was inhibited in the presence of either arrestin-2 mutant or the absence of AP-2. We also examined the role of Src kinase in FPR trafficking and signaling and determined that Src kinase has two independent roles in FPR-arrestin-2 regulation: one that controls FPR trafficking and one that mediated FPR signaling. Finally, we found that different SH3-binding domains of arrestin-2 regulate FPR trafficking and signaling independently. One arrestin-2 mutant did not rescue FPR-mediated apoptosis, but did mediate normal FPR trafficking.

DTIC

Apoptosis; Breast; Cancer; Mammary Glands

20070036070 Jackson (Henry M.) Foundation, Rockville, MD USA

Physiologic and Endocrine Correlates of Overweight and Obesity in African Americans and Caucasians

Deuster, Patricia A; Mar 2007; 13 pp.; In English

Contract(s)/Grant(s): DAMD17-03-2-0024

Report No.(s): AD-A470584; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470584>

Obesity has reached epidemic levels and yet the incidence continues to rise. The current study is seeking to examine the hypothesis that obesity may reflect dysfunctioning of the hypothalamic-pituitary-adrenal (HPA) axis in response to stressors. African American persons are at greatest risk, but reasons for this difference are unknown. We will study 120 men and women of Caucasian and African American ethnicity and examine their responses to physiologic stressors: exercise and ingestion of a meal. Methods: The HPA axis will be studied in some detail by using two stressor paradigms and two steroid regimens. We expect to be able to detect subtle differences in HPA axis reactivity in obese individuals that might contribute to morbidity and perhaps even make individuals resistant to therapeutic interventions. Results: We have enrolled 124 participants, with 93 completed. Data collection and analyses are proceeding on schedule. Two abstracts were presented in 2006 and one is submitted and accepted for presentation in Summer 2007. Conclusions: We are on schedule for all study milestones and look forward to being able to answer the important questions regarding the potential role of the HPA axis in obesity.

DTIC

Africa; Endocrine Glands; Endocrinology; Epidemiology; Hypotheses; Obesity; Physiology; Races (Anthropology)

20070036076 Foundation for Health Care Quality, Seattle, WA USA

Puget Sound Infectious Disease Tracking System

Dunber, Peter J; Mar 2007; 88 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-04-1-0418

Report No.(s): AD-A470593; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470593>

This study is a community-based observational study in conjunction with local public health authorities across a multi-jurisdictional region. Purpose: To develop usable useful syndromic surveillance capabilities that would improve CON US force protection and support local public health authorities. The aim was to integrate multi-jurisdictional civilian health care data sources with military data to facilitate force protective surveillance. Scope: The work determined the feasibility of clinical data reporting in a variety of settings and implementation models; relative utility of data gathered for both surveillance and detection; and developed feasible technical and policy approaches to implement bi-directional data exchange between civilian and military health systems. Major findings to date: The difficulties in the development of public health informatics systems that impact multiple jurisdictions are primarily organizational and political in nature. We found both the technical and organizational development can in proceed parallel if sufficient flexibility is built into the technical architecture. Up-to-date report - results/significance: Development of a formal reference document (charter) that enabled cross-jurisdictional cooperation in organizing a multi-jurisdictional surveillance. Designed developed and installed a state of the art syndromic surveillance system for both local health jurisdictions with major military installations (Kitsap and Pierce) - and WA Department of Health.

DTIC

Infectious Diseases; Sounds (Topographic Features)

20070036077 Beth Israel Deaconess Medical Center, Boston, MA USA

The Role of ADAM9 in Tumor-Stromal Interactions in Breast Cancer

Fry, Jessica L; Apr 1, 2007; 12 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-06-1-0460

Report No.(s): AD-A470594; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470594>

The tasks outlined in the Statement of Work for the first year of research on the action of ADAM9 isoforms in tumor-stromal interactions encompassed the creation of reagents to properly and thoroughly study the problem as well as preliminary work studying exogenous ADAM9 in a cell-based system. The major developments during this research period were preliminary data showing that the longer form of ADAM9 (ADAM9-L) enhances the migration of breast cancer cells and that this is dependent on its metalloprotease activity and the development of an ADAM9-S(secreted form) antibody which allows us to detect both isoforms endogenously allowing for the development of more rigorous models using siRNA and endogenous protein to more thoroughly test our hypothesis.

DTIC

Breast; Cancer; Drugs; Mammary Glands; Proteins; Therapy; Tumors

20070036078 Iowa Univ., Iowa City, IA USA

Genetically Targeted Radiotherapy Utilizing the Human Sodium Iodide Symporter in Human Breast Carcinoma Cells

Krager, Kimberly; Jul 2007; 10 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-04-1-0405

Report No.(s): AD-A470595; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470595>

The purpose of this proposal was to elaborate on the viability of NIS-mediated genetically targeted radiotherapy as a possible novel therapeutic intervention in human breast carcinoma. Problems encountered with SK- Pr-3 forced other cell lines to be utilized for tumor growth and imaging. A stable NIS expressing clone was derived from SK-Pr-3 cell line. The ability of the clone to accumulate radioactivity was lost after several passages, which may be due to epigenetically silencing. The NIS expressing clone was unable to accumulate radioactivity in vitro. The acquisition of a pin-hole collimator enables mice bearing Ad-NIS treated tumors to be non-invasively imaged following radioactive administration. The imaging enables dosimetric calculation to be performed to determine the absorbed dose to the tumor. Correlations between the absorbed dose and therapeutic outcome can provide a possible prediction of tumor response. Real-time RT-PCR experiments were used to

detect increased NIS expression after treatment with several histone deacetylase inhibitors (NDACi), including sodium butyrate (SR), trichostatin A (TSA), in conjunction with the DNA methyltransferase inhibitor 5-aza-2'deoxyctidine.

DTIC

Blood Cells; Breast; Cancer; Carcinogens; Mammary Glands; Radiation Therapy; Sodium Iodides

20070036079 Brown Univ., Providence, RI USA

Electroacoustic Tissue Imaging

Diebold, Gerald J; Mar 2007; 97 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAMD17-02-1-0307

Report No.(s): AD-A470596; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470596>

Research has been directed towards detection of tumors using a new imaging modality based on an electrokinetic effect known as the ultrasonic vibration potential. Major accomplishments include completion of a theory for image formation for a colloidal object, such as a pool of blood, development of instrumentation for recording images, and testing of the theory with phantoms with differing geometries. Additionally, phase contrast x-ray imaging for tumor detection has been initiated. A high resolution imaging apparatus has been assembled and tested for imaging soft tissue. Methods for calculating phase contrast images from symmetrical bodies has been developed. The phase contrast method has shown unprecedented detail for imaging microvasculature.

DTIC

Electroacoustics; Imaging Techniques; Ultrasonics

20070036080 Minnesota Univ., Minneapolis, MN USA

Hyaluronan Biosynthesis in Prostate Cancer

McCarthy, James B; Jan 2006; 18 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAMD17-02-1-0102

Report No.(s): AD-A470597; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470597>

Despite advances in the diagnosis and treatment of prostate cancer in the last several years metastasis represents the major cause of frustration and failure in the successful treatment of prostate cancer patients. Hyaluronan (HA) is polymeric anionic carbohydrate that is elevated within primary prostate tumors most notably within the tumor-associated stroma. We have demonstrated that increased HA synthesis by human prostate carcinoma cells correlates with metastatic potential. This increased synthesis results from the elevated expression of specific hyaluronan synthases (HAS) in the tumor cells. Metastatic prostate carcinoma cells exhibiting high levels of HAS assemble and retain a pericellular HA matrix on their cell surfaces. We have used vectors to stably express constructs encoding antisense for HAS enzymes to study the importance of elevated hyaluronan synthesis in prostate carcinoma adhesion growth and tumor formation. The studies outlined in this annual report document our observations that support an important role for hyaluronan in prostate tumor progression.

DTIC

Biosynthesis; Cancer; Prostate Gland

20070036082 Minnesota Univ., Minneapolis, MN USA

Hyaluronan Biosynthesis in Prostate Carcinoma

McCarthy, James B; Jan 2007; 17 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAMD17-02-1-0102

Report No.(s): AD-A470599; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470599>

Despite advances in the diagnosis and treatment of prostate cancer in the last several years, metastasis represents the major cause of frustration and failure in the successful treatment of prostate cancer patients. Hyaluronan (HA) is polymeric anionic carbohydrate that is elevated within primary prostate tumors, most notably within the tumor-associated stroma. We have demonstrated that increased HA synthesis by human prostate carcinoma cells correlates with metastatic potential. This increased synthesis results from the elevated expression of specific hyaluronan synthases (HAS) in the tumor cells. Metastatic prostate carcinoma cells exhibiting high levels of HAS assemble and retain a pericellular HA matrix on their cell surfaces. We have used vectors to stably express constructs encoding antisense for HAS enzymes to study the importance of elevated

hyaluronan synthesis in prostate carcinoma adhesion, growth and tumor formation. The studies outlined in this annual report document our observations that support an important role for hyaluronan in prostate tumor progression.

DTIC

Biosynthesis; Cancer; Metastasis; Neoplasms; Prostate Gland

20070036083 Jackson (Henry M.) Foundation, Rockville, MD USA

Carcinogenicity of Embedded Tungsten Alloys in Mice

McClain, David E; Mar 2007; 7 pp.; In English

Contract(s)/Grant(s): W81XWH-06-2-0025

Report No.(s): AD-A470600; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470600>

A variety of tungsten alloys and other unusual metals have begun to enter U.S. military arsenals as substitutes for depleted uranium (DU) in munitions. There are questions about the health effects of exposure to the tungsten alloys that are similar to those originally surrounding DU especially for embedded shrapnel exposures. The Armed Forces Radiobiology Research Institute (AFRRI) recently performed research that showed one of the militarily promising tungsten alloys to be a potent carcinogen when implanted in rats. The need to confirm the carcinogenicity of such alloys in another rodent species is an important second step required in biological as well as regulatory terms to better assess the cancer risk in humans. Results of this work will help in formulating policies for military surgeons who must treat personnel wounded by fragments of the alloys. Indications of unacceptable risks of exposure will also help determine the advisability of deploying (or developing) similar munitions. Planned timelines for the first year of the project have been disrupted when unanticipated difficulties procuring the custom pellets required for implantation were encountered including added costs and metallurgical problems associated with the manufacture of pellets. Pellet deliveries are now expected early within the second year of the project.

DTIC

Carcinogens; Embedding; Mice; Spent Fuels; Tumors; Tungsten Alloys; Uranium

20070036084 Lankenau Inst. of Medical Research, Wynnewood, PA USA

Development of a Novel Therapeutic Paradigm Utilizing a Mammary Gland-Targeted, Bin-1 Knockout Mouse Model

Muller, Alexander J; Mar 2007; 51 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-05-1-0279

Report No.(s): AD-A470604; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470604>

Evidence of loss or attenuation of the Bin 1 gene in human breast cancers has implicated Bin 1 as a tumor suppressor or negative modifier gene in mammary gland epithelial cells. We have discovered that Bin 1 loss can promote tumorigenesis through an immune escape mechanism. This correlates with the negative regulatory impact that we have found Bin 1 to exert on the important immunomodulatory enzyme indoleamine 2,3-dioxygenase (IDO). Previously we have reported how in combination with certain chemotherapeutic agents inhibitors of IDO can be employed in a non-obvious therapeutic regimen to successfully treat pre-established autochthonous breast tumors in MMTV-Neu transgenic mice. During this reporting period we have obtained evidence in mouse models that IDO expressed in plasmacytoid dendritic cells that accumulate in the tumor draining lymph node may be the relevant mechanism of immune escape in breast cancers not direct expression of IDO in the tumor. We have further found that inhibiting IDO may not be an effective chemopreventive strategy for breast cancer but may be an effective strategy for suppressing breast cancer metastasis.

DTIC

Breast; Cancer; Genes; Knockout Mice; Mammary Glands; Metastasis; Therapy; Tryptophan

20070036085 California Univ., San Diego, La Jolla, CA USA

Optimized NSAIDs for Breast Cancer Prevention

Carson, Dennis A; Apr 2007; 12 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-04-1-0453

Report No.(s): AD-A470606; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470606>

Population studies have shown that women who use non-steroidal anti-inflammatory drugs (NSAIDs) develop breast cancer less frequently. However NSAIDs have side effects on the stomach and kidneys particularly at the high doses potentially required to prevent breast cancer. This project has focused on developing an optimized NSAID for breast cancer prevention that

can be taken safely at high doses and determining its mechanisms of action. The side effects of NSAIDs are mainly due to inhibition of cyclo-oxygenase (COX) enzymes. Based on preliminary experiments we hypothesized that the preventative action of NSAIDs in breast cancer is not solely due to COX inhibition but rather to alterations in the Wnt signaling pathway. Using a modified NSAID that does not inhibit the COX enzyme but does inhibit Wnt signaling we attempted chemoprevention of breast tumors in the MMTV-wnt1 and MMTV-neu transgenic mouse strains. Significant gene expression changes in a Wnt target involved in cancer proliferation Cyclin D1 have been found. Unfortunately protein levels of Cyclin D1 were unaffected and current experiments are characterizing the mechanism of this disparate finding. Regardless these data have already encouraged early biomarker based, clinical trials in women with breast cancer.

DTIC

Breast; Cancer; Mammary Glands; Prevention; Steroids

20070036086 Baylor Coll. of Medicine, Houston, TX USA

Cell Therapy to Obtain Spinal Fusion

Olmsted-Davis, Elizabeth A; Davis, Alan R; Moran, Kevin M; West, Jennifer; Mar 2007; 104 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-04-1-0068

Report No.(s): AD-A470607; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470607>

Surgery of the spine to fuse the vertebral bones is one of the most commonly performed operations with an estimated 350,000 Americans undergoing this surgery annually with estimated costs of \$60 billion. Current procedures are highly invasive with limited success. The goal of this study is to develop a safe efficacious system for inducing spine fusion which will eliminate the need for invasive surgery. We have currently developed a cell based gene therapy system that can induce rapid bone formation at a targeted location which is independent of immune status of the model. This system relies on adenovirus transduced cells expressing bone morphogenetic protein 2 to induce bone formation leading to vertebral fusion after delivery into the paraspinal musculature. To prolong cell survival and insure cells are maintained at the target site we have encapsulated them in a non-degradable hydrogel material. This provides additional safety by eliminating direct injection of the virus through cell delivery and prevention of cell diffusion through encapsulation. Here we provide preliminary data; demonstrating spine fusion using this system at 6 weeks after induction. This is the first step in demonstrating efficacy a critical component of preclinical testing. Thus with validation of our hypothesis this approach can now be developed as a safe and efficacious gene therapy system for spine fusion thus circumventing the need for costly invasive surgery.

DTIC

Adenoviruses; Gene Therapy; Spine; Surgery; Therapy

20070036087 Virginia Commonwealth Univ., Richmond, VA USA

Development of a Cytochrome c Oxidase Based Sensor for Monitoring Respiration and Metabolism

Hawkridge, Fred M; Jun 2007; 8 pp.; In English

Contract(s)/Grant(s): W81XWH-05-2-0033

Report No.(s): AD-A470608; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470608>

Electrodes modified with bilayers that incorporate cytochrome c oxidase (CCO), the terminal enzyme in mammalian respiration, will be studied as biosensors for cyanide. This CCO modified electrode has an architecture that exhibits robust response behavior and stability that mimics the in vivo behavior of this enzyme. These CCO modified electrodes remain active on storage in buffer, can withstand exposure to temperatures as extreme as 80 deg C (176 deg F) and have a functional lifetime exceeding two months. The structure of the CCO modified electrode proposed for study here is uniquely similar to its in vivo environment in the inner mitochondrial membrane. No other enzyme modified electrodes reported thus far in the literature has this structure. Experiments have shown that the electrochemical response of these CO modified electrodes to the oxidation of reduced cytochrome c (its reductive reaction partner) is sensitive to cyanide and the response is reversible. Work proposed here will characterize the affect of cyanide on the direct electron transfer reaction of these CCO modified electrode with ambient dioxygen concentrations (its oxidative reaction partner). Initial experiments testing this hypothesis have been positive. This is a simpler biosensor configuration compared with the cytochrome c system described above (no added component) and it has potential for providing a practical sensors with failure to military applications for toxins that inhibit the electron transfer reactions of CCO with lethal consequences.

DTIC

Cytochromes; Enzymes; Metabolism; Mitochondria; Oxidase; Respiration

20070036089 Cornell Univ., Ithaca, NY USA

Investigating the Role of FIP200 in Mammary Carcinogenesis Using a Transgenic Mouse Model

Nagy, Tamas; Apr 2007; 14 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-04-1-0400

Report No.(s): AD-A470610; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470610>

In this report we give a preliminary account on the consequences of mammary-specific Focal Adhesion Kinase (FAK) deletion in mammary-specific polyoma middle-T transgenic mice. We monitored mammary carcinogenesis in positive control (FAKFlox/Flox; MMTV-PyVT) and target (FAKFlox/Flox; MMTV-Cre; MMTV-PyVT) females. We found that mammary-specific FAK deletion lengthens the tumor-free interval by 33.2 days. We also found that cumulative subcutaneous mammary tumor burden and tumor growth rate were larger in positive control females than in target females. Additionally we also found that FAK is virtually not expressed in mammary tumors from target animals but FAK expression was abundant in positive control animals. Transgenic polyoma middle-T antigen expression was similar in mammary tumors from both positive control and target females. Based upon the preliminary data we conclude that FAK although not absolutely required but it still plays a contributory role in polyoma middle-T antigen induced mammary carcinogenesis in female mice.

DTIC

Cancer; Carcinogens; Diseases; Genetic Engineering; Genetics; Mammary Glands; Mice

20070036090 Louisiana State Univ., Shreveport, LA USA

A Role for TIMP-1 in Breast Cancer Progression

Cardelli, James A; Bigelow, Rebecca; Jan 2007; 19 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAMD17-03-1-0451

Report No.(s): AD-A470612; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470612>

In order to assess the role of TIMP-1 in breast cancer development, we created several MCF-7 and MDA-MB-231 cell lines which overexpress TIMP-1 as well as MDA-MB-231 cells which underexpress TIMP-1 using shRNA. Compared to vector control cells, MCF-7 TIMP-1(+), MDA-MB-231 TIMP-1(+) cells and MDA-MB-231 (-) cells displayed no change in proliferation, and these cells did not demonstrate activation of the p38, ERK, AKT or FAK signaling pathways. Additionally, exogenously supplied TIMP-1 did not activate these signaling pathways in either MCF-7 or MCF10A cells, contrary to published reports. Also, TIMP-1 overexpression inhibited MCF-7 motility in modified Boyden Chamber assays, whereas no differences in invasion were observed in MDA-MB-231 (-) cells compared to vector controls. In vivo xenograft studies in SCID/bg mice revealed that TIMP-1 was able to stimulate tumorigenesis of MCF-7 cells, potentially by stimulating angiogenesis as noted by the increase in CD34 positive blood vessels. No differences in tumor growth were observed with MDA-MB-231 TIMP-1 shRNA cells compared to control cells. Finally, Affymetrix array analysis revealed that TIMP-1 overexpression did have an effect on gene expression in MCF-7 and MDA-MB-231 cells.

DTIC

Breast; Cancer; Mammary Glands; Proteins

20070036092 Beth Israel Deaconess Medical Center, Boston, MA USA

Molecular Mechanisms of Par-4-Induced Apoptosis in Prostate Cancer

Ladiaz, John A; May 2007; 8 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-05-1-0622

Report No.(s): AD-A470614; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470614>

The prostate apoptosis response-4 (Par-4) protein induces apoptosis in prostate cancer cells but not in normal cells. The region spanning residues 145-203 of human Par-4 kills androgen-dependent and androgen-independent cancer cells but not normal cells, and is termed selective for apoptosis induction in cancer cells (SAC) domain. Par-4 also contains a C-terminal coiled-coil (CC) domain that interacts with the protein kinase Akt1 and the DNA-binding domain of WT1. Phosphorylation of Par-4 by Akt1 results in inhibition of apoptosis. To obtain insights into the mechanisms of Par-4 selective killing of prostate cancer cells, we expressed the human Par-4 SAC domain in bacteria and purified it to homogeneity. Numerous attempts to crystallize this protein in the apo form failed to yield diffraction-quality crystals. Analysis of the SAC domain using NMR spectroscopy revealed that it is unstructured, demonstrating the need to perform a structural analysis of this domain bound to its binding partner, where SAC will likely adopt a structure. The structures of Par-4 SAC and CC domains will facilitate the

elucidation of the mechanisms underlying the selective killing of prostate cancer cells by this protein and will guide the development of novel molecular targeted therapies for prostate cancer.

DTIC

Apoptosis; Cancer; Prostate Gland; Proteins

20070036093 Texas Univ. Health Science Center, San Antonio, TX USA

Molecular Identification of Human Fungal Pathogens

Wickes, Brian L; Mar 2007; 13 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-06-1-0234

Report No.(s): AD-A470615; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470615>

Each task that was proposed in the first 12 months of this study is on, or ahead of schedule. Methods have been standardized so that they can be performed and accomplished independent of the species of fungus. We have developed a simple universal extraction method and a universal PCR method, which most importantly, uses a single extraction reagent and the same set of primers for each isolate. Databases have been set up and data are now being added. A web portal has been created to allow access to search algorithms for the database. Preliminary identifications using our methods have been successful and resulted in a publication, as well as a new collaboration on an NIH grant. Type cultures and clinical cultures are being added to our collections, and their sequences are being added to the databases. The framework, from database entries to sequence recovery, has been established and will be continually ramped up as we add sequences at a faster rate. We will also continue to improve our methods, such as a filter based DNA extraction (for easy transport) and sequencing (for cost reduction), in order to make the entire process as efficient as possible.

DTIC

Fungi; Microorganisms; Pathogens; Sequencing

20070036095 California Univ., Riverside, CA USA

The Role of Constitutively Active Prolactin Receptors in the Natural History of Breast Cancer

Huang, Kuang-tzu; Apr 2007; 7 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-06-1-0448

Report No.(s): AD-A470617; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470617>

Prolactin receptor (PRLR) is a single transmembrane receptor that normally requires ligand-binding to trigger intracellular signaling. Several isoforms of the human PRLR have been identified, including a long form (LF) and two short forms (SF1a and SF1b). These isoforms share identical amino acid sequence in the extracellular domain, but altered cytoplasmic domain as a consequence of alternative splicing. The extracellular domain consists of two fibronectin-like subdomains, S1 and S2. Recently we have identified the existence of naturally-occurring S2 deleted (delta S2) variants in several human cancer cell lines. We also showed that these human delta S2 isoforms were constitutively dimerized in the absence of PRL. When overexpressed in breast cancer cells, the delta S2 LF increased cell proliferation. The aim of our proposed training grant was to analyze the effect of delta S2 PRLR in a stable transfection system. We found that one of the S2 deleted short isoforms, delta S2 SF1b, was able to inhibit cell growth and migration.

DTIC

Breast; Cancer; Mammary Glands; Pituitary Hormones

20070036096 Johns Hopkins Univ., Baltimore, MD USA

Role of Polyamine Oxidase (PAOh1/SMO) in Human Breast Cancer

Goodwin, Andrew C; Richards, Talmesha A; Apr 2007; 11 pp.; In English

Contract(s)/Grant(s): W81XWH-04-1-0457

Report No.(s): AD-A470618; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470618>

This report provides an update on the study of the role of polyamine oxidase (PAOh1/SMO, spermine oxidase) in drug response of human breast cancer. The cytotoxic effects of two novel polyamine analogue compounds, CGC-11144 and CGC-11047 were evaluated in the human breast cancer cell lines MDA-MB-231, Hs578t, MCF-7, 468, and T47D. Additionally, the

hypothesis that induction of spermine oxidase by pro-inflammatory agents plays a role in carcinogenesis was evaluated using a model system of exposure of MCF-10a human breast epithelial cells to cigarette smoke extract (CSE).

DTIC

Breast; Cancer; Enzymes; Mammary Glands; Oxidase; Polymers

20070036097 South Carolina Univ., Columbia, SC USA

A Diet, Physical Activity, and Meditation Intervention in Men With Rising Prostate-Specific Antigen (PSA)

Hebert, James R; May 2006; 12 pp.; In English

Contract(s)/Grant(s): DAMD17-03-1-0139

Report No.(s): AD-A470620; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470620>

Following surgery or radiation of primary early-stage prostate cancer (PrCA), one in three patients will experience an elevation in serum prostate antigen (PSA) within 10 years. This rises to one in two at 15 years. After such evidence of recurrence, the most common treatment is androgen ablation. We hypothesize that the host-PrCA balance in asymptomatic men with biochemically recurrent PrCA, as reflected by the PSA rise, is favorably affected by an intensive, vegetable-based diet, plus physical activity and mindfulness-based stress reduction. This randomized trial will enroll 60 men with rising PSA levels along with a partner of their choice, half of whom will be randomized to the intervention and half to usual care. The intervention will continue for 3 months, followed by monthly booster sessions for 3 months. Data will be collected on main study outcomes, protocol compliance and adherence, and potential effect modifiers, mediators, and confounders of treatment effect.

DTIC

Antigens; Cancer; Diets; Human Beings; Males; Metastasis; Prevention; Prostate Gland

20070036098 South Carolina Univ., Columbia, SC USA

A Diet, Physical Activity, and Meditation Intervention in Men With Rising Prostate-Specific Antigen (PSA)

Hebert, James R; May 2007; 16 pp.; In English

Contract(s)/Grant(s): DAMD17-03-1-0139

Report No.(s): AD-A470621; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470621>

Following surgery or radiation of primary early-stage prostate cancer (PrCA), one in three patients will experience an elevation in serum prostate antigen (PSA) within 10 years. This rises to one in two at 15 years. After such evidence of recurrence, the most common treatment is androgen ablation. We hypothesize that the host-PrCA balance in asymptomatic men with biochemically recurrent PrCA, as reflected by the PSA rise, is favorably affected by an intensive, vegetable-based diet, plus physical activity and mindfulness-based stress reduction. This randomized trial will enroll 60 men with rising PSA levels along with a partner of their choice, half of whom will be randomized to the intervention and half to usual care. The intervention will continue for 3 months, followed by monthly booster sessions for 3 months. Data will be collected on main study outcomes, protocol compliance and adherence, and potential effect modifiers, mediators, and confounders of treatment effect.

DTIC

Antigens; Cancer; Diets; Human Beings; Males; Metastasis; Prevention; Prostate Gland

20070036099 Colorado Univ., Aurora, CO USA

The Role of HOX Proteins in Androgen-Independent Prostate Cancer

Daddario, Sunshine; Nov 2006; 7 pp.; In English

Contract(s)/Grant(s): W81XWH-06-1-0064

Report No.(s): AD-A470623; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470623>

Our preliminary data demonstrated that HOXC8 and HOXC6 overexpression inhibits androgen receptor (AR)-mediated signaling in human prostate cancer (PCa) cells. Based on these findings, coupled together with previous reports demonstrating that homeodomain-containing proteins interact with and inhibit the histone-acetyltransferase (HAT) activity of the steroid receptor coactivators CBP and p3001, we hypothesized that HOXC8 inhibits AR-mediated signaling through inhibition of CBP/p300 HAT activity. In support of this hypothesis, we have recently shown that increased expression of CBP relieves HOXC8 induced inhibition of AR-mediated transcription in a dose dependent manner. Further, we have demonstrated by

chromatin immunoprecipitation that hormone-induced histone acetylation at the androgen-responsive MMTV promoter in inhibited upon overexpression of HOXC8. We have created a series of PCa cell lines (LNCaP, DU-145, PC-3-AR and ALVA-31) stably overexpressing HOXC8. We wanted to demonstrate that HOXC8 inhibition of AR-mediated signaling is upheld in cells stably overexpressing HOXC8, not just in transient experiments. We have demonstrated that PSA induction is inhibited in LNCaP-HOXC8 when compared with LNCaP empty vector control cells. We have also performed various tumorigenicity assays in these HOXC8 overexpressing cells, such as cell proliferation, migration, invasion and anchorage independent growth. However thus far we have been unable to detect any significant difference between the HOXC8 overexpressing cell lines and control cell lines in these experiments. Because HOXC8 overexpression may be involved in early tumorigenesis, we believe that it will be important to perform similar tumorigenicity assays in cells lines derived from non-transformed normal prostate epithelial cells. We have therefore recently created cell lines stably overexpressing HOXC8 using RWPE-I and PWR-IE prostate epithelial derived cell lines.

DTIC

Cancer; Gene Expression; Hormones; Hydrogen Compounds; Males; Oxides; Prostate Gland; Proteins

20070036108 Chicago Univ., Chicago, IL USA

Angiogenesis and Invasiveness in Prostate Cancer Detected with High Spectral and Spatial Resolution MRI

Karczmar, Greg; Jul 2006; 71 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAMD17-02-1-0033

Report No.(s): AD-A470635; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470635>

We propose to develop new MR methods to improve early and accurate detection of prostate cancer, and guide treatment of the cancer. Although conventional MRI has high sensitivity, its specificity has been disappointing. New more specific and sensitive MRI methods would have a significant impact on clinical management of prostate cancer. Previous work in this laboratory showed that high spectral and spatial resolution (HiSS) MRI improves image quality and detection of the effects of contrast agents. HiSS images can be acquired with clinically acceptable run times by using frequency resolved echo planar methods to obtain detailed spectra of the water and fat resonances associated with each image voxel. We will test the hypothesis that: Contrast enhanced HiSS MRI increases sensitivity to angiogenesis and invasiveness of prostate cancer. As a result HiSS MRI can accurately distinguish metastatic from non-metastatic cancer based on detailed scans of the primary tumor.

DTIC

Angiogenesis; Cancer; High Resolution; Imaging Techniques; Magnetic Resonance; Prostate Gland; Spatial Resolution; Spectral Resolution

20070036109 Pittsburgh Univ., Pittsburgh, PA USA

An Organotypic Liver System for Tumor Progression

Wells, Alan; Griffith, Linda; Stolz, Donna; Lauffenburger, Douglas; Apr 2007; 18 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-04-1-0480

Report No.(s): AD-A470636; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470636>

Our overall objective is to understand which tumor cell behaviors contribute to invasion and metastasis. This would allow rationale approaches to limit these aspects of tumor progression. While great strides have defined critical molecular determinants, the current experimental models of tumor invasion limit the dissection of complex cellular responses. In vitro assays do not capture tumor/host relations or relevant tissue architecture and physiology. In vivo model systems provide the relevant organism contexts but cannot readily be manipulated. Quantal advances would be enabled by combining the best attributes direct manipulation of tumor and host, long-term visualization, and tissue relevant architecture. Our central premise is that an ex vivo organotypic liver tissue system can provide an environment to study tumor cell invasion and metastasis. Our objective is to utilize a physiologically relevant microreactor that has proved suitable for organotypic liver culture to investigate metastatic seeding. The sub-millimeter scale of this liver allows for real-time imaging over weeks in culture. We established this system to determine what step is rate-limiting for tumor progression. We have now established an organotypic liver tissue culture that supports metastatic establishment and growth. This will be used to probe the molecular steps that are key to this progression.

DTIC

In Vitro Methods and Tests; In Vivo Methods and Tests; Liver; Metastasis; Tissue Culturing; Tumors

20070036110 Texas Univ., Houston, TX USA

The Effects of Exercise Training on Tumor Vascularity and Response to Neoadjuvant Therapy in Operable Breast Cancer: A Phase I-II Study (Idea Award)

Jones, Lee W; Peterson, Bercedis; Blackwell, Kimberly; Dewhirst, Mark W; Marcom, P K; Kraus, William; Baker, Jay; Allen, Jason D; Nov 2006; 20 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-06-1-0336

Report No.(s): AD-A470637; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470637>

To explore the effects of exercise training on tumor vascularity and response to neoadjuvant therapy in operable breast cancer in a phase I-II randomized design. Method: Using a two-armed, prospective, randomized design, potential participants will be identified and screened for eligibility via medical record review of patients scheduled for their primary neoadjuvant chemotherapy treatment consultation at DUMC. Following the successful completion of all baseline assessments participants will be randomly assigned to an exercise or control group. Participants assigned to combined exercise training and chemotherapy will perform an individualized exercise training program consisting of three cycle ergometry sessions per week at approximately 60-80% of VO₂peak on nonconsecutive days for the duration of neoadjuvant chemotherapy (approximately 12 weeks). Most Significant Research Finding During Reporting Period: As per our statement of work, human ethical approval was obtained (Task 1); all exercise testing / training procedures and clinical protocols were clarified (Task 2), and data collection has been initiated (Task 3). To date, all 3 patients in phase I of the study have been enrolled and no doselimiting toxicities have been identified with acceptable exercise adherence (>60%), thus phase II has been initiated.

DTIC

Breast; Cancer; Cardiovascular System; Chemotherapy; Mammary Glands; Physical Exercise; Physiological Effects; Therapy; Tumors

20070036111 Utah Univ., Salt Lake City, UT USA

Optimization of Breast Cancer Treatment by Dynamic Intensity Modulated Electron Radiotherapy

Gaffney, David K; Leavitt, Dennis D; Apr 2006; 24 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAMD17-01-1-0435

Report No.(s): AD-A470638; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470638>

This project clearly demonstrates that intensity modulated electron arc radiotherapy is feasible using the photon multi-leaf collimator of a modern linear accelerator. Secondary and tertiary collimators are replaced by the multi-leaf collimator and by dynamic field edge enhancement. Three-dimensional dose calculation models are required in order to properly account for changing patient shape both axially and in the cephalo-caudal direction. Both Monte Carlo and 3-dimensional pencil beam algorithms have been examined. Comparison of electron arc therapy dose distributions vs. standard photon tangent breast fields show that a more uniform dose distribution is achievable by dynamic electron arc, match-line inhomogeneities can be minimized or avoided, and dose to lung and critical organs can be reduced. Particular advantage is noted in treatment plans for bilateral post-mastectomy breast treatment. Continuing issues include 1) calculation throughput, even with up to 32 processors calculating in parallel, 2) implementation in a clinical mode readily available to radiotherapy clinics, 3) automation of dynamic field edge enhancement. Further discussion with the radiotherapy vendors will be required.

DTIC

Breast; Cancer; Clinical Medicine; Mammary Glands; Radiation Therapy

20070036112 Michigan Univ., Ann Arbor, MI USA

BIG1 as a Potential Guanine Nucleotide Exchange Factor for Rheb

Guan, Kun-Liang; Nov 2006; 19 pp.; In English

Contract(s)/Grant(s): W81XWH-06-1-0046

Report No.(s): AD-A470639; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470639>

The original aim of this idea grant is to demonstrate whether BIG1 functions as a nucleotide exchange factor (GEF) for the Rheb small GTPase. This was very exciting and provocative hypothesis. We found that BIG1 has no GEF activity towards Rheb. Therefore, our experimental data do not support the original hypothesis. The finding is not surprising because research hypothesis often are disproved or modified by experimental results. However, we had made important progress on a related topic in a different direction. We have identified Sin1 as a novel component of TORC2 (TOR complex 2). We demonstrated that Sin1 is essential for TORC2 complex formation and kinase activity. We also established that TORC2 is the kinase

responsible for phosphorylation of the hydrophobic site of AKT. This finding significantly advanced our understanding on the function and regulation of the mTOR pathway.

DTIC

Enzymes; Guanines; Nucleotides; Phosphorus; Phosphorylation

20070036113 Texas Univ., Houston, TX USA

TSC2 Haploinsufficiency Leads to a Mutator Phenotype

Short, John D; Nov 2006; 8 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-06-1-0049

Report No.(s): AD-A470640; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470640>

Tuberous Sclerosis Complex (TSC) patients develop tumors of the brain, kidney, skin and heart upon loss of either the TSC1 or TSC2 gene, and we are interested in elucidating early molecular events that contribute to loss of TSC2 and in understanding how TSC2 heterozygosity might contribute to this process. Our lab uses the Eker rat, which possesses an inactivating retroviral insertion in one Tsc2 allele (Tsc2Ek/+), as a model to better understand how Tsc2 heterozygosity contributes to cancer susceptibility. The goal of this award was to determine whether Tsc2 haploinsufficiency generated a mutator phenotype in target tissues in vivo that possibly contributed to early events in tumorigenesis within TSC2+/- individuals and establish an in vitro model of Tsc2 haploinsufficiency. We were able to successfully establish an in vitro method of depleting Tsc2 expression, and we are performing experiments to analyze mutation frequency and spectra in vitro in the presence or absence of Tsc2 expression. In addition, our preliminary results indicate that rats heterozygous for Tsc2 have a higher mutation frequency in vivo as they age compared to wild-type rats.

DTIC

Genes; Mutations; Phenotype

20070036115 New South Wales Univ., Sydney, Australia

Formulated Delivery of Enzyme/Prodrug and Cytokine Gene Therapy to Promote Immune Reduction of Treated and Remote Tumors in Mouse Models of Prostate Cancer

Russell, Pamela J; Khatri, Aparajita; Husaini, Yasmin; Chapman, Jane; Jan 2007; 127 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAMD17-02-1-0107

Report No.(s): AD-A470642; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470642>

Prostate cancer is the second highest cause of cancer death in men in Western society. Early disease is treatable by surgery or radiation but once late stage disease becomes refractory to hormone removal patient care is limited to pain management. New treatments are needed. We use gene therapy alone and in combination with hormones called cytokines that stimulate the immune system. The concept is that delivering a cell-killing agent to an accessible tumor coupled with help from the immune system can promote tumor reduction both at the treatment site and at remote locations. In this therapy a gene (a fusion of cytosine deaminase and uracil phosphoribosyltransferase (CD/UPRT)) is delivered to a cancer cell by a virus or expressed by molecular engineering so that harmless bacterial proteins are made. When followed by a pro-drug 5 fluorocytosine (5FC) cancer cells that make CD/UPRT convert 5FC to a toxin that kills the original and neighbouring cells. This system works in slow growing tumors like prostate cancer. Killing the tumor cells attracts immune cells. We are identifying these and then delivering cytokine genes that attract more immune cells into the tumors. We will deliver the cytokine gene alone or with the suicide gene because in other studies combination therapy works better.

DTIC

Bacteria; Cancer; Enzymes; Gene Therapy; Mice; Prostate Gland; Tumors

20070036128 Massachusetts General Hospital, Boston, MA USA

Magnetic Resonance Spectroscopy: An Objective Technique for the Quantification of Prostate Cancer Pathologies

Cheng, Leo L; Feb 2007; 234 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-04-1-0190

Report No.(s): AD-A470689; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470689>

In the past year, the three years of the award, according to our proposed Statement of Work, we continued our efforts on

the collection of specimens from prostate cancer patients, and spectroscopic and histopathological measurements of these samples for the construction of metabolic markers aimed at tumor diagnosis based on HRMAS 1HMR evaluation. Significant progresses have been achieved. Three peer-reviewed papers from the project have been published, and one new manuscript has been submitted. In addition, two peer-reviewed review articles and one book chapter are currently in pending for publication, and one patent application as the results of the direct funding support from this award. Furthermore, two NIH grants have been submitted as a direct result of researches supported by this award. These advancements will assist us to better understand tumor metabolism observed with MR spectroscopy, and contribute to better patient cares in the future.

DTIC

Cancer; Magnetic Resonance; Pathology; Prostate Gland; Spectroscopy

20070036140 Texas Univ., Galveston, TX USA

Closed-Loop Resuscitation of Hemorrhagic Shock: Novel Solutions Infused to Hypotensive and Normotensive Endpoints

Kramer, George C; Jun 29, 2007; 9 pp.; In English

Contract(s)/Grant(s): N00014-02-1-0363

Report No.(s): AD-A470719; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470719>

To define optimal fluid resuscitation regimens for use in combat casualty care. Specific goals are to determine the infusion regimens and fluids that are most efficient (least volume) and most effective (lowest mortality with best cardiovascular and metabolic function). We tested both FDA approved fluids and novel formulations. Our long-term goal is to develop efficient and efficacious resuscitation regimens for combat casualty care and to develop a microprocessor controlled closed-loop resuscitation system that will optimize the delivery of the solution(s) found best. Over the 3.75-year grant we completed 16 full studies, a total of 24 treatment groups with 218 individual experiments. Using our multi-bleed model conscious sheep hemorrhage model we studied 18 treatment groups in 124 experiments.

DTIC

Body Fluids; Casualties; Feedback Control; Hemorrhages; Hypotension; Resuscitation

20070036297 Organisatie voor Toegepast Natuurwetenschappelijk Onderzoek, Rijswijk, Netherlands

Sleep and Alertness Management IV: Effects of Alertness Enhancers Caffeine and Modafinil on Performance in Marmosets

Philippens, I H; van Vliet, S A; Jongasma, M J; Vanwersch, R A; Mar 2007; 33 pp.; In English; Original contains color illustrations

Report No.(s): AD-A470744; TNO-DV 2006-A271; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Flumazenil might be effective to maintain normal performance in case of an alertness demanding situation directly after taking a hypnotic. However, in case personnel have to be alert during a time of the day that the circadian rhythm is programmed for sleep, the use of wake promoting drugs 'night be more efficient. The alertness enhancer caffeine counteracted the sleep deprivation induced decline on the performance and activity. Modafinil even improved the activity. Chronic use of caffeine or modafinil did not negatively affect the performance and the activity during daytime and resulted in comparable effects as after a single use of these compounds. This means that caffeine and modafinil are both effective in reducing the sleep deprivation induced declines in performance. Moreover, the stimulants remain effective when used in combination with a hypnotic and even after chronic use no worsening of day time performance was observed. Modafinil reach its maximum effect 2-4 hours after oral administration indicating that it can only be used in situation in which the operation is planned by forehand. Caffeine, a fast and short acting compound, should be useful for short scenarios. In case long term improved alertness is needed a slow release administration will be needed.

DTIC

Alertness; Caffeine; Monkeys; Sleep; Sleep Deprivation

20070036299 National Academy of Sciences - National Research Council, Washington, DC USA

Continuation of Support for the Institute for Laboratory Animal Research (ILAR)

Zurlo, Joanne; Jul 2007; 12 pp.; In English

Contract(s)/Grant(s): DAMD17-03-1-0494

Report No.(s): AD-A470748; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The National Academies continue the activities of the Institute for Laboratory Animal Research (ILAR), the recognized

leader in developing and disseminating guidelines for laboratory animal care, breeding, and use, (including the internationally accepted standard Guide for the Care and Use of Laboratory Animals); resources for identifying animal models for human diseases and physiological processes; and reports on the humane and scientific use of laboratory animals (including education and training of scientists and technicians in the care and use of laboratory animals; reduction of pain and distress in research animals; occupational safety and health of employees; and nomenclature of inbred, transgenic, and other genetically defined animals). The program goal is to improve the humane and scientifically valid use of laboratory animals as well as the availability, quality and care of laboratory animals. ILAR accomplishes this goal through a core program, carried out by staff, and a special-project program, carried out by National Academies-appointed experts. Both programs are guided by a 16-member advisory council (the Council). The Council meets three times a year to provide program direction and strategic planning; to oversee the communication and information programs (consisting of the ILAR web site and the ILAR Journal); to oversee special projects; and to direct ILAR's international programs (including participation as the US national member of the International Council of Laboratory Animal Sciences).

DTIC

Animals; Education; Medical Science

20070036314 Miami Univ., Coral Gables, FL USA

Enzymatic Decontamination of Environmental Organophosphorus Compounds

Leblanc, Roger M; Dec 4, 2006; 13 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAAD19-03-1-0131

Report No.(s): AD-A470792; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This final report describes the research performed during the award period (June 5, 2003 to December 4, 2006). The main thrust of the research project was to investigate the surface chemistry of and molecular interactions between OP compounds and enzymes. The objective were: i) to characterize the Langmuir films of organophosphorus acid hydrolase (OPH) and organophosphorus acid anhydrase (OPAA) by studying their interfacial and spectroscopic properties at air/water interface; ii) to investigate the molecular interactions between OPH and OPAA and the OP compounds using Polarization Modulation FTIR spectroscopy; iii) to characterize the topography of OPH and OPAA by scanning probe and environmental scanning electron microscopies; iv) to characterize the basic features of AChE biosensor based on LB film technology. v) to simulate the active site of acetylcholinesterase (AChE)

DTIC

Decontamination; Enzyme Activity; Enzymes; Organic Phosphorus Compounds

20070036319 Alabama Univ., Birmingham, AL USA

Systemic and Gene Modified Mesenchymal Stem Cell Therapy for Metastatic Prostate Cancer

Ponnazhagan, Selvarangan; May 2007; 7 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-06-1-0069

Report No.(s): AD-A470809; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Bone is the frequent metastatic site for human prostate cancer resulting in significant morbidity and mortality in patients with advanced disease. The type of bone defect encountered in prostate cancer bone metastasis is osteoblast lesions resulting in excess bone. However, initiation of osteoclastogenesis is first aided by osteolysis, mediated by osteoclasts. The areas provided as source for osteoblast accumulation later leads to thickening of the bone. In this proposal, we planned to address arresting both the events of osteolysis and osteoblastogenesis by biological inhibitors of these two events. Osteoprotegerin (OPG) is a decoy receptor that competes with RANK for RANKL, thus, modulating the effects of RANKL. Thus, OPG remains an effective molecule for future therapies for bone metastasis. We sought to achieve sustained effects of OPG combining cell therapy and gene therapy approaches. Similarly, for inhibiting osteoblast activity we chose noggin, capable of arresting osteoblast formation. The aims were to determine therapeutic effects of OPG and noggin expression by rAAV gene therapy in a murine model of prostate cancer bone metastasis. So far, we produced high-titer recombinant AAV vectors encoding osteoprotegerin, and noggin and currently testing the feasibility of MSC therapy for reducing bone burden initiated by cancer growth. Continuation of the ongoing studies in to next year will provide valuable information on therapeutic effects of this therapy for prostate cancer bone metastasis.

DTIC

Cancer; Metastasis; Prostate Gland; Stem Cells; Therapy

20070036321 Albert Einstein Coll. of Medicine, Bronx, NY USA

Monoclonal Antibodies to Prevent Use of Mycotoxins as Biological Weapons

Feldmesser, Marta; Jul 2007; 7 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-06-1-0085

Report No.(s): AD-A470817; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Aflatoxin exposure causes a broad range of adverse effects including acute hepatic failure hepatic carcinoma and immunosuppression. The ability to weaponize aflatoxins has already been demonstrated raising concern that these potent agents might be used for biowarfare or agroterrorism. Passive antibody therapy is used for the treatment of toxin exposures and its potential for use in the event of bioterrorism has been highlighted. Monoclonal antibodies have been made to aflatoxins but currently none have been demonstrated to neutralize the adverse effects of exposure. The research goal is to generate monoclonal antibodies to aflatoxins for study of their potential to prevent disease. We generated a novel aflatoxin conjugate using keyhole limpet hemocyanin as a carrier and used this conjugate to immunize rats. We found that vaccination by either the intraperitoneal or subcutaneous route induced very high aflatoxin BI-binding antibody titers that were completely competed by free aflatoxin BBI in solution. We will make and characterize monoclonal antibodies to aflatoxins BI and GI and test them for their ability to inhibit cytotoxicity to rat hepatocytes and macrophages in vitro. Protective MAbs would subsequently be further developed for passive therapy in humans in the event that aflatoxins are used as agents of biowarfare. DTIC

Antibiotics; Antibodies; Biological Weapons; Warfare

20070036323 Mount Sinai School of Medicine, New York, NY USA

Increasing Early Detection of Prostate Cancer in African American Men through a Culturally Targeted Print Intervention

Thompson, Hayley; Mar 2007; 7 pp.; In English

Contract(s)/Grant(s): W81XWH-04-1-0026

Report No.(s): AD-A470820; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Prostate cancer (PCa) incidence and mortality is higher among African American (AA) men compared to all other groups. There is compelling evidence that higher mortality is due to the greater likelihood of AA men to be diagnosed with advanced-stage PCa. PCa screening specifically prostate-specific antigen test (PSA) and digital rectal exam (DRE), has been shown to increase early-stage diagnoses. Although several organizations recommend annual PCa screening starting at age 45 for AA men, screening among AA men is low. Indeed, interventions to increase screening and the early detection of PCa among AA men are critical. Although culturally targeted health interventions have been found to be effective there are no interventions that have systematically addressed culturally relevant factors in PCa screening among AA men. The primary aim of the proposed study is to develop and evaluate the impact of a culturally targeted (CT) print intervention on PCa screening participation among AA 410 men through a randomized controlled trial. The proposed research also seeks to investigate the mediational pathways (i.e., mechanisms) through which the culturally targeted print intervention impacts screening participation. DTIC

DTIC

Africa; Cancer; Detection; Human Beings; Males; Prostate Gland

20070036335 Pennsylvania Univ., Philadelphia, PA USA

X-Ray Polarization Imaging

Maidment, Andrew D; Jul 2006; 61 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAMD17-02-1-0593; CA85454

Report No.(s): AD-A470862; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Conventional mammography evaluates the spatial arrangement of tissue in the breast; the recorded signal is determined by the x-ray attenuation of the materials in each projection. Due to the low x-ray energy, every x-ray attenuated by the breast is absorbed by the breast (i.e., all of the x-ray energy is deposited in the breast). We have investigated whether it is possible to produce breast images based on x-ray polarization. Polarization radiography appeared to have the potential to supplement mammographic images by imaging the ability of breast tissue to rotate the x-ray polarization vector. We had hoped that new information about the breast could be gleaned at a low dose to the breast; preference being given to x-rays which would pass through the breast and have altered polarization, rather than being absorbed by the breast). We performed fundamental experiments regarding x-ray polarization to determine whether the polarization effect was sufficiently large to allow it to be used to produce images. Two different x-ray polarimeters were developed and tested. We were able to demonstrate polarization

of the incident x-ray beam. However, neither polarimeter allowed successful measurement of polarization alterations of any material. We did, however, develop an excellent model of x-ray spectra, which has already seen wide usage.

DTIC

Breast; Cancer; Mammary Glands; Models; X Ray Imagery; X Ray Spectra

20070036336 Miami Univ., FL USA

Breast Cancer Therapy Using Antibody-Endostatin Fusion Proteins

Shin, Seung-Uon; Apr 1, 2007; 15 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-05-1-0351

Report No.(s): AD-A470864; No Copyright; Avail.: Defense Technical Information Center (DTIC)

To produce a more effective form of trastuzumab and improve efficacy of endostatin we constructed several anti-HER2 IgG3-endostatin fusion proteins by fusing human endostatin to the 3 end of a humanized anti-HER2 IgG3 antibody. Antibody targeting is designed to enhance local delivery of endostatin to tumor as well as increase endostatin half-life. We constructed two endostatin fusion proteins based on native human endostatin and/or a mutant endostatin with a P125A substitution to confer increased antiangiogenic activity. Native and P125A mutant fusion proteins inhibited tube formation and proliferation of HUVEC in vitro although P125A fusion protein showed greater inhibition than either native endostatin or endostatin fusion protein. Treatment of established SKBR-3 with the mutant P125A fusion resulted in complete regression of xenografts in SCID mice (5/5 tumor free) compared to untreated anti-HER2 IgG3 human endostatin or the native endostatin fusion protein treated mice. Combination of huEndo fusion protein and Avastin synergistically enhanced anti-tumor activity. Linking endostatin to an antibody may significantly enhance anti-tumor activity of trastuzumab. Mutant P125A fusion antibody showed better anti-tumor activity. Targeting antiangiogenic proteins using antibody is a versatile approach that could be applied to other targets (e.g. EGFR PSMA) or using other antiangiogenic protein domains.

DTIC

Antibodies; Breast; Cancer; Mammary Glands; Proteins; Therapy

20070036337 Yale Univ., New Haven, CT USA

The Role of Ubiquitin E3 Ligase SCF-SKP2 in Prostate Cancer Development

Zhang, Hui; Feb 2007; 41 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-04-1-0230

Report No.(s): AD-A470865; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Low or absent expression of CDK inhibitor p27Kip1 is associated with malignant prostatecarcinomas. Loss of tumor suppressors p53 and Pten is also associated with prostate cancers. We found that p27 is regulated by both SCF-SKP2 and a novel ubiquitin E3 ligase containing CUL4-DDB1-WD40-repeat proteins. In addition, we have identified that a specific CUL4A-DDB1-L2DTL/CDT2-PCNA ubiquitin E3 ligase binds and targets p53 polyubiquitination-dependent proteolysis in cooperation with MDM2. By interacting with a WD40-repeat proteins as a substrate targeting subunit, the CUL4-DDB1 ubiquitin E3 ligase regulates a wide array of biological events including cell cycle regulation, genome stability, and histone methylation; alteration of these events have been shown to associate with the development of prostatecarcinogenesis. We in addition found that expression of SKP2 and Pten heterozygosity do not cooperate in the mouse prostate carcinoma models, suggesting that SKP2 may act downstream of Pten pathway. Our work provides novel insights into the mechanism of prostate tumorigenesis.

DTIC

Cancer; Enzymes; Prostate Gland; Self Consistent Fields

20070036338 Institute of Cancer Research, Surrey, UK

Identification, Characterization and Clinical Development of the New Generation of Breast Cancer Susceptibility Alleles

Rahman, Nazneen; Mar 2007; 30 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-05-1-0204

Report No.(s): AD-A470866; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Breast cancer is a common disease in women but the causes are still largely unknown. There is considerable evidence to suggest that genetic factors play an important role in causing breast cancer, but the genes involved in the majority of breast cancers are currently unknown. Our aim is to identify genetic factors that increase the chance of breast cancer occurring. We have collected clinical information and samples from over 1500 breast cancer families. We will compare the frequency of

genetic factors in these cases with control women without breast cancer. Within the last year we have used this new strategy to identify three new breast cancer predisposition genes, ATM, BRIP1 and PALB2, that each confer a 2-3 fold risk of breast cancer and account for ~3% of excess risk of breast cancer. We have also performed an experiment to evaluate 15,000 coding genetic variants in 864 breast cancer cases and 1498 controls and we are following up these results in additional cases.

DTIC

Breast; Cancer; Mammary Glands

20070036341 Wisconsin Univ., Madison, WI USA

Regulation of Tumor Cell Growth by the Mesenchymal Environment of the Bone Marrow is Enhanced by a High-Fat Diet

Jefcoate, Colin; Apr 2007; 15 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-06-1-0205

Report No.(s): AD-A470870; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Obesity enhances prostate cancer (PC) metastasis to bone. Factors secreted from adipocytes enhance PC growth. We hypothesized that feeding a high fat diet to C57BL/6 mice would enhance bone marrow (BM) fibroblastic progenitor differentiation to adipocytes. Mice were fed isocaloric low (LFD) and high (HFD) fat diets for up to 11 weeks postweaning. BM cells were isolated and cultured in serum-free RPMI 1640 media (PC media), generating BM conditioned media (BM-CM). The HFD increased the adipocyte population. BM-CM-LFD inhibited LNCaP cell growth. The HFD partially reversed this suppression. Cytochrome P4501B1 (CYP1B1), which is expressed in BM and in prostate tumor stroma and epithelia, is suspected to influence PC. CYP1B1^{-/-} BM-CM increased the proportion of DU145 cells in S-phase relative to C57BL/6 media. We conclude that BM cells secrete PC inhibitory paracrine factors, but also generate a stimulatory component in response to the HFD. CYP1B1 metabolism positively affects PC growth by metabolizing growth inhibitory factors.

DTIC

Bone Marrow; Cancer; Cell Division; Cells (Biology); Diets; Fats; Prostate Gland; Tumors

20070036345 Vanderbilt Univ., Nashville, TN USA

Therapy Selection by Proteomic Profiling

Hayward, Simon W; Feb 1, 2007; 8 pp.; In English

Contract(s)/Grant(s): W81XWH-04-1-0242

Report No.(s): AD-A470875; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The long term goal of this work is to develop a new prognostic tool with which to determine the response of a patient to a given therapy, with the view of providing the most appropriate treatments tailored to individual patients. The central hypothesis of this proposal is that a subset of the proteins expressed in a prostate tumor can be used to predict response to specific therapeutic regimens. The purpose of this work is to generate predictive methods which will allow patients to be selected for specific treatment protocols. In the current funding period we have completed the collection of human prostate cancer tissue, its grafting to mice and treatment of these mice with Taxotere. Tissues have been harvested and MALDI-MS profiles generated from both tumor epithelium and adjacent stroma. Efforts are currently underway to rigorously define and quantitate the response to Taxotere of the tissue samples, on an individual basis, prior to initiation of bioinformatic analysis of the mass spectrometry data sets. The project is proceeding behind its predicted timeline as outlined in the accepted statement of work and a no cost extension to complete the work has been requested.

DTIC

Cancer; Prostate Gland; Proteome; Therapy

20070036355 Chicago Univ., Chicago, IL USA

The Characterization and Treatment of Aggressive Breast Cancer

Nanda, Rita; May 2007; 72 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-04-1-0545

Report No.(s): AD-A470889; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Several groups have demonstrated that women with BRCA1 germline mutations are more likely to have breast cancers that are basal-like by gene expression profiling. While BRCA1 germline mutations are uncommon and contribute to fewer than 5% of breast cancers our lab has demonstrated that methylation occurs in up to 50% of high-grade hormone receptor negative sporadic tumors. As promoter methylation leads to transcriptional repression we propose that such tumors will be sensitive to DNA damaging agents and resistant to microtubule inhibitors given the role that BRCA1 plays in both DNA repair and cell

cycle. Using the alamar blue cytotoxicity assay and five breast cancer cell lines my laboratory has demonstrated that one of two BRCA1 methylated cell lines is significantly more sensitive to cisplatin and more resistant to paclitaxel as compared to other human breast cancer cell lines with normal BRCA1 expression. These findings are currently being translated into a clinical trial where the BRCA1 methylation status of a patient's tumor will be correlated to response of the tumor to platinum-based therapy.

DTIC

Breast; Cancer; Mammary Glands; Neoplasms

20070036358 California Univ., San Francisco, CA USA

Targeting MRS-Defined Dominant Intraprostatic Lesions with Inverse-Planned High Dose Rate Brachytherapy

Pouliot, Jean; Hsu, I-Chow; Kurhanewicz, John; Noworelski, Sue; Feb 2007; 42 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-04-1-0282

Report No.(s): AD-A470893; No Copyright; Avail.: Defense Technical Information Center (DTIC)

During these three years we have obtained CHR approval (December 2004) from the three step process (G.U. P.R.C. and C.H.R.) committees at UCSF. D.O.D. CHR approval was finally obtained in December 2006. Patient enrollment will begin immediately after receiving UCSF-CHR re-confirmation. We have developed a deformable image registration method to improve the quality of registration of (probe-in) MRSI data for (probe-out) radiation treatment planning. A similarity index (SI) of 98.1 % was obtained for rigid probe patient data. We have also obtained a class solution for the boost of DIL defined by MRI/MRSI as well as for the sparing of organs at risk including bladder rectum urethra and penile bulb. Patients enrollment will be initiated shortly.

DTIC

Cancer; Dosage; Imaging Techniques; Lesions; Magnetic Resonance; Prostate Gland; Spectroscopy

20070036359 Naval War Coll., Newport, RI USA

Practicing What You Preach: Achieving Unity of Effort and Unified Action During Domestic Response Operations

Elliott, James; May 10, 2007; 36 pp.; In English; Original contains color illustrations

Report No.(s): AD-A470895; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The Department of Defense (DOD) strongly advocates unity of effort and coordinated action in their myriad joint publications and doctrine; however, DOD has yet to achieve these overarching objectives when working across interagency lines in the domestic realm. DOD Combatant Commanders have chosen instead to create a separate parallel command structure that results in inefficient response operations and duplication of effort, and may yield fatal consequences during the next catastrophic domestic event. This paper will examine the evolution of the National Incident Management System (NIMS), the National Response Plan (NRP) and DOD's role in domestic response operations; review select lessons learned from major disaster response operations, National Special Security Events (NSSE), and national exercises; and provide recommendations to fully integrate DOD capabilities into domestic response operations to improve the efficiency and effectiveness of the nation's management of homeland security operations and catastrophic events.

DTIC

Emergencies; Rations; Security

20070036361 Jackson (Henry M.) Foundation, Rockville, MD USA

Trials of Transcranial Stimulation for the Treatment of Parkinson's Disease

Hallett, Mark; Lomarev, Mikhail P; Richardson, Sarah P; Wassermann, Eric; Bara, William; Lopez, Grisel; May 2007; 6 pp.; In English

Contract(s)/Grant(s): W81XWH-06-1-0534

Report No.(s): AD-A470897; No Copyright; Avail.: Defense Technical Information Center (DTIC)

During the first year of the study, we have been mainly working on the protocol 'Transcranial Electrical Polarization for the Treatment of Bradykinesia and Rigidity in Patients with Parkinson's Disease'. This is one of three protocols of the grant. This protocol was approved by the Office of Research Protections USAMRMC on 03/06/2007. Since then 3 patients were recruited in the protocol. The data was collected in 2 of them during the period of 8 TEP sessions. These patients are still in the protocol, and the data from them will be collected at 1 and 3 months follow up visits.

DTIC

Diseases; Stimulation

20070036363 Louisiana State Univ., Shreveport, LA USA

Dendritic Cell-Based Genetic Immunotherapy for Ovarian Cancer

Mathis, James M; Dec 2006; 17 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-05-1-0055

Report No.(s): AD-A470901; No Copyright; Avail.: Defense Technical Information Center (DTIC)

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 co-stimulatory 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 cyto-kine production. These results demonstrate that DCs can be successfully transduced using a CD40 targeted adenoviral vector and that transduced DCs show activation.

DTIC

Cancer; Genetics; Immunology; Ovaries

20070036364 Miami Univ., Coral Gables, FL USA

Detection of Organophosphorus Compounds by Covalently Immobilized Organophosphorus Hydrolase

Orbulescu, Jhony; Rastogi, Vipin K; Constantine, Celeste A; Shah, Saumil S; DeFrank, Joseph J; LeBlanc, Roger M; Oct 1, 2006; 8 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAAD19-03-1-0131

Report No.(s): AD-A470902; No Copyright; Avail.: Defense Technical Information Center (DTIC)

As a consequence of organophosphorus (OP) toxins posing a threat to human life globally, organophosphorus hydrolase (OPH) has become the enzyme of choice to detoxify such compounds. Organophosphorus hydrolase was covalently immobilized onto a quartz substrate for utilization in paraoxon detection. The substrate was cleaned and modified prior to chemical attachment. Each modification step was monitored by imaging ellipsometry as the thickness increased with each modification step. The chemically attached OPH was labeled with a fluorescent dye (7-isothiocyanato-4-methylcoumarin) for the detection of paraoxon in aqueous solution, ranging from 1 nanomole to 10 micromole. UV-visible spectra were also acquired for the determination of the hydrolysis product of para-oxon, namely p-nitrophenol.

DTIC

Enzymes; Organic Phosphorus Compounds; Toxins and Antitoxins; Water Pollution

20070036365 Research Triangle Inst., Research Triangle Park, NC USA

Motivational Interventions to Reduce Alcohol Use in a Military Population

Brown, Janice M; Mar 2007; 70 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-04-1-0072

Report No.(s): AD-A470903; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The overriding objective of this research is to reduce hazardous drinking in a military sample by implementing two motivational interventions and comparing them to a treatment-as-usual condition. Individuals who are referred to the Air Force Alcohol and Drug Abuse Prevention and Treatment (ADAPT) program as the result of an alcohol incident or who are self-referred are randomly assigned to one of three interventions: (1) a group motivational intervention (2) an individual motivational intervention or (3) a treatment-as-usual group. All participants provide data regarding drinking and related problems at baseline and at 3 6 and 12 months following the interventions. Analyses focus on (1) determining the effectiveness of the interventions in reducing alcohol use and alcohol-related problems (2) testing factors that may mediate or moderate responses to the interventions and (3) determining the cost and cost-effectiveness of treatment. The research includes a large sample (N = 675) and an extended follow-up (1 year) on intervention effects components that most previous intervention studies have lacked. From a practical perspective the ability to classify which individuals will benefit from a motivational intervention has important military readiness and alcohol policy implications.

DTIC

Alcohols; Armed Forces (United States); Drugs; Military Personnel; Motivation; Populations; Therapy

20070036366 Alabama Univ., Huntsville, AL USA

Novel Magnetic Fluids for Breast Cancer Therapy

Mazuruk, Konstanty; Apr 1, 2007; 22 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAMD17-03-1-0176

Report No.(s): AD-A470904; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The extended project dealt with the characterization of magnetic nano-colloids prepared by wet chemical process using FTIR absorption spectroscopy FTIR indicated that the nano-particles were more likely made of Fe₃O₄. New method and apparatus was developed for laser spark milling of magnetic micro-powders into nano-powders Two compounds were tested: Fe₂O₃:TiO₂:MgO water and MnAs in water/alcohol In both cases nano-colloids were made out of micro-powder suspensions. Provisional patent application has been submitted to USPTO for the method and apparatus.

DTIC

Breast; Cancer; Ferrofluids; Fluids; Mammary Glands; Therapy

20070036367 Johns Hopkins Univ., Baltimore, MD USA

AKT Rescue in Cardiomyocytes but not Breast Cancer Cells after Doxorubicin and Anti-erbB2 Treatment

Gabrielson, Kathleen; May 1, 2007; 20 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-04-1-0541

Report No.(s): AD-A470905; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Study Design: The proposed study will first evaluate the role of Akt, in protection against doxorubicin and anti-erbB2-cardiomyocyte toxicity, using adenoviral expression of active Akt pharmacological inhibitors of this pathway, and two peptides that activate Akt, cardiotrophin-1 and urocortin. Since these peptides have not been reported expressed in breast tissues or cancer, to confine this, we will evaluate the expression of both peptides and their receptors in six commonly studied breast cancer cell lines and 160 breast cancer tissue arrays by immuno-histochemistry and western blotting methods. Even if expression is observed in breast tissue, peptide treatment may improve cancer therapy as seen in other models. In aim 3, the cardiotrophin-1 and urocortin cardiac protection strategy, will be tested against cardiac toxicity induced by doxorubicin, anti-erbB2, chemical inhibitors of erbB1 or erbB2, or combination treatments. This will be a direct comparison of rat and human cardiomyocytes with 6 breast cancer cell lines using MTT assay. Next both peptides, will be administered in pilot studies to Sprague Dawley rats to establish a dose that protects against doxorubicin induced cardiac toxicity. Finally, using a female nude rat breast cancer xenograph model, these peptides will be evaluated for specific cardiac protection, during treatment with doxorubicin, anti-erbB2, combination of doxorubicin and anti-erbB2 and controls. Echocardiography, to evaluate ejection fraction, white blood cell counts, to evaluate bone marrow toxicity, histopathology, xenograph tumor size and weights will be used to assess peptide cardiac specific protection and anti-neoplastic therapy. Relevance: Doxorubicin is currently a first choice drug for breast cancer treatment, limited in use by its cardiac toxicity. Combination drug treatment is the standard of care.

DTIC

Adenoviruses; Breast; Cancer; Mammary Glands; Rescue Operations

20070036368 George Mason Univ., Fairfax, VA USA

Discovery of Novel Virulence Factors of Biothreat Agents: Validation of the Phosphoproteome-Based Approach

Bailey, Charles L; van Hoek, Monique L; Jun 2007; 31 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-06-C-0360

Report No.(s): AD-A470906; No Copyright; Avail.: Defense Technical Information Center (DTIC)

We are developing a novel application of Reverse Phase Protein Microarrays (RPMA) technology to the study of biothreat organisms. The power of this technology to survey the phosphorylation status of multiple proteins simultaneously enables us to map the host cell response to infection with multiple strains and species of Francisella as well as to begin to dissect which individual factors or proteins are contributing to the complex signals generated during infection, and thereby perhaps also to virulence. We will demonstrate the utility of this technology to examine host responses to bacterial infection, host responses to extracellular macromolecules, and host responses to individual proteins applied either extracellularly or intracellularly to the host cell. We will also compare different strains and species of Francisella using RPMA to elucidate the molecular differences in host response to the strains. Furthermore, we will begin to establish a model of how to use RPMAs to screen a genome-worth of open reading frames (ORFs) for potential virulence factors (VFs) by identifying those factors with an effect on host cell signaling pathways.

DTIC

Bacterial Diseases; Organisms; Virulence

20070036379 Illinois Univ., Chicago, IL USA

Dietary Influences on Alpha-Methylacyl-CoA Racemase (AMACR) Expression in the Prostate

Ananthanarayanan, Vijayalakshmi; Gann, Peter; Nonn, Larissa; VanBreenen, Richard; Apr 2007; 45 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-06-1-0414

Report No.(s): AD-A470920; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Alpha Methyl Acyl CoA Racemase (AMACR), a peroxisomal and mitochondrial enzyme, is up regulated in majority of prostate cancers (PCa). This enzyme is involved in the breakdown of phytanic & pristanic acids, which are derived primarily through the ingestion of dairy and red meat products. There are no studies done so far that have examined the relationship of this enzyme with red meat and dairy intake and therefore PCa risk. The current research focuses on examining the relationships between AMACR expression in the prostate and phytanic/pristanic acid levels in the blood and prostate. So far, ten patients with Pca have been recruited in the study. Research staff has been trained to obtain dietary information as well as process tissue and blood samples from participants. Protocols for processing biological samples have been established. Preliminary optimization of laboratory assays relevant to the study is being performed. The long term goal of this project is to better understand relationships between diet and AMACR expression and its implication in PCa risk. prostate cancer risk.

DTIC

Cancer; Diets; Prostate Gland

20070036384 California Univ., San Francisco, CA USA

Characterizing the Role of 1p36 Deletion in Breast Cancer and Identifying Candidate Tumor Suppressors

Hackett, Christopher S; Apr 2007; 11 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-06-1-0458

Report No.(s): AD-A470931; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Over 60% of human breast tumors display a deletion of one copy of the 1p36 region of the short arm of chromosome 1. Tumors with this deletion show a three-fold increase in mortality, suggesting a biological role for this deletion in tumor development, and suggesting the presence of one or more tumor suppressors in this region. Purpose: Characterization of the unique biology of tumors with 1p36 deletion, and characterization of the tumor suppressor(s) in the region may inform therapeutic strategies, and present unique therapeutic targets for this subset of breast cancer cases with relatively poor survival. Scope: The goals of this research project are to 1) develop a mouse model for 1p36 deletion in breast cancer by generating mice harboring IoxP sequences flanking the deletion region, and crossing to tissue-specific Cre expressing mice, 2) perform in-vivo insertional mutagenesis in breast tumors using the two-component Sleeping Beauty transposon system (mutagenic transposons mobilized by a trans-acting transposase) to tag tumor suppressors and oncogenes during tumor development and 3) to combine these two systems to identify tumor suppressors in the 1p36 region. To date, we have acquired targeting constructs, generated cohorts of mice for insertional mutagenesis, and developed in vitro alternative approaches.

DTIC

Breast; Cancer; Chromosomes; Deletion; Identifying; Mammary Glands; Mutagenesis; Suppressors; Tumors

20070036385 Texas Univ., Houston, TX USA

BATTLE: Biomarker-Based Approaches of Targeted Therapy for Lung Cancer Elimination

Hong, Waun K; Herbst, Roy; Mao, Li; Kim, Edward; Apr 2007; 104 pp.; In English

Contract(s)/Grant(s): W81XWH-06-1-0303

Report No.(s): AD-A470935; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The Program BATTLE (Biomarker-integrated Approaches of Targeted Therapy for Lung Cancer Elimination) seeks to establish individualized targeted therapy by prospectively examining patients' tumor biomarker profiles and assigning them to corresponding targeted therapies with the expectation to yield a better clinical outcome. This novel approach will be a proof-of-principle experiment to test the benefit of molecular-based individualized targeted therapy for lung cancer patients. Specifically, the objectives of the BATTLE program are: 1) To establish a clinical trial program using biomarkers to select individualized targeted therapy for patients with chemorefractory advanced NSCLC through the implementation of molecular classification based on the status of specific targeted biomarkers and adaptive randomization via hierarchical Bayes modeling. 2) To study the molecular mechanisms of response and resistance to targeted agents to discover new signaling pathways for test in future trials. 3) To identify molecular features in tumor tissues to correlate with tumor response or resistance, and identify serum biomarkers as surrogates. 4) To investigate other targeted agents in combination to overcome the resistance due to novel signaling pathways (e.g., mTOR and PI3K/Akt) and improve treatment efficacy. BATTLE is composed of four

Specific Aims with four phase II clinical trials and an umbrella protocol in Aim 1, six research projects in Aims 2 - 4, and two potential phase I trials in Aim 4. Here, we present our scientific progression the BATTLE program for the first grant year.
DTIC

Biomarkers; Blood; Cancer; Lungs; Physical Examinations; Serums; Therapy

20070036386 Texas Univ., Arlington, TX USA

Non-Invasive Monitoring for Optimization of Therapeutic Drug Delivery by Biodegradable Fiber to Prostate Tumor

Popa, Dan; Liu, Hanli; Tang, Liping; Feb 2007; 30 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-04-1-0229

Report No.(s): AD-A470936; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Chemotherapeutic drugs delivered by systematic administration exhibit great toxicity; patients have to endure suffering from frequent injection or low dose IV treatment. Thus controlled release and of these drugs and real-time monitoring of the effects of the drug can be a better treatment modality. The Hypotheses are (1): A near-infrared (NIR) imager can non-invasively monitor the vascular oxygenation and blood volumes in prostate tumors. (2): The dynamic response of prostate tumor oxygenation to the chronic drug delivery can serve as indicator for treatment prognosis. (3): The control of drug delivery rate will have a significant impact on the treatment prognosis. The specific aims of the of the project are: (1): To design and implement a NIR spectroscopic imaging system. (2): To develop imaging of drug concentration and tumor oxygenation. (3): To control the delivery of drug using a novel implantable micropump (IDDS).(4): To study the relationship between drug release rate, tumor oxygen levels and therapeutic outcome. (5): To create appropriate cancer tumor animal models, that will guide the growth of cancer tumor in Copenhagen rats.

DTIC

Biodegradability; Biodegradation; Cancer; Drugs; Near Infrared Radiation; Prostate Gland; Therapy; Tumors

20070036387 Mayo Clinic, Rochester, MN USA

Functional Characterization of a Novel Pro-Apoptotic Transcription Regulatory Protein in Ovarian Cancer

Shridhar, Viji; Dec 2006; 66 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-04-1-0085

Report No.(s): AD-A470937; No Copyright; Avail.: Defense Technical Information Center (DTIC)

In an effort to identify genetic changes involved in ovarian cancer (OvCa) development, we performed differential display-PCR, cDNA microarray and suppression subtraction hybridization analyses (SSH) to identify early genetic alterations associated with OvCa. These studies resulted in identification of several genes differentially expressed in OvCa, including a novel gene encoding a transcription elongation-like protein with the ability to induce apoptosis and suppress cancer cell growth. We named the protein ProApoptotic Protein on chromosome X (PAPX). Pro-apoptotic protein on X (PAPX) is a novel nuclear protein with sequence homology to transcription elongation factor like 1 (TCEAL1) [1]. PAPX expression is down-regulated in majority of ovarian cancer cell lines and primary tumors [2]. Re-expression of PAPX induces cell death and attenuates cell growth. We therefore proposed to study the functional role of PAPX as a candidate tumor suppressor in ovarian cancer. We proposed to (1) determine effect of PAPX on tumor and cell growth in vivo and in vitro; (2) analyze genes regulated by PAPX by transcriptional profiling using microarray chips; and (3) identify proteins that interact with PAPX and elucidate the function of PAPX related to tumor suppression.

DTIC

Apoptosis; Cancer; Genes; Ovaries; Proteins

20070036390 Texas Univ., Galveston, TX USA

Molecular Pathogenesis of Rickettsioses and Development of Novel Anti-Rickettsial Treatment by Combinatorial Peptide-Based Libraries

Walker, David H; Olano, Juan P; Feb 1, 2007; 101 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAMD17-02-1-0198

Report No.(s): AD-A470950; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The purpose of this study is to utilize adaptein libraries coded within pantropic retroviral vectors that confer protection against rickettsiae and to study the molecular pathogenesis of rickettsioses. The following specific aims were proposed: 1) To establish heterogeneous cell populations, with each cell expressing a unique member of a complex combinatorial peptide-based (e.g., adaptein) library and challenge with *R. prowazekii*, *R. rickettsii*, and *O. tsutsugamushi*; 2) To determine the role of NF- κ B, cytokines, ROS and NO in intracellular killing of rickettsia-infected monolayers containing adapteins and

3) To characterize signal transduction pathways modulating the cytoskeletal events responsible for the increased vascular permeability. Work on specific aim 1 was partially successful. Resistant colonies of 20-25 cells were obtained after rickettsial challenges. However, expansion of such colonies was not possible. Great progress was made on specific aims 2 and 3. The role of rickettsiae, cytokines (IFN-gamma, TNF-alpha, and IL-1beta), ROS and NO in endothelial permeability was very well characterized in vitro. Changes in occludin, p120 and beta-catenin have also been documented by confocal microscopy and are related to increased endothelial permeability. mRNA microarray experiments revealed differences between infected and non-infected endothelial monolayers and between *R. conorii* and *R. rickettsii*-infected endothelial monolayers.

DTIC

Arthropods; Combinatorial Analysis; Diseases; Libraries; Pathogenesis; Peptides; Typhus

20070036392 Colorado Univ., Denver, CO USA

Magnetic Resonance Spectroscopy (MRS) of Prostatic Fluids for Early Detection of Prostate Cancer

Crawford, E D; Serkova, Natalie J; Gamito, Eduard J; Jones, Richard H; O'Donnell, Colin; Kominsky, Douglas J; Brown, Jaimi L; Green, Spencer; Sullivan, Holly; Hedlund, Tammy; Apr 1, 2007; 33 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-04-1-0858

Report No.(s): AD-A470954; No Copyright; Avail.: Defense Technical Information Center (DTIC)

In this study, the metabolic profiles of expressed prostatic secretions (EPS) from 52 men with prostate cancer (PCa) and from 26 healthy controls were analyzed using quantitative proton nuclear magnetic resonance spectroscopy (¹H-NMRS). The metabolites quantified included citrate, spermine, myo-inositol, lactate, alanine, phosphocholine, glutamine, acetate, and hydroxybutyrate. Logistic regression (LR) was used to model the risk of PCa based on metabolite concentrations while adjusting for age. The LR models indicated that the absolute concentrations of citrate, myo-inositol, and spermine were highly predictive of PCa and inversely related to the risk of PCa. The areas under the receiver operating characteristic curves (AUROC) for citrate, myo-inositol and spermine were 0.89, 0.87, and 0.79, respectively. At 90% sensitivity, these metabolites had specificities of 74%, 51% and 34%, respectively. The LR analysis indicated that absolute levels of these three metabolites were independent of age. The results indicate that citrate, myo-inositol and spermine are potentially important markers of PCa in human EPS. Further, the absolute concentration of these metabolites in EPS appears to be independent of age, increasing the potential utility of these markers due to elimination of age as a confounding variable.

DTIC

Cancer; Detection; Magnetic Resonance; Magnetic Resonance Spectroscopy; Metabolites; Prostate Gland; Spectroscopy

20070036394 Cincinnati Univ., OH USA

Molecular Connections Between Arousal and Metabolic Disease: Orexin and Modafinil

Benoit, Stephen C; Apr 2007; 15 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-06-2-0019

Report No.(s): AD-A470956; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Obesity and metabolic diseases are known to be tightly linked to arousal-sleep cycles. Further, both metabolic disease and arousal are known to have significant impacts on cognitive function in humans and animals. Importantly, the armed forces represent a population at significant risk for increased stress and disrupted arousal-sleep cycles. Because the incidence of metabolic disease and obesity is increasing, even in these physically fit individuals, understanding the interactions between these systems is highly significant. Further, some anti-fatigue pharmacologies (e.g. modafinil) are already used in military settings, though their long-term effects on metabolism or central nervous system function are not well-understood. We have completed Year 1 of the proposed funding period to assess the physiological and behavioral effects of this pharmacology on rat subjects. Our first year data demonstrate that chronic administration of intraperitoneal modafinil decreases food intake and body weight in rats. Additionally, we observed that acute central modafinil has deleterious effects on some hippocampal-dependent forms of learning. These findings support our overall hypothesis that pharmacological activation of the central orexin system may modulate energy balance. Ongoing studies are assessing the effects of treatment on insulin sensitivity and also the effects of drug withdrawal on body weight regulation and cognitive function.

DTIC

Arousal; Cognition; Metabolism; Obesity; Pharmacology

20070036402 TRADOC Analysis Command, Fort Leavenworth, KS USA

Avian Influenza: Potential Impact on Sub-Saharan Military Populations with High Rates of Human Immunodeficiency Virus/Acquired Immunodeficiency Syndrome

Feldman, Robert L; Nickell, Kent; Jul 2007; 7 pp.; In English

Report No.(s): AD-A470975; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Several sub-Saharan militaries have large percentages of troops with human immunodeficiency virus (HIV)/acquired immunodeficiency syndrome. With the arrival of avian influenza in Africa, the potential exists that some of those soldiers might also become infected with H5N1, the virus responsible for the disease. Two possible scenarios have been postulated regarding how such a coinfection of HIV and H5N1 might present. (1) Soldiers already weakened by HIV/acquired immunodeficiency syndrome rapidly succumb to H5N1. The cause of death is a 'cytokine storm,' essentially a runaway inflammatory response. (2) The weakened immune system prevents the cytokine storm from occurring; however, H5N1 is still present, replicating, and being shed, leading to the infection of others. A cytokine storm is particularly dangerous for individuals of military age, as evidenced by the large number of soldiers who died during the 1918 influenza epidemic. If large numbers of sub-Saharan soldiers suffer a similar fate from avian influenza, then military and political instability could develop.

DTIC

Acquired Immunodeficiency Syndrome; Africa; Birds; Human Immunodeficiency Virus; Influenza; Military Personnel; Populations; Signs and Symptoms; Viruses

20070036404 Virginia Univ., Charlottesville, VA USA

Role of Adrenomedullin in Breast Cancer Bone Metastasis and Chemoresistance

Siclari, Valerie A; May 1, 2007; 32 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-06-1-0512

Report No.(s): AD-A470977; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The majority of patients with advanced breast cancer develop bone metastases, which are incurable. Recently, tumor-secreted factors have shown promise as targets for the treatment of bone metastasis. Adrenomedullin (AM) is a breast cancer-secreted peptide that is pro-proliferative, anti-apoptotic, pro-angiogenic, and stimulates new bone formation. AM overexpression increases bone metastases while AM knockdown decreases bone metastases in mouse models of prostate and lung cancer respectively. Objective/Hypothesis: The objective of this project is to validate AM as an important target for the treatment of breast cancer bone metastasis. I hypothesize that AM expression increases bone metastases and resistance to chemotherapy. Specific Aims: (1) To determine if AM expression by breast cancer cells increases bone lesion formation in bone metastasis mouse models. (2) To determine the role of AM in breast cancer cells. Key Research Accomplishments: (1) A human AM expression vector has been produced and is being used to make stable MCF-7 AM-overexpressing cells. (2) Stable AM shRNA knockdown MDA-MB-231 breast cancer cell clones have been produced and will be ready for mouse heart injection in June. (3) Current evidence does not indicate that AM is regulated by RhoGDI2 in breast cancer cells. Relevance: Currently no treatments improve overall survival for breast cancer bone metastasis patients. Studying AM may lead to the development of an adjuvant therapy to improve treatment.

DTIC

Bones; Breast; Cancer; Mammary Glands; Metastasis

20070036407 University of Southern California, Los Angeles, CA USA

Aberrant AR Signaling as a Function of Declining Androgen

Coetzee, Gerhard A; Pinski, Jacek; Aug 1, 2006; 20 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-04-1-0049

Report No.(s): AD-A470980; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This was an Exploration - Hypothesis Development Award (EHO) in which we modeled, in a mouse model system of xenograft human tumor growth, the natural androgen decline in the aging male (ADAM) as it occurs after the age of 40 years in humans. We explored the possibility that different testosterone levels may influence prostate tumor growth. We have completed the proposed study and found that all mice receiving testosterone at declining concentrations (even as little as 0.5 mg) developed xenograft tumors at about the same time and rate as fully androgenized mice. Only in androgen ablated mice did the tumors developed after months of delay. It therefore seems that tumor growth can be maintained at very low testosterone levels. We analyzed in detail PSA gene expression in tumors from the two extreme groups of animals (no testosterone and normal levels of testosterone) and found that tumors from ablated mice had on average higher steady-state levels of PSA mRNA than those in the testosterone group. However, tumors from ablated mice displayed elevated histone H3-K9/K14 acetylation across the entire body of the PSA gene. The data therefore indicates that loci-specific chromatin

alterations contribute to basal gene expression of specific AR target genes in androgen-independent PCa cells and may thus contribute to the androgen-independent phenotype of these cells.

DTIC

Aberration; Abnormalities; Hormones; Males; Neoplasms; Prostate Gland

20070036408 Texas Univ. Health Science Center, San Antonio, TX USA

Summer Undergraduate Fellowships in Breast Cancer Research

Christy, Barbara A; May 1, 2007; 8 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAMD17-03-1-0308

Report No.(s): AD-A470981; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The aim of this grant was to support a summer training program for undergraduate students interested in biomedical research, especially cancer-related research. The students selected for the program participated in cancer-related basic research for a 10-week summer period in the Department of Molecular Medicine, University of Texas Health Science Center at San Antonio. Each student was assigned a faculty mentor and placed in a laboratory, depending on their expressed interests. Each student participated in actual research in the mentor's laboratory during the summer, and attended weekly seminars to learn about topics relevant to breast cancer research. At the end of the summer, each student made a formal presentation to the entire department about their summer research project. The aim of the proposal was to expose talented young scientists to biomedical research, with the hope of attracting some of them to pursue biomedical research careers. Over the last four summers, this grant has supported 27 participating students. 66% of the participants were female, and 30% were from underrepresented minority populations. The program has been of great benefit to all involved.

DTIC

Breast; Cancer; Mammary Glands; Medical Science; Summer

20070036410 State Univ. of New York, Stony Brook, NY USA

Innovative Surveillance and Risk Reduction Systems for Family Maltreatment, Suicidality, and Substance Problems in USAF

Slep, Amy M; Heyman, Richard E; Mar 1, 2007; 20 pp.; In English

Contract(s)/Grant(s): DAMD17-03-1-0166

Report No.(s): AD-A470983; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This project aims to enhance the capacity of the Air Force (AF) to reduce death, injury, and degraded force readiness via reduction of the prevalence and impact of family maltreatment, suicidality, and alcohol/drug problems ('secretive problems'). Managing risk and increasing resilience in military human resources (i.e., 'Force Health Protection') is a top priority for DoD and Armed Forces leadership. The objective of this study is to enhance the AF's current prevention delivery (known as the Integrated Delivery System: IDS) infrastructure through (a) the development and validation of a information system needed to direct prevention efforts more effectively and efficiently: (b) the adoption of a prevention-science-based approach: and (c) the evaluation of its effectiveness. When funded, the proposed project was broken into two phases. This first phase is a demonstration project on which to build a randomized trial. This project is meeting the objectives by: (a) pilot testing the development of an innovative surveillance system and validating its accuracy (at 4 AF bases) for family maltreatment, suicidality, and problematic alcohol and drug use, and (b) pilot testing the creation of an enhanced IDS by training community leaders in prevention-science-based intervention methodology and testing the impact on factors that are prerequisites for effective community prevention initiatives and on targeted outcomes.

DTIC

Drugs; Health; Human Resources; Risk; Surveillance

20070036411 Purdue Univ., West Lafayette, IN USA

Chemical Probes of Rapid Estrogen Signaling in Breast Cancer Treatment and Chemoprevention

Weatherman, Rose V; Apr 1, 2007; 52 pp.; In English

Contract(s)/Grant(s): W81XWH-04-1-0447

Report No.(s): AD-A470984; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The goal of this project was to design new chemical tools to selectively probe the molecular mechanisms of action of rapid estrogen receptor action and their relevance to breast cancer drugs like tamoxifen. Over the course of the project, we synthesized and tested approximately 15 new estrogen receptor modulators, some with novel activity in terms of both classic transcriptional and rapid response modulation. We discovered that the structure activity relationship for some rapid estrogen

responses is different than the SAR required for transcriptional regulation, but that rapid responses could not be separated from the transcriptional modulation. We synthesized a novel metabolite of tamoxifen, called endoxifen, which appears to be the major bioactive metabolite of tamoxifen in women. This work also resulted in a letter to the FDA concerning possible drug interactions between tamoxifen and women taking certain antidepressants. We also made a new polymer-based conjugate of 4-hydroxytamoxifen that not only shows great uptake into ER positive breast cancer cells, but also shows antiproliferative activity against antiestrogen sensitive and antiestrogen-resistant breast cancer cell lines. We are currently trying to translate this unexpected finding into the design of new experimental therapeutics for the treatment of tamoxifen-resistant breast cancer, an urgent need for breast cancer patients.

DTIC

Breast; Cancer; Estrogens; Mammary Glands

20070036414 Virginia Commonwealth Univ., Richmond, VA USA

The Role of Sphingosine Kinase 2 in Apoptosis of Human Breast Cancer Cells

Sankala, Heidi; Spiegel, Sarah; May 2007; 21 pp.; In English

Contract(s)/Grant(s): W81XWH-04-1-0393

Report No.(s): AD-A470987; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Two isoforms of sphingosine kinase (SphK) catalyze the formation of sphingosine-1-phosphate (S1P). Whereas, SphK1 stimulates cell growth and survival, it was found that when overexpressed in mouse NIH 3T3 fibroblasts SphK2 enhances caspase-dependent apoptosis in response to serum deprivation, independently of S1P receptors. Sequence analysis revealed that SphK2 contains a 9 amino acid motif similar to that present in BH3-only proteins. Studies showed that the BH3-only domain and catalytic activity contribute to the apoptotic effects of overexpressed SphK2. Further studies in human carcinoma cells showed that overexpression of SphK2 increased the expression of the cyclin dependent kinase (cdk) inhibitor p21, but interestingly had no effect on p53 or its phosphorylation. Correspondingly, down regulation of endogenous SphK2 with small interfering RNA (siRNA) targeted to unique mRNA sequences decreased basal and doxorubicin-induced expression of p21 without affecting p53. In addition, down regulation of SphK2 decreased G2/M arrest in response to doxorubicin. Surprisingly however, siSphK2 markedly enhanced apoptosis induced by doxorubicin in MCF7 cells. This result raises the question of how overexpression of SphK2 decreases cell growth and enhances apoptosis while its down regulation sensitizes cells to apoptosis. A partial answer may come from the possibility that when SphK2 is overexpressed it does not always have the same subcellular distribution as the endogenous protein. It may also be possible that proteolysis of overexpressed SphK2 might induce apoptosis due to liberation of its BH3 peptide domain, which does not occur at the levels at which endogenous SphK2 is expressed. Collectively, these results demonstrate that endogenous SphK2 is important for p53-independent induction of p21 expression by doxorubicin and suggest that SphK2 expression may influence the balance between cytostasis and apoptosis.

DTIC

Apoptosis; Breast; Cancer; Catalysts; Mammary Glands

20070036415 Fox Chase Cancer Center, Philadelphia, PA USA

Modeling Human Epithelial Ovarian Cancer in Mice by Alteration of Expression of the BRCA1 and p53 Genes

Connolly, Denise; Feb 2007; 8 pp.; In English

Contract(s)/Grant(s): W81XWH-04-1-0063

Report No.(s): AD-A470988; No Copyright; Avail.: Defense Technical Information Center (DTIC)

About one out of every ten cases of epithelial ovarian cancer (EOC) is inherited. The majority >90% of inherited cases of EOC are the result of mutations in the breast cancer associated gene I (BRCA1). This gene was originally identified based on genetic linkage to families with an increased risk of developing breast and ovarian cancer. It is involved in controlling normal cellular growth and is thought to suppress the growth of tumors. That is if BRCA1 is mutated the risk to develop breast and ovarian cancer increases. Another gene that is important in the development of cancer is p53. It also helps maintain normal cellular growth and is the most commonly mutated gene in all human cancers. The p53 gene has been shown to be mutated in at least 50% of all cases of epithelial ovarian cancer. In addition to mutations of BRCA1 mutations of the p53 gene are often found in patients with breast and ovarian cancer syndrome. Based on the importance of both of these genes in the development of this type of ovarian cancer we hypothesize that inactivation of BRCA1 and p53 in the ovaries of mice will result in epithelial ovarian cancer in the animals.

DTIC

Cancer; Genes; Mice; Ovaries

20070036416 Michigan Univ., Ann Arbor, MI USA

Genetic and Hormonal Risk Factors for Prostate Cancer in African-American Men

Sarma, Aruna V; May 1, 2007; 33 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAMD17-03-1-0270

Report No.(s): AD-A470989; No Copyright; Avail.: Defense Technical Information Center (DTIC)

African American men are at greater risk for developing and dying from prostate cancer compared to white men. This disparity is likely due to a number of factors including environmental and genetic factors. The Flint Men's Health Study (FMHS) was established in 1995 as a population-based case-control study of African American men aged 40-79 residing in Genesee County, Michigan. The initial sample consisted of 730 men who completed an in-home interview consisting of potential risk factors for prostate cancer; medical history; and demographic data. 431 men provided a blood sample and 369 men who were determined to be free of cancer completed a comprehensive urologic exam. Additionally, 119 cases of prostate cancer have been identified from the same population. Studies have suggested a role for hormones and genetics in cancer incidence. However, studies have been completed in white populations and results have been conflicting. The objective of this study is to more clearly delineate the potential role(s) of selected hormones and growth factors in prostate cancer development.

DTIC

Africa; Cancer; Genetics; Hormones; Human Beings; Males; Prostate Gland; Risk

20070036417 Pittsburgh Univ., Pittsburgh, PA USA

The Impact of Exercise on the Vulnerability of Dopamine Neurons to Cell Death in Animal Models of Parkinson's Disease

Zpgmond, Michael J; Smith, Amanda; Liou, Anthony; Jul 1, 2007; 12 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAMD17-03-1-0479

Report No.(s): AD-A470990; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Parkinson's disease results in part from the loss of dopamine neurons. We hypothesize that exercise reduces the vulnerability of dopamine neurons to neurotoxin exposure, which is modulated by stress. We have outlined experiments to test this hypothesis in rats treated with one of several neurotoxins, beginning with 6-hydroxydopamine. Over the past year, we increased the size and training of our research team and made a number of observations of direct relevance to our hypothesis. We also have received permission to expand our original Statement of Work to include critical studies on the mechanism of the actions of exercise, using both in vivo and in vitro approaches. Our focus continues to be on the effects of stress and exercise on the vulnerability of DA neurons, and the role played in these phenomena by trophic factors and intracellular signaling cascades.

DTIC

Death; Diseases; Dopamine; Neurons; Physical Exercise; Veterinary Medicine; Vulnerability

20070036418 Meharry Medical Coll., Nashville, TN USA

Development of the Meharry Medical College Prostate Cancer Research Program

Ukoli, Flora A M; Cui, Yong; Washington, William; Stewart, LaMonica; Ogunkua, O; Amaefuna, Emeka; Malin, Alecia; Dittus, Robert S; Matusik, Robert J; Morrow, Jason; Cookson, Michael; Fowke, Jay H; Kasper, Susan; Wills, Marcia; Mar 2007; 29 pp.; In English

Contract(s)/Grant(s): W81XWH-05-1-0229

Report No.(s): AD-A470991; No Copyright; Avail.: Defense Technical Information Center (DTIC)

There is substantial urology, oncology, epidemiology, nutrition and other expertise at Meharry and Vanderbilt to address issues relating to prostate cancer (PCa) disparity among African-American (AA) men. Six new/junior minority investigators have initiated pilot projects, continue to maintain partnerships with mentors at VU, and two PIs have established viable community network ties. Dr. Ukoli has recruited 64 participants into the lycopene study, sent 200 stored plasma samples for lycopene analysis, and developed a lycopene clinical trial to be submitted in June. Dr. Washington has recruited 14 participants into the PCa health care seeking behavior study. 300 blood samples of AA and Nigerians will be sent to the GCRC at VU for DNA extraction and genotyping for Dr. Cui's study in collaboration with Dr. Marshall (new investigator). Dr. Ogunkua has dosed/ sacrificed 40 mice recording data at all time-points. Dr. Stewart has received independent funding for the PCa cell lines Thalidomide growth inhibitory study, and two students have submitted pre-doctoral grants from her laboratory. Dr. Abu, postdoctoral fellow, has developed a career development award proposal to look at quality of life following PCa treatment to be submitted in June. 2 MSPH graduate students have selected related topics for their thesis.

DTIC

Cancer; Medical Science; Prostate Gland; Universities

20070036419 Duke Univ., Durham, NC USA

Design, Implementation, and Characterization of a Dedicated Breast Computed Mammo Tomography System for Enhanced Lesion Imaging

McKinley, Randolph L; Mar 1, 2007; 96 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-05-1-0280

Report No.(s): AD-A470992; No Copyright; Avail.: Defense Technical Information Center (DTIC)

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 characterized in terms of dose efficiency and contrast sensitivity indicating the potential for sub-dual-view-dose imaging. The 2D and 3D MTFs have been determined. Observer studies have been performed to determine the lower limits of detectability and a comparison with dual view mammography indicates mammotomography can detect significantly smaller lesions in the presence of overlying structure. Patient bed optimization has also been investigated and a prototype patient bed designed and tilt angles evaluated for optimization of chest wall imaging and patient comfort. Future studies for the remaining phase (Year 3) of project will focus on feasibility of vertical patient bed motion and evaluation of breast sizes.

DTIC

Breast; Cancer; Computer Aided Tomography; Imaging Techniques; Lesions; Mammary Glands; Tomography

20070036420 Jackson (Henry M.) Foundation, Rockville, MD USA

Interstitial Metabolic Monitoring During Hemorrhagic Shock

Pamnani, Motilal B; Nov 1, 2005; 32 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAMD17-02-1-0263

Report No.(s): AD-A470993; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Decompensation in hemorrhagic shock is the critical stage after which resuscitative efforts may prove futile. We hypothesize that decompensation results from K⁺-mediated vasodilation and/or loss of cardiac contractility. Anesthetized rats were bled to a constant mean arterial pressure of 40 mmHg and subsequent resuscitated with normal saline at early (pre-decompensatory) and late (decompensatory) stages of shock. In the first set of experiments, microdialysis probes were implanted in skeletal muscle for continuous assessment of potassium and other metabolic markers. In a second set of experiments, animals underwent left heart catheterization and continuous measurement of cardiac contractility during hemorrhage and resuscitation. At the end of experiments, tissues were harvested for ex vivo Na⁺,K⁺-ATPase (NKA) activity. K⁺ concentrations in muscle interstitium were significantly higher in hemorrhaged animals than controls (2.34 times baseline vs. 1.24, p < 0.05), this difference was not reflected in blood values. NKA in early and late hemorrhagic shock was increased vs. controls in skeletal and cardiac muscle. Cardiac contractility fell with hemorrhage but was restored with resuscitation in both early and late shock. These results suggest that decompensation results from a loss of peripheral rather than cardiac responsiveness.

DTIC

Interstitials; Metabolism; Shock (Physiology)

20070036421 North Carolina Univ., Chapel Hill, NC USA

Zinc Finger Transcription Factors as Novel Switches to Modulate Metastatic Progression of Breast Tumors

Blancafort, Pilar; May 2007; 17 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-06-1-0477

Report No.(s): AD-A470994; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The transcriptional programs cooperatively required for the malignant progression of breast tumors are largely unknown. In this project we propose the isolation of Artificial Transcription Factors (TFs) for the discovery of gene panels, which cooperate during the generation of metastatic behavior. An ATF is made by linkage of a DNA-binding domain (DBD) with a transcriptional effect or domain, which mediates activation or repression of endogenous genes. ATFs are typically made of arrays of Cys2-His2 zinc finger (ZF) domains. The objective of this proposal is to apply large ATF libraries to identify and regulate genes that cooperate during the process induction of breast cancer cell invasion and progression. We have delivered ATF libraries into non-invasive breast cancer cell lines. We have selected ATFs able to induce or enhance breast cell invasion. The ATF-selections were performed in vitro using materiel invasion assays (Boyden chambers). In the future, ATFs modulating cell invasion will be profiled using DNA microarrays to determine genes differentially regulated by the ATF that are responsible for the phenotype change.

DTIC

Breast; Cancer; Fingers; Mammary Glands; Metastasis; Switches; Tumors; Zinc

20070036422 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 2007; 39 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-05-1-0173

Report No.(s): AD-A470995; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Prostate cancer 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. We constructed 5 tissue microarrays representing 40 African-American and 159 Caucasian prostate cancer patients and performed immunohistochemistry on these arrays using antibody to AMACR and EZH2. Protein expression was scored on these arrays for both AMACR and EZH2 analyzed the data generated from these experiments to investigate the relative levels of two markers in prostate cancer patients from the two racial subgroups and also for any associations with survival patterns and clinic-pathologic parameters. The mean of AMACR expression percentage of PCA patients is significantly higher in Caucasian patients than African American patients with prostate cancer. The mean of EZH2 intensity score in CaucaPCA patients is not significantly different from the score in AA PCA patients.

DTIC

Africa; Biomarkers; Cancer; Human Beings; Immunology; Males; Prostate Gland; Races (Anthropology)

20070036423 Duke Univ., Durham, NC USA

Early Detection of Breast Cancer via Multiplane Correlation Breast Imaging

Chawla, Amarpreet; Samei, Ehsan; Apr 2007; 37 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-06-1-0449

Report No.(s): AD-A470997; No Copyright; Avail.: Defense Technical Information Center (DTIC)

One of the major deficiencies of standard mammography is the camouflaging effect of overlapping structures in the projection images that limits the rendering of breast cancer. To minimize the effect of this limiting factor, we investigated the feasibility of Multi-plane Correlation Imaging (MCI) technique. In this technique, multiple radiographic images of the breast are obtained from different angles. Angular information is used to identify and positively reinforce the lesion signals between different projections. In the first stage of this study, we investigated the optimal geometry of acquisitions in MCI which yields superior diagnostic information. Towards this end, a LG CHO mathematical observer model was constructed to assess the detectability of a simulated mass embedded in the different angular projections acquired as part of MCI. Detectability performance on various angular projections were combined using three techniques to determine a final figure of merit as a measure of the system's performance. Lastly, different components of acquisitions such as the number of angular projections and the angular span of them were changed to investigate which one of the combinations maximizes the detectability performance.

DTIC

Breast; Cancer; Detection; Imaging Techniques; Mammary Glands

20070036424 New Jersey Medical School, New Brunswick, NJ USA

RNA-Binding Proteins as Novel Oncogenes and Tumor Suppressors in Breast Cancer

Brewer, Gary; May 2007; 13 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAMD17-03-1-0267

Report No.(s): AD-A471000; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Post transcriptional control of gene expression is particularly important for oncoproteins and cell cycle proteins because their sustained synthesis favors cell growth rather than differentiation, a hallmark of the neoplastic phenotype. Control is exerted via the opposing actions of the RNA-binding proteins AUF1 and HuR. AUF1 triggers degradation of mRNA subsets while HuR promotes mRNA stabilization. Phase I of this work is to examine the effects of AUF1 and HuR expression levels on global gene expression in human breast carcinoma cells. Phase II is to assess roles of AUF1 and HuR in cellular proliferation and tumorigenesis in vivo. Previously, we discovered that AUF1 knockdown elevates expression of c-myc proto-oncogene by in vivo association with the mRNA, accelerates breast cancer cell proliferation, and alters their cell-cell adhesion properties. To explain the biological effects of AUF1 knockdown, we performed cDNA microarray analyses during the final funding period to identify AUF1's target mRNA subsets and their regulation by AUF1.

DTIC

Breast; Cancer; Carcinogens; Mammary Glands; Oncogenes; Proteins; Ribonucleic Acids; Suppressors; Tumors; Viruses

20070036425 Jackson (Henry M.) Foundation, Rockville, MD USA

A Randomized Placebo-Controlled Trial of Citalopram for Anxiety Disorders Following Traumatic Brain Injury

Warden, Deborah L; Apr 2007; 5 pp.; In English

Contract(s)/Grant(s): DAMD17-03-2-0028

Report No.(s): AD-A471001; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The overarching goal of this project is to study the effects of a serotonin reuptake inhibitor (SRI), citalopram, for the treatment of anxiety experienced by individuals after traumatic brain injury (TBI). Specifically, this project seeks to treat individuals who meet criteria for DSM-IV diagnosis of Anxiety Disorder Due to a General Medical Condition, within 3 to 24 months of TBI. A randomized placebo controlled design with 1-year follow-up will be utilized to evaluate the effectiveness of citalopram in alleviating significant anxiety symptoms that cause significant distress and can lead to medical retirement of active duty soldiers.

DTIC

Anxiety; Brain Damage; Injuries; Order-Disorder Transformations; Signs and Symptoms

20070036428 Albert Einstein Coll. of Medicine, Bronx, NY USA

Proteomic Prediction of Breast Cancer Risk: A Cohort Study

Rohan, Thomas E; Mar 1, 2007; 42 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-05-1-0298

Report No.(s): AD-A471005; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Our objective is to develop and test proteomic methods for the prediction of breast cancer risk, an approach that has not been attempted previously. Our underlying hypothesis is that proteomic analysis of serum will identify proteins differentially expressed in women who do versus those who do not develop invasive breast cancer, and that these differences will be identifiable prior to the clinical presentation of breast cancer. Our work is being conducted in two phases, a training phase and a test phase. Both phases will be conducted as case-control studies nested in a population-based cohort of women who were members of Kaiser Permanente. These serum specimens were collected between 1986 and 1992. To date, we have finalized our cohort definition; finalized the definition of cases and controls; finalized the criteria for matching controls to cases; selected the cases and controls; pulled and aliquotted the serum specimens; and we have developed a detailed protocol for the proteomic analysis of the serum samples. Briefly, with respect to the latter, the serum sample is loaded onto an immunoaffinity column to deplete the twelve most abundant proteins, and the flow through fraction is collected and subjected to tryptic digestion. Subsequently, the peptides are labeled with iTRAQ reagents and fractionated by strong cation exchange chromatography (SCX). Each SCX fraction is loaded onto a reverse phase column and spotted onto a MALDI target followed by MALDI-TOF/TOF (4700 Proteomic Analyzer) analyses. The data collected are automatically processed, combined, and searched against human protein databases.

DTIC

Breast; Cancer; Mammary Glands; Proteome

20070036429 Wake Forest Univ., Winston-Salem, NC USA

Contribution of AMACR and Phytanic Acid to Prostate Cancer Risk Among African Americans in North Carolina

Chang, Bao-Li; Feb 1, 2007; 8 pp.; In English

Contract(s)/Grant(s): W81XWH-06-1-0245

Report No.(s): AD-A471007; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Several lines of evidence have suggested genetic and dietary differences may be important in PCa, particularly among AA (African American) men. In this study, we aim to test the hypothesis that mutations/sequence variants in the AMACR gene, and dietary intake of foods rich in phytanic acid, increase the risk to PCa among AA men. We will conduct a population based study by ascertaining 250 AA men who have PCa and 250 race, age, and county-matched controls from eight counties of North Carolina. We are in the process of carrying out the 1st task, study subject recruitment, until year 2008. In the past funding year, we have obtained IRB approval and started subject recruitment. We have also contacted other investigators to explore the possibility of expanding our study area. Additionally, we have also submitted two additional grant applications to investigate genetic and environmental risk factors based on this study population. The results from this study, as well as other future studies based on this study population, will greatly increase our knowledge for potential risk factors and suggest potential preventive strategies for prostate cancer in AA men.

DTIC

Africa; Cancer; Prostate Gland; Risk

20070036431 Pennsylvania State Univ., University Park, PA USA

The Role of Osteoblast-Derived Cytokines in Bone Metastatic Breast Cancer

Bussard, Karen M; Mar 1, 2007; 42 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-06-1-0363

Report No.(s): AD-A471009; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Breast cancer (BC) metastasizes to bone. It is likely bone provides a hospitable environment that attracts BC cells and allows them to colonize and grow. Current models suggest BC-derived cytokines are key to understanding BC metastasis. We hypothesize that osteoblasts can be directed by metastatic BC cells to produce cytokines that are chemoattractants for osteoclasts and cancer cells, and growth or maintenance factors for BC cells. Our purpose is to determine how osteoblast-derived cytokines influence BC metastases to bone. Goals include investigating the production of osteoblast-derived cytokines in response to BC cells or their conditioned medium (CM), the production of bone-derived cytokines in response to BC cells in vivo, and the presence of functional cytokine receptors on osteoblasts and BC cells. Using murine osteoblasts, and human metastatic BC and non-metastatic cells, we found that BC CM treatment increased osteoblast-derived cytokine secretion of IL-6, KC, VEGF, MIP-2, and MCP-1. Maximum induction of osteoblast-derived cytokine secretion occurred with 20 day old cells. Treatment with CM of a bone-seeking cancer variant enhanced osteoblast-derived cytokine production at Day 20. Murine-specific ELISAs showed osteoblast-derived cytokine secretion to MDA-231 variant CM was dose-dependent. No significant changes in osteoblast-derived cytokine secretion were observed in 4 day old cells.

DTIC

Bones; Breast; Cancer; Mammary Glands; Metastasis; Osteoblasts

20070036432 Michigan Univ., Ann Arbor, MI USA

Development of a Smart Diagnostics Platform for Early-Stage Screening of Breast Cancer

Lahann, Joerg; Apr 1, 2007; 28 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-06-1-0271

Report No.(s): AD-A471011; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The proposed research aims to develop innovative technology that could ultimately lead to new breast cancer screening tests ones, which will not require expensive equipment for read-out, but rather will be compatible with miniaturized systems integrated in cheap handheld devices. Towards this goal, we have designed and realized in practice a surface that can act as detection unit. This opens the door for further work that will be geared towards testing of biomarkers.

DTIC

Breast; Cancer; Diagnosis; Mammary Glands

20070036434 Duke Univ., Durham, NC USA

Early Detection of Breast Cancer via Multiplane Correlation Breast Imaging

Kapadia, Anuj J; Apr 1, 2007; 42 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-06-1-0484

Report No.(s): AD-A471013; No Copyright; Avail.: Defense Technical Information Center (DTIC)

We are developing a tomographic technique called Neutron Stimulated Emission Computed Tomography (NSECT) for early detection of breast cancer. NSECT is sensitive to metabolic changes in trace element concentrations that are seen in tumors at very early stages of development. Detecting and measuring these element concentrations has the potential to detect breast cancer early. Using neutrons as the imaging radiation leads to significant concerns about patient dose. While preliminary experiments show that it is possible to perform NSECT scans with dose similar to that of an abdominal CT scan, one of our primary goals in this project is to reduce dose further to allow NSECT to be more easily accepted as a screening tool. This project aims at evaluating the effects of NSECT dose-reduction techniques on the accuracy of cancer diagnosis. There are 4 dose reduction techniques under evaluation: reducing neutron flux; using fewer spatial projections; fewer angles; and using multiple detectors. As evaluation of each technique individually using experimental studies is not feasible, this study uses Monte-Carlo simulations as an alternative. In the first part of the study, we have designed and built a Monte Carlo simulation of the NSECT tomographic scanning system using GEANT4. We have designed the scanning system as a 3 part system consisting of: (a) a neutron beam source with user-defined neutron flux and neutron beam width, (b) a gantry with user-defined spatial and angular beam sampling rates, and (c) gamma detectors with user-defined detector material, radius, efficiency and location. We have also built GEANT4 phantoms for benign and malignant breast tissue based on element concentrations reported in various experimental studies. Finally, we have integrated the phantoms and tomographic system to simulate a complete NSECT scan of the human breast.

DTIC

Breast; Cancer; Computer Aided Tomography; Detection; Imaging Techniques; Mammary Glands

20070036435 Children's Hospital, Boston, MA USA

Prevention of the Angiogenic Switch in Human Breast

Folkman, Judah; Mar 1, 2007; 22 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-04-1-0316

Report No.(s): AD-A471014; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Our overall goal is to determine if human breast cancer can be prevented from becoming angiogenic when it is still at a microscopic size ($< \sim 1 \text{ mm}^3$). To date we have made the following progress: (1) We have cloned three different human breast cancers that undergo the angiogenic switch at predictable times. (2) We have found that the angiogenic switch time is modified by host stroma: two-fold earlier for tumors in the mammary fat pad, compared to tumors implanted in subcutaneous tissue. (3) We have found that the angiogenic switch is preceded by repression of stromal expression of thrombospondin-1. Angiogenic tumor cells continue to secrete a novel thrombospondin-1 repressing factor. This protein has been purified and partially sequenced. (4) For one of the breast cancers, the angiogenic switch can be detected at a microscopic size by a significant increase in bFGF in platelet alpha granules. (5) We have determined that the BRCA1 gene (breast cancer susceptibility gene), appears to regulate a ratio of thrombospondin-1 to VEGF in breast cancer cells. The lower the thrombospondin-1/VEGF ratio, the sooner the tumor cells will spontaneously switch to the angiogenic phenotype and grow large tumors in SCID mice.

DTIC

Angiogenesis; Breast; Cancer; Mammary Glands; Prevention; Switches

20070036439 Virginia Polytechnic Inst. and State Univ., Blacksburg, VA USA

High Energy Density Nastic Structures Using Biological Transport Mechanisms

Leo, Donald J; Feb 28, 2007; 33 pp.; In English; Original contains color illustrations

Report No.(s): AD-A471018; No Copyright; Avail.: Defense Technical Information Center (DTIC)

A new mechanical actuation concept is demonstrated based on the controlled transport of fluid across semi-permeable membranes. This concept is based on the pressurization of cells similar to the process that plants use to maintain homeostasis and regulate cell function. In all plant systems, the transport of ions and fluid produce localized pressure changes (called turgor pressure) that perform many cell functions, such as maintaining cell integrity and controlling plant growth. In this article, we demonstrate that the concept of fluid transport caused by protein transporters can be used to control the actuation properties of a mesoscale device. The device considered in this work consists of two chambers separated by a semi-permeable membrane substrate that contains protein transporters suspended in a lipid bilayer. The protein transporters convert biochemical energy in the form of ATP into a protein gradient across the semipermeable membrane. The proton gradient, in turn, induces a flow of fluid across the porous substrate and pressurizes a closed volume. The experimental demonstration uses a directly applied gradient. The pressurization of the closed volume produces a deformation in the cover plate of the chamber, thus transforming the chemical energy of the ATP into a measurable motion in the actuator. Experiments on the device demonstrate that micron-scale displacements can be induced in a millimeter-scale actuator. The time constant of the response is on the order of tens of seconds, and results demonstrate that the pH gradient (or) amount of ATP and ATPase control the actuation properties of the device. To our knowledge, this is the first demonstration of using natural protein transporters as the active component of a mechanical actuator.

DTIC

Actuators; Biomimetics; Hydraulic Equipment

20070036441 Tufts Univ., Medford, MA USA

Uncovering Design Principles of Intermediate Filaments, a Self-Assembling Biomaterial: Lessons in Nanoscale Materials Design

Lee, David H; Feb 21, 2007; 18 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAAD19-03-1-0330

Report No.(s): AD-A471024; A140001-ARM205; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Our broad long-term objective is to create novel biomaterials that advance the technical capabilities of the U.S. Army. In the short term, we seek to design self-assembling biomaterials that are adaptable in their structure and function. To do so, we must understand the molecular physicochemical aspects of biomaterials design, and we use three different systems to study this issue: 1) intermediate filaments, a class of protein with a broad range of structural roles from the nanometer to macroscale, as a model system; (2) self-assembled virus-based nanostructures, and (3) adiponectin, an adipocyte-produced hormone that serves as a soluble model system of higher order collagen. Such proteins may be harnessed for military purposes (eg. protective self-healing materials or nanoscale scaffolds) if one had a better understanding of how molecular structure

determines material properties. In this final progress report, we summarize our studies on these systems.

DTIC

Design Analysis; Molecular Structure; Ribonucleic Acids

20070036442 Wisconsin Univ., Madison, WI USA

Characterizing a Rat Brca2 Knockout Model

Gould, Michael N; May 1, 2007; 51 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-04-1-0436

Report No.(s): AD-A471025; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Brca2 mutation carriers, while rare in the population have a high probability to develop breast cancer. In order to better understand the etiology of this disease as well as to develop prevention and treatment strategies for it we require good animal models. In this project we characterized the first rat knockout produced which was that of the Brca2 locus. We showed that Brca2^{-/-} rats survive and develop multiple cancers but not breast cancer. The lack of breast cancer was likely due to a Brca2^{-/-} associated lack of ovarian follicular development. We developed two approaches to address this problem using inbred WF rats on which this knockout allele was placed. The first involved trans-planting wild-type ovaries to knockout rats. Brca2^{-/-} rats having wild type ovaries did not develop mammary carcinomas due to regression of the transplanted tissue over time. The alternative strategy was to transplant mammary glands from Brca2^{-/-} rats into wild type rats. Brca2^{-/-} mammary glands did not develop carcinomas when transplanted into wild type recipients. However their morphologic characteristics differed from wild type transplants showing a higher degree of branching and lobularity. As an alternative to these transplant models we induced mammary carcinomas in Brca2^{+/-} and Brca2^{+/+} controls with 7,12-dimethylbenz(a)anthracene (DMBA) and nitrosomethylurea (NMU), but found no differences in tumor multiplicity between the two genotypes. Although we were unable to produce a mammary tumor model the Brca2^{-/-} knockout rat provides a valuable complement to existing mouse models to study the tissue-specific functions of the Brca2 protein.

DTIC

Breast; Cancer; Genes; Mammary Glands; Rats

20070036448 Texas Univ., Galveston, TX USA

The Role of the Sonic Hedgehog Pathway for Prostate Cancer Progression

Xie, Jingwu; Feb 2005; 34 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-04-1-0286

Report No.(s): AD-A471034; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The hedgehog pathway plays a critical role in the development of prostate. However, the role of the hedgehog pathway in prostate cancer is not clear. Here we report that activation of the hedgehog pathway occurs frequently in advanced human prostate cancer. We find that high levels of hedgehog target genes, PTCH1 and hedgehog-interacting protein (HIP), are detected in over 70% of prostate tumors with Gleason scores 8-10, but in only 22% of tumors with Gleason scores 36. Furthermore, four available metastatic tumors all have high expression of PTCH1 and HIP. We find that Su(Fu) protein is undetectable in 11 of 27 PTCH1 positive tumors, two of them contain somatic loss-of function mutations of Su(Fu). Furthermore, expression of sonic hedgehog protein is detected in the majority of PTCH1 positive tumors (24 out of 27). High levels of hedgehog target genes are also detected in three prostate cancer cell lines (DU145, LN-Cap and PC3). We demonstrate that inhibition of hedgehog signaling by smoothed antagonist, cyclopamine, suppresses hedgehog signaling, down-regulates cell invasiveness and induces apoptosis. All these data suggest a significant role of the hedgehog pathway for cellular functions of prostate cancer cells. Our data indicate that activation of the hedgehog pathway, through loss of Su(Fu) or overexpression of sonic hedgehog, may involve tumor progression and metastases of prostate cancer. Thus, targeted inhibition of hedgehog signaling may have significant implications of prostate cancer therapeutics.

DTIC

Cancer; Prostate Gland

20070036454 Cincinnati Univ., OH USA

High Altitude Platforms Mobile Robotic Telesurgery (HAPsMRT)

Broderick, Timothy J; Sep 2006; 18 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-05-2-0080

Report No.(s): AD-A471041; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This document serves as an interim report for the HAPsMRT. A prototype surgical robot from the University of

Washington was deployed in an extreme environment near Simi Valley, CA. The robot controller (master) and robot (slave) were separated by approximately 100 feet. These were connected wirelessly using AeroVironment's Unmanned Airborne Vehicle (UAV). Using this system, University of Cincinnati surgeons were able to manipulate the end effectors. This demonstrated that a surgical robot could be deployed in an extreme environment and controlled by a surgeon who was remotely located from the robot using a wireless communication system (UAV) normally used for military operations.

DTIC

High Altitude; Radiotelephones; Robotics; Robots; Surgery

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*.

20070035194 Wyle Labs., Inc., Houston, TX USA

The Effects of a Palm Cooling Device and a Cooling Vest During Simulated Pilot Heat Stress

Ballidin, Ulf; Whitmore, Jeff; Harrison, Richard; Fisher, Dion; Fischer, Joseph; Stork, Roger; Jan 2007; 26 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): FA8650-04-D-6472; Proj-7757

Report No.(s): AD-A470115; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470115>

A cooling vest (CV) and a Rapid Thermal Exchange (RTX(Registered)) hand cooling device were tested in a thermal chamber simulating aircrew pre-flight walk around at 95 F. Physiologic cooling protection, cognitive performance and mood changes were studied. Twelve male subjects were tested. Rectal and skin temperatures as well as cognitive performance and mood changes were assessed. The chamber was heated to 35 degrees C with a relative humidity of 85% and the subjects walked on a treadmill for 20 min. A period of slow cooling down over 75 minutes followed. The subjects weight was recorded before and after each experiment. Three different conditions were tested: a control without any cooling device, a Rapid Thermal Exchange hand cooling device (RTX(Registered)) and a RFD(Registered) Beaufort Liquid conditioning Vest (CV). The CV provided significant cooling benefit as seen by core temperature, weight loss, heart rate, subjective heat and mood scores, compared to a control condition without any cooling devices. While RTX(Registered) appeared to have some slight benefits compared to control (i.e. mean values tended to fall in between control and cooling vest), there was little statistical evidence (other than weight loss) to support this tendency. The heat stress induced in this study (i.e. simulating aircrew pre-flight walk around) was moderate and not severe as some other operational environments could be (e.g. for flight-line maintenance crew). Therefore, cognition was not impaired by the heat stress generated in this study, and, thus, no observed improvement could be seen from the two cooling conditions.

DTIC

Cooling; Heat Tolerance; Pilots; Vests

20070035821 Organisatie voor Toegepast Natuurwetenschappelijk Onderzoek, Rijswijk, Netherlands

Selection of Protease Inhibitors to Prevent or Attenuate Inflammatory Processes

Wolterink, A. F. W. M.; Kieboom, J.; August 2007; 2 pp.; In English; Original contains color and black and white illustrations

Contract(s)/Grant(s): TNO Proj. 014.17764

Report No.(s): TD2007-0 136; TNO-DV 2007 A272; Copyright; Avail.: Other Sources

Inflammation is a coordinated response aimed at the protection of the host at the onset of infection. In this process, human and bacterial proteases play a critical role. The regulation of human proteases is carried out by pro- and anti-inflammatory signals. Deregulation of human (metallo)peptidases results in many pathological reactions such as microbial invasion or inflammatory tissue damage. Also bacterial proteases can influence the balance between pro- and anti-inflammatory signals and thus cause tissue damage. A disadvantage of selecting a bacterial protease inhibitor is that inflammation caused by other bio-warfare agents like viruses or toxins can not be treated. It would be more appropriate to select human proteases which have a function in the coordinated response aimed at the protection of the host at the onset of an inflammatory response. The kallikrein-kinin system can modulate both the innate and adaptive immunity and could therefore represent a promising approach for the development of novel strategies to treat bacterial infections. Efforts in future research in which the blockade

of kinin receptors only or in combination with other compounds might result in the development of treatment to protect the host at the onset of infection.

Author

Inhibitors; Microorganisms; Protease; Protection; Immune Systems; Immunology; Physiological Defenses

20070035863 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

Prototyping Mid-Infrared Detector Data Processing Algorithms

Ressler, Michael E.; August 17, 2000; 6 pp.; In English; SciPy 2006 Python for Scientific Computing, 17-18 Aug. 2006, Pasadena, CA, USA; Original contains color and black and white illustrations; Copyright; Avail.: Other Sources

ONLINE: <http://hdl.handle.net/2014/40244>

Over the past year, much progress has been accomplished to complete this study. The last data collection segment was completed and all data was analyzed. The data from the Functional Mobility Course were presented at a scientific meeting. The entire study will be presented at the National Student Researcher's Forum in May.

Author

Adaptation; Sensorimotor Performance; Barriers; Rotation; Head Movement

20070035874 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

A Comprehensive Assessment of Biologicals Contained Within Commercial Airliner Cabin Air

LaDuc, Myron T.; Osman, Shariff; Dekas, Anne; Stuecker, Tara; Newcombe, Dave; Piceno, Yvette; Fuhrman, J.; Andersen, Gary; Venkateswaran, Kasthuri; Bearman, Greg; September 13, 2006; 294 pp.; In English; Workshop on Aircraft Cabin Air Quality, 13 Sep. 2006, Washington, DC, USA; Original contains color and black and white illustrations; Copyright;

Avail.: Other Sources

ONLINE: <http://hdl.handle.net/2014/40334>

Both culture-based and culture-independent, biomarker-targeted microbial enumeration and identification technologies were employed to estimate total microbial and viral burden and diversity within the cabin air of commercial airliners. Samples from each of twenty flights spanning three commercial carriers were collected via air-impingement. When the total viable microbial population was estimated by assaying relative concentrations of the universal energy carrier ATP, values ranged from below detection limits (BDL) to 4.1×10^6 cells/cubic m of air. The total viable microbial population was extremely low in both of Airline A (approximately 10% samples) and C (approximately 18% samples) compared to the samples collected aboard flights on Airline A and B (approximately 70% samples). When samples were collected as a function of time over the course of flights, a gradual accumulation of microbes was observed from the time of passenger boarding through mid-flight, followed by a sharp decline in microbial abundance and viability from the initiation of descent through landing. It is concluded in this study that only 10% of the viable microbes of the cabin air were cultivable and suggested a need to employ state-of-the art molecular assay that measures both cultivable and viable-but-non-cultivable microbes. Among the cultivable bacteria, colonies of *Acinetobacter* sp. were by far the most profuse in Phase I, and Gram-positive bacteria of the genera *Staphylococcus* and *Bacillus* were the most abundant during Phase II. The isolation of the human pathogens *Acinetobacter johnsonii*, *A. calcoaceticus*, *Janibacter melonis*, *Microbacterium trichotecenolyticum*, *Massilia timonae*, *Staphylococcus saprophyticus*, *Corynebacterium lipophiloflavum* is concerning, as these bacteria can cause meningitis, septicemia, and a handful of sometimes fatal diseases and infections. Molecular microbial community analyses exhibited presence of the alpha-, beta-, gamma-, and delta- proteobacteria, as well as Gram-positive bacteria, Fusobacteria, Cyanobacteria, Deinococci, Bacterioidetes, Spirochetes, and Planctomyces in varying abundance. *Neisseria meningitidis* rDNA sequences were retrieved in great abundance from Airline A followed by *Streptococcus oralis/mitis* sequences. *Pseudomonas synxantha* sequences dominated Airline B clone libraries, followed by those of *N. meningitidis* and *S. oralis/mitis*. In Phase II, Airline C, sequences representative of more than 113 species, enveloping 12 classes of bacteria, were retrieved. Proteobacterial sequences were retrieved in greatest frequency (58% of all clone sequences), followed in short order by those stemming from Gram-positives bacteria (31% of all clone sequences). As for overall phylogenetic breadth, Gram-positive and alpha-proteobacteria seem to have a higher affinity for international flights, whereas beta- and gamma-proteobacteria are far more common about domestic cabin air parcels in Airline C samples. Ultimately, the majority of microbial species circulating throughout the cabin airs of commercial airliners are commensal, infrequently pathogenic normal flora of the human nasopharynx and respiratory system. Many of these microbes likely originate from the oral and nasal cavities, and lungs of passengers and flight crew and are disseminated unknowingly via routine conversation, coughing, sneezing, and stochastic passing of fomites. The data documented in this study will be useful to generate a baseline microbial population database and can be utilized to develop

biosensor instrumentation for monitoring microbial quality of cabin or urban air.

Derived from text

Aircraft Compartments; Bacteria; Commercial Aircraft; Infectious Diseases; Viruses; Biomarkers; Cabin Atmospheres

20070036088 Army Research Inst. of Environmental Medicine, Natick, MA USA

Trace Mineral Losses in Sweat

Chinevere, Troy D; McClung, James P; Chevront, Samuel N; Jan 2007; 7 pp.; In English

Report No.(s): AD-A470609; USARIEM-M07-08; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470609>

Copper, iron and zinc are nutritionally essential trace minerals that confer vital biological roles including the maintenance of cell structure and integrity, regulation of metabolism, immune function, oxygen transport, and muscle and central nervous system function. Dietary Reference Intakes (DRIs) for these minerals are useful for the general population, but these guidelines may be inadequate for some populations (e.g., soldiers, athletes) who experience copious sweating due to high physical activity levels and/or frequent exposure to extreme environmental conditions. The trace mineral content of sweat may predispose these populations to subclinical/clinical nutritional deficiencies. Studies on sweat trace mineral losses report highly variable results. Much of the variability may be methodological. Non-standardization of collection techniques, collections sites (local versus whole body), and numerous other variables cloud definitive conclusions on sweat trace mineral losses. The objectives of this manuscript are to 1) review the literature on sweat copper, iron and zinc losses, 2) present the potential sources of variability, 3) interpret findings in relation to nutritional needs, and 4) identify directions for future research.

DTIC

Copper; Iron; Losses; Minerals; Perspiration; Sweat; Zinc

54

MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT

Includes human factors engineering, bionics, man-machine systems, life support, space suits and protective clothing. For related information see also *16 Space Transportation and Safety* and *52 Aerospace Medicine*.

20070035484 Army Research Inst. of Environmental Medicine, Natick, MA USA

The Effects of the Personal Armor System for Ground Troops (PASGT) and the Advanced Combat Helmet (ACH) with and without PVS-14 Night Vision Goggles (NVG) on Neck Biomechanics During Dismounted Soldier Movements

LaFiandra, Michael; Harman, Everett; Cornelius, Nancy; Frykman, Peter; Gutekunst, David; Nelson, Gabe; Jul 2007; 40 pp.; In English

Report No.(s): AD-A470312; USARIEM-TR-T07-09; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Kevlar helmets provide the soldier with basic ballistic and impact protection. However, the helmet has recently become a mounting platform for devices such as night-vision goggles, drop down displays, weapon-aiming systems, etc. Although designed to enhance soldier performance, these systems increase the mass of the helmet and typically shift the position of the helmet's center of mass forward. The effects of changing the mass properties of the helmet on head and neck forces and moment on neck muscle activity and fatigue are well documented for aviators and soldiers in vehicles. No research to date has been focused on the effects of helmets of varying mass and mass distribution on head and neck forces and moments during a combat foot soldier's physical activities. Physical demands on the combat foot soldier are substantially different from those on aviator or soldiers in vehicles. Therefore, changing the mass properties of the helmet likely has different effects on combat foot soldiers than on aviators. The study answers the militarily relevant question of what forces and moments on the head and neck are associated with currently used Army helmets and night vision goggles during combat physical activities of the ground soldier.

DTIC

Armor; Biodynamics; Combat; Goggles; Helmets; Military Personnel; Night Vision

20070035501 Army Research Lab., Aberdeen Proving Ground, MD USA

Future Force Warrior: Insights from Air Assault Expeditionary Force Assessment

Turner, Daniel D; Carstens, Christian B; Jul 2007; 152 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): Proj-62716AH70

Report No.(s): AD-A470334; ARL-TR-4191; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Future Force Warrior (FFW) Soldier ensembles were evaluated in 2006. One 9-man squad of infantry Soldiers was

equipped with the Soldier or Leader variation of the FFW system. Each system included the FFW uniform and helmet, body armor chassis, global positioning system tracking receivers, radio communication equipment, a computer system with operating software, and voice-activated controls. In addition, the Leader systems included laser range finding devices and associated software. The ensembles contained a goggle-mounted visual display or a personal digital assistant display. The Soldiers received extensive hands-on training in a variety of tactical contexts, including mission planning, land navigation, laser target designation, ambush, reconnaissance, and defense. Following training, the Soldiers participated in multiple offensive and defensive scenarios. Questionnaires concerning the form, fit, and function of the FFW components were administered after each exercise and at the end of the assessment. The results show that the FFW systems were very well received by the test Soldiers. They strongly preferred the FFW equipment to their baseline gear for virtually every activity. They especially liked the capability to maintain radio contact with squad members, the ease of mission planning and land navigation, the ease of learning and operating the software packages, and the situational awareness afforded by the system. The Soldiers liked the load-carrying capacity and comfort of the body armor chassis. Problems were encountered with some of the system components. The voice-activated controls were difficult to use if the Soldier was breathing heavily, and the controls did not work well for Soldiers who had heavy accents. The goggle-mounted displays seemed to interfere with the use of monocular night vision devices, and there were problems with the mounting system. Soldiers noted several problems with the icon displays. Suggestions were made for improving the system.

DTIC

Armor; Attacking (Assaulting); Personnel; Telecommunication

20070035547 Naval Postgraduate School, Monterey, CA USA

Real-Time Speech Recognition System for Robotic Control Applications Using an Ear-Microphone

Kolioussis, Dimitrios S; Jun 2007; 159 pp.; In English; Original contains color illustrations

Report No.(s): AD-A470422; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This study is part of an ongoing research started in 2004 at the Naval Postgraduate School (NPS) investigating the development of a human-machine interface command-and-control package for controlling robotic units in operational environments. An ear microphone is used to collect the voice-activated commands providing hands-free control instructions in noisy environments [Kurcan, 2006; Bulbulla, 2006]. This study presents the hardware implementation of a theoretical Isolated Word Recognition (IWR) system designed in an earlier study. The recognizer uses a short-term energy and zero-crossing based detection scheme, and a discrete Hidden Markov model recognizer designed to recognize seven isolated words. Mel frequency cepstrum coefficients (MFCC) are used for discriminating features in the recognizer phase. The hardware system implemented uses commercial off-the-shelf (COTS) electronic components, in-ear microphone, is portable and costs under \$50.00. The implemented speech capturing system uses the ear-microphone and the Si3000 Audio Codec to capture and sample speech clearly. The microprocessor processes the detected speech in real-time. The microprocessor's I/O devices work effectively with the audio codec and computer for sampling and training, without communication problems or data loss. The current implementation uses 1.181 msec to process each 15 msec data frame. Resulting recognition performances average around 73.72%.

DTIC

Commercial Off-the-Shelf Products; Ear; Microphones; Real Time Operation; Robotics; Speech Recognition; Telecommunication

20070035904 NASA Ames Research Center, Moffett Field, CA, USA

Automating CapCom Using Mobile Agents and Robotic Assistants

Clancey, William J.; Sierhuis, Maarten; Alena, Richard L.; Graham, Jeffrey S.; Tyree, Kim S.; Hirsh, Robert L.; Garry, W. Brent; Semple, Abigail; Shum, Simon J. Buckingham; Shadbolt, Nigel; Rupert, Shannon M.; October 2007; 48 pp.; In English; 1st Space Exploration Conference, January 2005, Orlando, FL, USA; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 706801.04.16,01,02.02

Report No.(s): NASA/TP-2007-214554; No Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: <http://hdl.handle.net/2060/20070035904>

Mobile Agents (MA) is an advanced Extra-Vehicular Activity (EVA) communications and computing system to increase astronaut self-reliance and safety, reducing dependence on continuous monitoring and advising from mission control on Earth. MA is voice controlled and provides information verbally to the astronauts through programs called 'personal agents.' The system partly automates the role of CapCom in Apollo-including monitoring and managing navigation, scheduling, equipment deployment, telemetry, health tracking, and scientific data collection. Data are stored automatically in a shared database in the

habitat/vehicle and mirrored to a site accessible by a remote science team. The program has been developed iteratively in authentic work contexts, including six years of ethnographic observation of field geology. Analog field experiments in Utah enabled empirically discovering requirements and testing alternative technologies and protocols. We report on the 2004 system configuration, experiments, and results, in which an EVA robotic assistant (ERA) followed geologists approximately 150 m through a winding, narrow canyon. On voice command, the ERA took photographs and panoramas and was directed to serve as a relay on the wireless network.

Author

Computers; Artificial Intelligence; Robotics; Systems Engineering; Astronauts; Geological Surveys; Safety; Protocol (Computers); Data Bases

20070036307 Northrop Grumman Information Technology, Inc., Fairborn, OH USA

Airman Performance Integration (AIRPRINT) Capability Document Analysis

Wnek, Robert; Salyer, Michael; Hettinger, Larry; Vincent, Patrick; Lindberg, Robert; May 2007; 91 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): FA8650-05-D-6633-007

Report No.(s): AD-A470772; XC-311 HSW/PEC; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Over forty capability-based requirements documents were reviewed and analyzed for their consideration of Human Systems Integration (HSI) concerns and the requirements of DoDI 5000.2. A checklist is included as a work aid for establishing human performance requirements for Key Performance Parameters (KPPs) and Key System Attributes (KSAs). There is a high degree of variability among the capability documents with regard to how HSI requirements are written. The results of this study support the need to improve how HSI requirements are addressed in capability documents. There are many ways in which this problem can be addressed, including developing training courses, creating work aids, and adding user profiles to the capability documents.

DTIC

Flight Crews; Human Factors Engineering; Measurement; Personnel; Reliability Analysis; Requirements; Systems Integration; Weapon Systems

20070036374 Air Force Academy, Colorado Springs, CO USA

Advanced Usability Evaluation Methods

Andre, Terence S; Schurig, Margaret; Apr 2007; 20 pp.; In English

Report No.(s): AD-A470915; USAFA-IITA-TR-07-02; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The Behavioral Sciences and Leadership Department at the USA Air Force Academy (USAFA) developed a low-cost human-computer interaction (HCI) laboratory in 2004. Since that time, the lab has grown into a teaching laboratory introducing HCI concepts to cadets in the Behavioral Sciences-Human Factors option as well as cadets in the Systems Engineering-Human Systems concentration. The HCI lab exposed cadets to contemporary methods and tools used in usability evaluation. The purpose of this final report is to document two studies recently conducted in the HCI laboratory. The first study examined the use of eye tracking as an advanced technique in determining the attentional focus of an evaluator watching a recorded usability highlight video. Current usability evaluation recording technology provides the usability practitioner with the capability to record audio, video of the user, and desktop screen activity in a 'picture-in-picture' (PIP) format, allowing the evaluator to observe the interface screen and the human user simultaneously. The research question in the first study focused on how best to present the PIP video that is often displayed along with the desktop screen capture. In the second study, instructors in the Behavioral Sciences and Leadership Department were interested in examining the changes in a student's technique of identifying usability problems while using the HCI laboratory. Practitioners in the usability field have noted that experience contributes to the quality of usability problem reports, especially when that experience includes exposure to a framework for doing usability evaluation. Thirteen students in an undergraduate HCI course participated in this study during the Fall 2006 semester.

DTIC

Human-Computer Interface; Man Machine Systems

20070036718 Ventana Research, Tucson, AZ USA

Lotus LADM Based Self-Decontaminating Surfaces

Lombardi, John L.; Michielsen, Stephen; Connors, Robert; Churchward, Gordon; May 1, 2007; 48 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W911NF-04-C-0081

Report No.(s): AD-A471026; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Recent events have lead to new concerns about biowarfare, bioterrorism, chemical warfare and chemical terrorism. Because of the potential range of agents that could be used, a non-specific decontamination system is desirable. Of particular interest are materials whose surfaces have been modified to be self-decontaminating and self-regenerating. Other beneficial attributes are that the surfaces be self-cleaning and very light weight. We have developed superhydrophobic coating materials. We have also developed Light Activated Decontamination Materials (LADM) that produce singlet oxygen. In addition novel sporicidal compounds were synthesized having thiolate functionality. Our approach simultaneously addresses surface modification, self-cleaning, and sporicide. To form our LADM coatings, a scaffold polymer was bonded to the surface of fibers. Then photo-active agents were grafted to this scaffold polymer. This increased the available photo-active agents >1000 fold. These photo-active agents absorb visible light and transfer the energy to oxygen in the air to generate singlet oxygen, which has been shown to destroy chemical and biological agents. Singlet oxygen was also expected to destroy spores. Self-cleaning surfaces rely on the Lotus effect in which water is suspended upon a hydrophobic surface with air gaps between different segments of the hydrophobic material. The droplet is supported on the raised portions with air gaps below large portions of the droplet. To render the surface superhydrophobic, or self-cleaning, we bonded short fibers to the surface through flocking. By controlling the flocking process, we could control the fiber height and spacing. These two factors have been shown to be important to generating the Lotus effect. This was not be sufficient to render the surface superhydrophobic. However, by modifying the surface further with fluorochemical or long chain alkanes, we were able to convert the surface from hydrophobic to superhydrophobic.

DTIC

Decontamination; Cleaning; Oxygen; Surface Finishing

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*.

20070035975 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

Fault Tolerant State Machines

Burke, Gary R.; Taft, Stephanie; September 8, 2004; 10 pp.; In English; Military and Aerospace Programmable Logic Device (MAPLD), 8 Sep. 2004, Washington, DC, USA; Original contains color illustrations

Report No.(s): D160/MALPD 2004; Copyright; Avail.: Other Sources

ONLINE: <http://hdl.handle.net/2014/40550>

State machines are commonly used to control sequential logic in FPGAs and ASKS. An errant state machine can cause considerable damage to the device it is controlling. For example in space applications, the FPGA might be controlling Pyros, which when fired at the wrong time will cause a mission failure. Even a well designed state machine can be subject to random errors as a result of SEUs from the radiation environment in space. There are various ways to encode the states of a state machine, and the type of encoding makes a large difference in the susceptibility of the state machine to radiation. In this paper we compare 4 methods of state machine encoding and find which method gives the best fault tolerance, as well as determining the resources needed for each method.

Author

Field-Programmable Gate Arrays; Fault Tolerance; Control Systems Design; Sequential Control; Coding; Random Errors

20070035998 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

Optimal Prediction of Clocks from Finite Data

Greenhall, Charles A.; June 24, 2005; 11 pp.; In English; 17th Annual International Conference on Finite Power Series and

Algebraic Combinations, 24 Hyb, 2995, Taormina, Italy; Original contains black and white illustrations; Copyright; Avail.: Other Sources

ONLINE: <http://hdl.handle.net/2014/40527>

This talk is about optimal linear prediction of processes with stationary dth increments, which serve as a class of models for random clock disturbances. The predictor is obtained by orthogonal projection on the affine space of estimators whose errors are invariant to additive polynomials of degree $< d$. The projection conditions give a system of linear equations that can be solved straightforwardly for the regression coefficients. If the data are equally spaced, then the predictor can be obtained by an extension of Levinson's algorithm.

Author

Clocks; Regression Coefficients; Random Processes; Linear Prediction; Polynomials; Linear Equations

20070036022 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

The New CCSDS Image Compression Recommendation

Yeh, Pen-Shu; Armbruster, Philippe; Kiely, Aaron B.; Masschelein, Bart; Moury, Gilles; Schafer, Christoph; March 5, 2004; 6 pp.; In English; IEEE Aerospace Conference, 5-12 Mar. 2005, Big Sky, MT, USA; Original contains color and black and white illustrations; Copyright; Avail.: Other Sources

ONLINE: <http://hdl.handle.net/2014/40554>

The Consultative Committee for Space Data Systems (CCSDS) data compression working group has recently adopted a recommendation for image data compression, with a final release expected in 2005. The algorithm adopted in the recommendation consists of a two dimensional discrete wavelet transform of the image, followed by progressive bit-plane coding of the transformed data. The algorithm can provide both lossless and lossy compression, and allows a user to directly control the compressed data volume or the fidelity with which the wavelet-transformed data can be reconstructed. The algorithm is suitable for both frame-based image data and scan-based sensor data, and has applications for near-earth and deep-space missions. The standard will be accompanied by free software sources on a future web site. An ASIC implementation of the compressor is currently under development. This paper describes the compression algorithm along with the requirements that drove the selection of the algorithm.

Author

Data Compression; Data Systems; Aerospace Systems; Coding; Image Processing; Deep Space

20070036759 American Inst. of Aeronautics and Astronautics, Reston, VA, USA

Mathematica 6: A new revolution?

Binder, John D.; Aerospace America; July 2007; ISSN 0740-722X, pp. 24-26; In English; Original contains black and white illustrations; Copyright; Avail.: Other Sources

In early May of 2007 the release of Mathematica 6 was announced. This release, according to the company, takes technical computing to a new level: more tightly bound, more natural, and more automated, applicable to a far wider range of areas than ever before. Central to this achievement is instant interactivity, taking models, simulations, computations, or just about any concepts and turning them into fully interactive applications, sometimes within seconds. Some of these new capabilities are: dynamic interactivity, unification of graphics, computational aesthetics, symbolic interface construction, and load on demand curated data.

Derived from text

Mathematics; Computer Programs

20070036789 American Inst. of Aeronautics and Astronautics, Reston, VA, USA

GEOSS: A Global View

Iannotta, Ben; Aerospace America; August 2007; ISSN 0740-722X; Volume 45, No. 8, pp. 38-40; In English; Original contains black and white illustrations; Copyright; Avail.: Other Sources

The use of satellite-borne sensors to study the Earth is forecasted to grow. The driving force is concern over global warming, and other environmental concerns. A new international organization called the Group on Earth Observations (GEO) is developing a system, Global Earth Observation System of Systems (GEOSS) to coordinate the massive amounts of data derived from the 30 or so Earth Observing Satellites operated by the USA, Europe, Japan, Brazil and private businesses, and other data sources (i.e., weather balloons, ocean buoys, and aircraft).

CASI

Earth Observations (From Space); Remote Sensing; Information Dissemination; Systems Integration; Systems Engineering

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*.

20070035541 Northwestern Univ., Evanston, IL USA

Machine Reading as a Cognitive Science Research Instrument

Forbus, Kenneth D; Lockwood, Kate; Tomai, Emmett; Dehghani, Morteza; Czyz, Jakub; Jan 2007; 7 pp.; In English
Report No.(s): AD-A470412; No Copyright; Avail.: Defense Technical Information Center (DTIC)

We describe how we are using natural language techniques to develop systems that can automatically encode a range of input materials for cognitive simulations. We start by summarizing this type of problem, and the components we are using. We then describe three projects that are using this common infrastructure: learning from multimodal materials, modeling decision making in moral dilemmas, and modeling conceptual change in development.

DTIC

Cognition; Readers; Reading

20070035542 Northwestern Univ., Evanston, IL USA

A Prototype System that Learns by Reading Simplified Texts

Forbus, Kenneth D; Riesbeck, Christopher; Birnbaum, Lawrence; Livingston, Kevin; Sharma, Abhishek; Ureel, Leo; Jan 2007; 7 pp.; In English

Report No.(s): AD-A470413; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Systems that could learn by reading would radically change the economics of building large knowledge bases. This paper describes Learning Reader, a prototype system that extends its knowledge base by reading. Learning Reader consists of three components. The Reader, which converts text into formally represented cases, uses a Direct Memory Access Parser operating over a large knowledge base, derived from ResearchCyc. The Q/A system, which provides a means of quizzing the system on what it has learned, uses focused sets of axioms automatically extracted from the knowledge base for tractability. The Ruminator, which attempts to improve the system's understanding of what it has read by off-line processing, generates questions for itself by several means, including analogies with prior material and automatically constructed generalizations from examples in the KB and its prior reading. We discuss the architecture of the system, how each component works, and some experimental results.

DTIC

Prototypes; Readers; Reading; Texts

20070035601 Princeton Satellite Systems, Falls Church, VA USA

ObjectAgent for Robust Autonomous Control

Surka, Derek M; Jan 2001; 6 pp.; In English

Contract(s)/Grant(s): F29601-00-C-0025; F29601-99-C-0029

Report No.(s): AD-A470519; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The ObjectAgent system is being developed to create a robust software architecture for autonomous control of complex systems. Agents are used to implement all of the software functionality and communicate through simplified natural language messages. These agents have a set of basic survival skills that monitor for internal software faults, providing low-level fault detection and recovery. Higherlevel fault detection and recovery capabilities, including modern artificial intelligence techniques, can easily be incorporated into an ObjectAgent-based system.

DTIC

Architecture (Computers); Artificial Intelligence; Automatic Control; Autonomy

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.

20070035128 Boeing Co., Saint Louis, MO, USA

Autocoding for Verifiability

Smith, Tim; Santhanam, Vdot; February 06, 2006; 19 pp.; In English; Boeing Software Conference, 6-7 Feb. 2006, Long Beach, CA, USA; Original contains color illustrations

Contract(s)/Grant(s): NAS4-0041; No Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: <http://hdl.handle.net/2060/20070035128>

A viewgraph presentation of an automatic code scheme for source verification issues is shown. The topics include: 1) Model-Based Control Law Development with Automatic Code Generation; 2) Source Verification Issues of Automatically Generated Code; 3) MXZ Code Generator; 4) Benefits and Limitations of MXZ; and 5) Current State of the Tool.

CASI

Program Verification (Computers); Automatic Control; Coding; Software Engineering; Control Systems Design; Flight Control

20070035150 Naval Postgraduate School, Monterey, CA USA

An OSKit-Based Implementation of Least Privilege Separation Kernel Memory Partitioning

Carter, Donald W; Jun 2007; 101 pp.; In English; Original contains color illustrations

Report No.(s): AD-A470041; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470041>

In an environment with valuable information assets, the threat of subversion is real. Thus, systems must be built from the ground up to counter the level of sophistication and capital that is pitted against them. To build such systems, rigorous assurance criteria must be met. Currently for high assurance systems there is no publicly available example of their design and construction. The Trusted Computing Exemplar (TCX) Project is intended to make publicly available a high assurance component and its evaluation evidence. This work is to build a working prototype of selected TCX kernel functionality. The prototype is constructed and based on OSKit, and restricts information flow between memory partitions and resource accesses made by processes. Pages are statically allocated on a per-partition basis and page faults are handled by the kernel. The prototype demonstrates a least privilege-based approach to exported resource management. It uses a separation kernel with preloaded configuration data to allocate memory resources to processes.

DTIC

Kernel Functions; Security

20070035167 Oasis Systems, Inc., Lexington, MA USA

Embedded Statistical Profiling

Corley, Michael; May 2007; 17 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): FA8750-05-C-0022; Proj-4519

Report No.(s): AD-A470076; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470076>

Embedded Statistical Profiling is an initiative to support both offensive and defensive computer network applications. The basis for the effort comprises the development of an environment framework known as Simplified Protocol Capture (SIMPCAP). The environment comprises a collection of tools manifested from SIMPCAP including a SQLite based packet querying engine, virtual file abstraction for seamless multi-file processing, and a complete packet capture / decoding Application Programming Interface (API). Together, these tools automatically integrate with existing LIBPCAP based tools, resulting in a highly tunable and robust environment for 1st level and 2nd level forensic analysts working in network centric operations.

DTIC

Application Programming Interface; Decoding; Embedding

20070035182 Naval Postgraduate School, Monterey, CA USA

Testing Automation Tools for Secure Software Development

Eatinger, Christopher; Jun 2007; 81 pp.; In English; Original contains color illustrations

Report No.(s): AD-A470101; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470101>

Software testing is a crucial step in the development of any software system, large or small. Testing can reveal the presence of logic errors and other flaws in the code that could cripple the system's effectiveness. Many flaws common in software today can also be exploited to breach the security of the system on which the software is running. These flaws can be subtle and difficult to find. Frequently it takes a combination of multiple events to bring them out. Traditional testing techniques focus on dealing with errors as they arise during normal operation of the system. This technique is not particularly effective. Thus, recent research has focused on developing new, more effective software testing techniques. Two such techniques are combinatorial testing and fuzz testing. This thesis explores the effectiveness of combining both combinatorial testing and fuzz testing into a single software testing tool to aid in the discovery of subtle system flaws. The tools developed for testing automation by this thesis will aid in the development of secure software, and bolster the ranks of testing techniques available to future developers.

DTIC

Computer Programming; Software Engineering

20070035192 Naval Postgraduate School, Monterey, CA USA

A Dynamic Three-Dimensional Network Visualization Program for Integration into CyberCIEGE and Other Network Visualization Scenarios

Sledz, Daniel A; Coomes, Donald E; Jun 2007; 135 pp.; In English; Original contains color illustrations

Report No.(s): AD-A470113; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470113>

Detailed information and intellectual understanding of a network's topology and vulnerabilities is invaluable to better securing computer networks. Network protocol analyzers and intrusion detection systems can provide this additional information. In particular, game-based trainers, such as CyberCIEGE, have been shown to improve the level of training and understanding of network security professionals. This thesis' objective is to enhance these applications by developing NTAV3D, or, Network Topology and Attack Visualizer (Three Dimensional). NTAV3D is a tool that displays network topology, vulnerabilities, and attacks in an interactive, three-dimensional environment. This augments the design and game play of CyberCIEGE by increasing game player interaction and data display. Additionally, NTAV3D can be expanded to provide this capability to network analysis and intrusion detection tools. Furthermore, NTAV3D expands on ideas and results from related work of the best ways to visualize network topology, vulnerabilities, and attacks. NTAV3D was created using open-source software technologies including Xj3D, X3D, Java, and XML. It is also one of the first applications to be built with only the Xj3D toolkit. Therefore, the development process allowed evaluation of these technologies, resulting in recommendations for future improvements.

DTIC

Education; Game Theory; Security; Topology; Vulnerability

20070035193 Army Construction Engineering Research Lab., Champaign, IL USA

ERDC-CERL LD-870 Download Program: Programming Manual

Niemoeller, Ben; Nykaza, Edward T; May 2007; 135 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): MIPR-6FXXR3A563

Report No.(s): AD-A470114; ERDC/CERL-SR-07-7; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470114>

The U.S. Army Engineer Research and Development Center Construction Engineering Research Laboratory has developed software that interfaces with an array of Larson-Davis Model 870 Environmental Noise Monitors for Aberdeen Test Center. This document explains logic and procedures used while programming the software that are of interest to a programmer looking to modify or expand the functionality of the program. The following topic areas are covered: terminology, time synchronization, and scheduling events. This document will be of interest to those who wish to modify the L-D Download software program. The code, which was written with Microsoft Visual Studio 2005, is included in the appendices.

DTIC

Computer Programming; Data Management; Manuals; Software Development Tools

20070035195 Toledo Univ., OH USA

Aperture and Receiver Technology. Delivery Order 0002: Bandwidth Invariant Spatial Processing. Volume 2. Digital Signal Processor (DSP) Based Implementation of Direction of Arrival (DOA) for Wideband Sources

Affo, Abdel; May 2007; 103 pp.; In English

Contract(s)/Grant(s): FA8650-05-D-1848-0002; Proj-7622

Report No.(s): AD-A470116; UT-EECS-DSPH-11; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470116>

Sensor arrays are used in many digital signal processing applications due to their ability to locate signal sources. For most of these applications, it is necessary to estimate the Direction of Arrival (DOA) of the sources. Numerous algorithms have been developed, but most of them focus on narrowband signals where the time delay can be approximated as a phase shift. This thesis focuses on the coherent signal subspace method for DOA estimation of wideband sources. However, the coherent signal subspace method has high computational requirements that prevented its use in many real-time applications. With the growth in technology, it's now possible to implement these algorithms in real-time embedded systems. These array signal processing algorithms can be implemented in hardware using Digital Signal Processors (DSP), Field Programmable Gate Arrays (FPGA), and Application-Specific Integrated Circuits (ASIC). DSPs offer flexibility and also the best development time and cost with proper use of high-level programming. In this thesis, we propose a DSP based architecture for detecting and estimating the DOA of wideband sources. Also, a parallelized algorithm is presented and its performance is evaluated with respect to the original architecture.

DTIC

Algorithms; Apertures; Architecture (Computers); Bandwidth; Broadband; Digital Systems; Receivers; Signal Analyzers; Signal Processing

20070035230 University of Central Florida, Orlando, FL USA

The Effects of Collaborative Technologies on Individual and Team Performance in a Network Centric Warfare (NCW) Environment

Guthrie, Joseph W; Rosen, Michael A; Salas, Eduardo; Nelson, W T; Bolia, Robert S; Feb 2007; 50 pp.; In English

Contract(s)/Grant(s): FA8650-05-C-6650; Proj-7184

Report No.(s): AD-A470167; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470167>

Organizations believe that teams are the answer to many of their problems and are implementing them more readily into their daily business practices. The ubiquitous nature of teams in organizations and the current organizational trend of focusing on a more global marketplace have changed the ways in which teams collaborate. In the public and private business sector, organizations foster global partnerships that require employees from different parts of the world to work together to develop new ideas, solve problems, and make decisions. In order to ensure that these teams continue to perform at a high level and produce desired outcomes, researchers must better understand how teams operate in collaborative environments.

DTIC

Decision Making; Human Performance; Teams; Warfare

20070035451 Air Force Research Lab., Rome, NY USA

Tools for Effects Based Course of Action Development and Assessment

Caroli, Joseph; Fayette, Daniel; Koziarz, Nancy; Stedman, Terrance; Jun 2004; 39 pp.; In English; Original contains color illustrations

Report No.(s): AD-A466210; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Software tools are now available to assist the Air and Space Operations Center (AOC) with effects based Course of Action (COA) development, analysis, comparison and selection. In 2001, the Information Directorate of the Air Force Research Laboratory (AFRL) initiated an advanced technology demonstration program in the area of effects based operations. The program set out to develop new concepts and a software toolset to meet the AOC requirement for effects based targeting and campaign assessment. At the core of the toolset are the Strategy Development Tool (SDT) and Causal Analysis Tool (CAT). The Strategy Development Tool guides the user through the development of effects based COAs. During the initial planning phase, the Causal Analysis Tool predicts the probability of achieving commander's intent for the effects based COAs. During execution, the Causal Analysis Tool acts as a campaign assessment tool by incorporating accrued evidence provided by a multi-intelligence fusion component. An attrition-based campaign level wargaming tool was also developed to supplement COA analysis. The goal is to transition the software tools to AOC strategists to help them achieve an effects based approach.

to the COA development process described in Joint Publication 3-30, Command and Control for Joint Air Operations. Though focused on air operations, the tools can be used at the Joint Force Command level as well.

DTIC

Command and Control; Computer Programs; Software Development Tools

20070035469 Library of Congress, Washington, DC USA

Critical Infrastructure: The National Asset Database

Moteff, John; Jul 16, 2007; 20 pp.; In English

Report No.(s): AD-A470289; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The Office of Infrastructure Protection (OIP) in the Department of Homeland Security (DHS) has been developing and maintaining a National Asset Database. The Database contains information on over 77,000 individual assets, ranging from dams, hazardous materials sites, and nuclear power plants to local festivals, petting zoos, and sporting good stores. The presence of a large number of entries of the latter type (i.e. assets generally perceived as having more local importance than national importance) has attracted much criticism from the press and from Members of Congress. Many critics of the Database have assumed that it is (or should be) DHS's list of the nation's most critical assets and are concerned that, in its current form, it is being used inappropriately as the basis upon which federal resources, including infrastructure protection grants, are allocated.

DTIC

Data Bases; Security

20070035473 Army Research Lab., Aberdeen Proving Ground, MD USA

Human Factors Experimental Design and Analysis Reference

Willages, Robert C; Jul 2007; 1129 pp.; In English; Original contains color illustrations

Report No.(s): AD-A470297; ARL-RP-0186; No Copyright; Avail.: Defense Technical Information Center (DTIC)

CADRE (computer-aided design reference for experiments) is a desktop computer tool for human factors and ergonomic researchers. The tool is in Acrobat format for cross-platform computer use and has more than 500 bookmarks for information search. This tool provides more than 850 Power-Point note pages of applied experimental design and analysis reference material. The reference material covers 25 topics and is divided into five major sections including introduction to experimental design, supplemental data collection design and analysis, basic analysis of variance (ANOVA) designs, advanced ANOVA designs, and empirical model building. References to the scientific literature are provided in each topic for supplemental reading. The CADRE tool also provides more than 200 pages explaining 40 examples of statistical analyses covered by the reference material. These examples are hyperlinked to Version 9.1.3 of the SAS(3) (2004) statistical analysis software, and the sample SAS programs can be easily modified for user-specific data.

DTIC

Computer Aided Design; Design Analysis; Experiment Design; Human Factors Engineering

20070035488 Clemson Univ., SC USA

Critical Thinking Traits of Top-Tier Experts and Implications for Computer Science Education

Bushey, Dean E; Aug 2007; 139 pp.; In English; Original contains color illustrations

Report No.(s): AD-A470319; No Copyright; Avail.: Defense Technical Information Center (DTIC)

A documented shortage of technical leadership and top-tier performers in computer science jeopardizes the technological edge, security, and economic well-being of the nation. The 2005 President's Information and Technology Advisory Committee (PITAC) Report on competitiveness in the computational sciences highlights the major impact of science, technology, and innovation in keeping America competitive in the global marketplace. It stresses that the supply of science, technology, and engineering experts is at the core of America's technological edge, national competitiveness, and security. However, recent data show that both undergraduate and postgraduate production of computer scientists is falling. The decline is 'a quiet crisis building in the USA,' a crisis that, if allowed to continue unchecked, could endanger America's well-being and preeminence among the world's nations. Past research on expert performance has shown that the cognitive traits of critical thinking, creativity, and problem solving possessed by top-tier performers can be identified, observed, and measured. Companies have begun to realize that cognitive skills are important for high-level performance and are reevaluating the traditional academic standards they have used to predict success for their top-tier performers in computer science. Previous research in the computer science field has focused either on the programming skills of its experts or has attempted to predict the academic success of students at the undergraduate level. This study examines the critical-thinking skills found among experts in the

computer science field and asks the following questions: ‘What cognitive skills do outstanding performers possess that make them successful?’ and ‘How do currently used measures of academic performance correlate to critical-thinking skills among students?’

DTIC

Cognition; Creativity; Education; Personnel; Problem Solving

20070035498 Lockheed Martin Advanced Technology Labs., Cherry Hill, NJ USA

Automated Spectrum Plan Advisor for On-The-Move Networks

Heisey, William; Kline, William; Zebrowitz, Harris; Poe, Randy; Sharma, Shanti; Cortese, Andrew; Hoque, Mahbub; Loso, Francis; Levy, Yoram; Oct 2006; 6 pp.; In English

Report No.(s): AD-A470331; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Warfighters today face new challenges in accessing the electromagnetic spectrum. These challenges are due to the significant growth in spectrum demands for deployed spectrum dependent systems, increased demand for information and advanced C2 concepts associated with net-centricity and increased competition for spectrum resources from commercial and civil interests. This adds up to near complete spectrum saturation in areas of potential DoD deployment. In addition, the rapid pace of future Net Centric Warfare requires spectrum plans for mission specific demands to be reduced from weeks/days to hours/minutes. The Coalition Joint Spectrum Management Planning Tool ‘CJSMPT’ Program is developing a system for assessing and planning at-the-halt ‘ATH’ and on-the-move ‘OTM’ spectrum use that will give warfighters the ability to rapidly predict conflicts and optimize spectrum utilization for mission success. This paper will describe the technical details of the CJSMPT system and its architecture. Details of the CJSMPT automated spectrum de-confliction algorithms will also be presented. Finally, this paper will discuss the current project status and the current transition plan into military operations.

DTIC

Command and Control; Electromagnetic Spectra; Spectra

20070035536 Duke Univ., Durham, NC USA

Redundancy Analysis and a Distributed Self-Organization Protocol for Fault-Tolerant Wireless Sensor Networks

Zou, Yi; Chakrabarty, Krishnendu; Jul 2007; 31 pp.; In English

Contract(s)/Grant(s): DAAD19-01-1-0504

Report No.(s): AD-A470400; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Sensor nodes in a distributed sensor network can fail due to a variety of reasons, e.g., harsh environmental conditions, sabotage, battery failure, and component wear-out. Since many wireless sensor networks are intended to operate in an unattended manner after deployment, failing nodes cannot be replaced or repaired during field operation. Therefore, by designing the network to be fault-tolerant, we can ensure that a wireless sensor network can perform its surveillance and tracking tasks even when some nodes in the network fail. In this paper, we describe a fault-tolerant self organization scheme that designates a set of backup nodes to replace failed nodes and maintain a backbone for coverage and communication. The proposed scheme does not require a centralized server for monitoring node failures and for designating backup nodes to replace failed nodes. It operates in a fully distributed manner and it requires only localized communication. This scheme has been implemented on top of an energy-efficient self-organization technique for sensor networks. The proposed fault-tolerance-node selection procedure can tolerate a large number of node failures using only localized communication, without losing either sensing coverage or communication connectivity.

DTIC

Fault Tolerance; Protocol (Computers); Radiotelephones; Redundancy; Self Organizing Systems

20070035540 Naval Postgraduate School, Monterey, CA USA

Multistage Security Mechanism For Hybrid, Large-Scale Wireless Sensor Networks

Katsis, Grigorios; Jun 2007; 80 pp.; In English; Original contains color illustrations

Report No.(s): AD-A470410; No Copyright; Avail.: Defense Technical Information Center (DTIC)

A wide area network consisting of ballistic missile defense satellites and terrestrial nodes can be viewed as a hybrid, large-scale mobile wireless sensor network. Building on research in the areas of the wireless sensor networks (WSN) and the mobile ad hoc networks (MANET), this thesis proposes an efficient multistage security mechanism for node and data authentication and data confidentiality. Node authentication is provided by digital signatures and the public key infrastructure (PKI). The TESLA algorithm and IPSec are utilized for data authentication and confidentiality, respectively. Performance analysis and simulation results demonstrate that the proposed mechanism meets the real-time data dissemination requirements

of a ballistic missile defense system while maintaining throughput commensurate with unencrypted Internet Protocol (IP).
DTIC

Hybrid Computers; Radiotelephones; Security

20070035556 Carnegie-Mellon Univ., Pittsburgh, PA USA

Accelerating the Adoption of Improved Acquisition Practices using Acquisition Pilots

Gallagher, Brian; Jan 2004; 16 pp.; In English

Report No.(s): AD-A470436; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The purpose of these briefing charts is to accelerate the create-apply-amplify lifecycle of SEI (Software Engineering Institute) practices within DoD acquisition programs; To conduct experiments with maturing SEI products and services in real-world acquirer contexts; To analyze the results and document the lessons learned; Lessons learned from these experiments will be widely disseminated through case studies, course modules, workshop content, SEI publications, DoD and professional society conferences, and technical literature.

DTIC

Acquisition; Computer Programming; Procedures; Software Engineering

20070035562 Carnegie-Mellon Univ., Pittsburgh, PA USA

CMMI: The DOD Perspective

Barbour, Rick; Oct 2006; 22 pp.; In English

Report No.(s): AD-A470443; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Computers and software have permeated every aspect of the military. The Department of Defense (DoD) faces an ever-increasing demand on systems and software engineering to solve the complexities of an interconnected battlespace. Capability Maturation Model(R) Integration (CMMI) is a process improvement approach that help organizations to integrate disparate functions and legacy systems. Many DoD contractors advertise high levels of process capability or organizational maturity as measured by either the Continuous or Staged representations of Capability Maturity Model Integration, yet from the perspective of acquisition program managers on some high visibility individual programs, strong systems engineering and project management practices still appear to be lacking. This briefing looks at the issues plaguing DoD's attempts at smooth integration and how CMMI version 1.2 had act as part of the solution.

DTIC

Computer Programming; Software Engineering; Systems Engineering

20070035574 Carnegie-Mellon Univ., Pittsburgh, PA USA

A Process-Oriented (Practical) Approach to Program Office Systems Engineering Management Using the CMMI-AM as a Guide

Schenker, Fred; Morrow, Tim; Gagliardi, Mike; Van Wie, Mike; Gomes, Mike; Miller, John; Jan 2005; 41 pp.; In English

Report No.(s): AD-A470472; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The following topics were addressed at this conference: Process Improvement in the Program Office; Program Office Systems Engineering activities; MMA Program Context; Program Office Documentation Hierarchy, Program Office System Engineering Planning, How did we integrate processes with the SEMP, OSD Guidance and Lessons Learned.

DTIC

Computer Programming; Project Management; Software Engineering; Systems Engineering

20070035581 Carnegie-Mellon Univ., Pittsburgh, PA USA

Introducing the CERT (Trademark) Resiliency Engineering Framework: Improving the Security and Sustainability Processes

Caralli, Richard A; Stevens, James F; Wallen, Charles M; White, David W; Wilson, William R; Young, Lisa R; May 2007; 142 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): FA8721-05-C-0003

Report No.(s): AD-A470489; CMU/SEI-2006-TR-009; No Copyright; Avail.: Defense Technical Information Center (DTIC)

As security issues dominate news headlines and affect our daily lives, organizations need to improve their ability to protect and sustain their business-critical assets -- people, information, technology, and facilities -- using human and financial resources efficiently and effectively. Traditional activities such as security and business continuity must not only be effective

at achieving these goals but also must offer the organization increased capabilities for managing and controlling operational resiliency. Unfortunately, organizations often manage these activities in a reactive posture fraught with stove-piped organizational structures and poorly defined and measured goals. The result: potentially less-than-adequate operational resiliency to support business objectives. But organizations can vastly improve operational resiliency by viewing it as an engineering-based process that can be defined, managed, measured, and improved. This view ensures collaboration between security and business continuity activities toward common goals and considers the role of supporting activities such as governance, asset and risk management, and financial control. This report introduces the CERT Resiliency Engineering Framework as a foundational model that describes the essential processes for managing operational resiliency, provides a structure from which an organization can begin process improvement of its security and business continuity efforts, and catalyzes the formation of a community from which further definition of this emerging discipline can evolve.

DTIC

Commerce; Computer Programming; Organizations; Resilience; Risk; Security; Software Engineering

20070035582 Georgia Inst. of Tech., Atlanta, GA USA

PRIVACYGRID: Supporting Anonymous Location Queries in Mobile Environments

Bamba, Bhuvan; Liu, Ling; Jan 2007; 17 pp.; In English

Report No.(s): AD-A470490; GIT-CERCS-07-17; No Copyright; Avail.: Defense Technical Information Center (DTIC)

We present PRIVACYGRID - a framework for supporting anonymous location-based queries in mobile information delivery systems. The PRIVACYGRID framework offers three unique capabilities. First, we provide a location privacy preference profile model, called location P3P, which allows mobile users to explicitly define their preferred location privacy requirements in terms of both location hiding measures 'e.g., location k-anonymity and location l-diversity' and location service quality measures 'e.g., maximum spatial resolution and maximum temporal resolution'. Second, we develop three fast and effective location cloaking algorithms for providing location k-anonymity and location l-diversity in a mobile environment. The Quad Grid cloaking algorithm is fast but has lower anonymization success rate. The dynamic bottom-up or top-down grid cloaking algorithms provide much higher anonymization success rate and yet are efficient in terms of both time complexity and maintenance cost. Finally, we discuss a hybrid approach that combines the top-down and bottom-up search of location cloaking regions to further lower the average anonymization time. In addition, we argue for incorporating temporal cloaking into the location cloaking process to further increase the success rate of location anonymization. We also discuss the PRIVACYGRID mechanisms for anonymous support of range queries. Our experimental evaluation shows that the PRIVACYGRID approach can provide optimal location anonymity as defined by per user location P3P without introducing significant performance penalties.

DTIC

Position (Location)

20070035584 Mitre Corp., Bedford, MA USA

Analysis of a Measured Launch

Millen, Jon; Guttman, Joshua; Ramsdell, John; Sheehy, Justin; Sniffen, Brian; Jun 5, 2007; 14 pp.; In English

Contract(s)/Grant(s): W15P7T-07-C-F600

Report No.(s): AD-A470495; MITRE-07-0843; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The design of a trusted system based on the Trusted Computing Group's Trusted Platform Module (TPM) was analyzed to understand the role and trust relationships of the TPM, firmware, and software modules involved. The objective was to confirm that the measurements stored and reported by the TPM can successfully discriminate a normal boot sequence, which leaves trusted system software in control, from an insecure one, where some trusted modules might have been replaced by malicious ones. The principal tool used in the analysis was the SMV symbolic model checker.

DTIC

Computer Information Security; Computers; Launching; Logic Design

20070035588 Carnegie-Mellon Univ., Pittsburgh, PA USA

Results of SEI Independent Research and Development Projects

Alberts, Christopher J; Anderson, Bill; Bass, Len; Bass, Matthew; Boxer, Philip; Brownsword, Lisa; Chaki, Sagar; Feiler, Peter H; Fisher, Dave; Forrester, Eileen C; Jul 2007; 80 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): FA8721-05-C-0003

Report No.(s): AD-A470503; CMU/SEI-2007-TR-006; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Each year, the Software Engineering Institute (SEI) undertakes several independent research and development (IRAD)

projects. These projects serve to (1) support feasibility studies investigating whether further work by the SEI would be of potential benefit, and (2) support further exploratory work to determine whether there is sufficient value in eventually funding the feasibility study work as an SEI initiative. Projects are chosen based on their potential to mature and/or transition software engineering practices, develop information that will help in deciding whether further work is worth funding, and set new directions for SEI work. This report describes the IRAD projects that were conducted during fiscal year 2006 (October 2005 through September 2006).

DTIC

Computer Programming; Military Technology; Research; Research and Development; Software Engineering

20070035596 CACI Technologies, Inc., Rome, NY USA

High Productivity Computing Systems and Competitiveness Initiative

Tichenor, Suzy; Jul 2007; 306 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): F30602-00-D-0221-0025; DARPA ORDER-Q455; Proj-Q455

Report No.(s): AD-A470513; No Copyright; Avail.: Defense Technical Information Center (DTIC)

In the face of increasing competition from other market economies, the US needs to ramp up its ability to innovate and High Performance Computing (HPC) must be a key ingredient in America's innovation capacity. The task ahead therefore must include broadening the use of HPC in US industry through collaborations in which more knowledgeable HPC users especially leading government users share their expertise and advanced computing resources with less-experienced and inexperienced private sector companies. We must move beyond today's 'islands of innovation' by making access to HPC much easier and more pervasive. Leveraging these world-class assets to their fullest is critical if we are going to successfully harness America's innovation capacity to drive future economic growth and industrial leadership. In today's high competitive global economy, the country that wants to outcompete must be able to out-compute. This report summarizes an initiative whose objective was to attempt to assure a path for realizing dual-use applications for next generation high performance computing.

DTIC

Competition; Computers; Industries; Information Systems; Productivity; United States

20070035598 Rose-Hulman Inst. of Tech., Terre Haute, IN USA

Evolutionary Computation in Polymorphous Computing Architectures: Metaoptimization of the Scale In-Lining Priority Function for Trips

Merkle, Lawrence D; Jul 2007; 28 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): FA8750-05-1-0019; Proj-NBGQ

Report No.(s): AD-A470516; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Leading polymorphous computing architecture (PCA) efforts include the Raw Architecture Workstation (RAW) and the Tera-op Reliable and Intelligently Adaptive Processing System (TRIPS), both of which are tile-based. The Raw toolchain places responsibility for program decomposition on the programmer but the TRIPS toolchain automatically generates hyperblocks and allocates them to processing elements. This report identifies evolutionary computation (EC) techniques that enable and that are enabled by PCA technology, focusing on application of EC in enhancing the effectiveness of the TRIPS toolchain, including the Scalable Compiler for Analytic Experiments (SCALE) compiler. In particular, computational experiments are described that investigate the application of genetic programming to the meta-optimization of the priority function used to increase the number of instructions per hyperblock in the in-lining optimization phase of SCALE.

DTIC

Architecture (Computers); Computation; Computer Programming; Linings; Polymorphism; Priorities

20070035604 Rice Univ., Houston, TX USA

Requirements for Data-Parallel Programming Environments

Adve, Vikram; Carle, Alan; Granston, Elana; Hiranandani, Seema; Kennedy, Ken; Koelbel, Charles; Kremer, Ulrich; Mellor-Crummey, John; Warren, Scott; Tseng, Chau-Wen; Apr 22, 1994; 25 pp.; In English

Contract(s)/Grant(s): DABT63-92-C-0038; CCR-9120008

Report No.(s): AD-A470524; CRPC-TR94378-S; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Over the past decade, research in programming systems to support scalable parallel computation has sought ways to provide an efficient machine-independent programming model. Initial efforts concentrated on automatic detection of parallelism using extensions to compiler technology developed for automatic vectorization. Many advanced techniques were tried. However, after over a half-decade of research, most investigators were ready to admit that fully automatic techniques

would be insufficient by themselves to support general parallel programming, even in the limited domain of scientific computation. In other words, in an effective parallel programming system, the programmer would have to provide additional information to help the system parallelize applications. This realization led the research community to consider extensions to existing programming languages, such as Fortran and C, that could be used to help specify parallelism. An important strategy for exploiting scalable parallelism is the use of data parallelism, in which the problem domain is subdivided into regions and each region is mapped onto a different processor. These factors have led to a widespread interest in data-parallel languages such as Fortran D, High Performance Fortran (HPF), and DataParallel C as a means of writing portable parallel software. To help the programmer make good design decisions, the programming system should include mechanisms that explain the behavior of object code in terms of the source program from which it was compiled. For sequential programs, the standard 'symbolic debugger,' supporting single-step execution of the program source rather than the object program, provides such a facility. A more recent example is the 'interactive vectorizer.' The goal of this paper is to convey an understanding of the tools and strategies that will be needed to adequately support efficient, machine-independent, data-parallel programming.

DTIC

Compilers; FORTRAN; Languages; Object-Oriented Programming; Parallel Processing (Computers); Parallel Programming; Programming Environments

20070035607 Tulsa Univ., OK USA

Identifying Evolvability for Integration

Davis, L; Gamble, Rose; Jan 2002; 12 pp.; In English

Contract(s)/Grant(s): F49620-98-1-0217; CCR-9988320

Report No.(s): AD-A470531; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The seamless integration of commercial-off-the-shelf (COTS) components offers many benefits associated with reuse. Even with successful composite applications, unexpected interoperability conflicts can arise when COTS products are upgraded, new components are needed, and the application requirements change. Recent approaches to integration follow pattern-based design principles to construct integration architecture for the composite application. This integration architecture provides a design perspective within the application environment. However, little attention has been paid to the evolvability of these architectures and their embedded functionality. In this paper, the authors discuss the need for design traceability based on the history of interoperability conflicts and resolution decisions that comprise the integration architecture. Additionally, the authors advocate that certain functional aspects of a pattern can be pinpointed to resolve a conflict. Combining these two aspects of integration architecture design, they illustrate that often evolution is possible with minimal changes to the integration solution.

DTIC

Commercial Off-the-Shelf Products; Computer Programming; Identifying; Interoperability; Software Engineering

20070035616 Office of the Deputy Under Secretary of Defense for Readiness, Washington, DC USA

Department of Defense Implementation Plan for Advanced Distributed Learning

May 19, 2000; 111 pp.; In English

Report No.(s): AD-A470552; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Vision. The Advanced Distributed Learning (ADL) Initiative is providing a federal framework for using distributed learning to provide high-quality education and training, that can be tailored to individual needs and delivered cost-effectively, anytime and anywhere. The Department of Defense (DoD) has developed its ADL Strategic Plan that describes how it expects to use information, computing and communications and technologies to modernize military education, training, and performance support. Importantly, the ADL Initiative's underpinnings and applications are germane not only to the Department of Defense, but to other government organizations, academia, and the private sector, as well. The ADL Initiative, therefore, is a cooperative effort between the public and private sectors to develop and share common standards, reusable learning tools, and content. The department's education and training programs must prepare the total force to meet national security challenges and opportunities. Training technologies, those available today as well as those on the horizon, provide an opportunity to help us achieve that goal. We must be able to train our forces effectively and rapidly, whether they are at home stations, en route, or in the theater of operations. The tools under development through the ADL Initiative will add another level of learning capability and the opportunity to strengthen our already impressive inventory of learning technologies, techniques, and procedures. The ADL Initiative, under which this Department of Defense Implementation Plan for Advanced Distributed Learning has been developed, is a complex and dynamic undertaking. It is designed to meet the goals of the department, the Congress, and the Office of Science and Technology Policy (OSTP), as well as the requirements of the

warfighter and the DoD learner. This Implementation Plan is a living roadmap that will change over time.
DTIC

Computer Assisted Instruction; Defense Program; Learning; Organizations

20070035617 Rice Univ., Houston, TX USA

Parallelizing Molecular Dynamics Programs for Distributed Memory Machines: An Application of the CHAOS Runtime Support Library

Hwang, Yuan-Shin; Das, Raj; Saltz, Joel; Brooks, Bernard; Scek, Milan H; Dec 1994; 20 pp.; In English

Contract(s)/Grant(s): NAG0101485; ASC-9213821

Report No.(s): AD-A470553; CRPC-TR94510; No Copyright; Avail.: Defense Technical Information Center (DTIC)

CHARMM 'Chemistry at Harvard Macromolecular Mechanics' is a program that is widely used to model and simulate macromolecular systems. CHARMM has been parallelized by using the CHAOS runtime support library on distributed memory architectures. This implementation distributes both data and computations over processors. This data-parallel strategy should make it possible to simulate very large molecules on large numbers of processors. In order to minimize communication among processors and to balance computational load, a variety of partitioning approaches are employed to distribute the atoms and computations over processors. In this implementation, atoms are partitioned based on geometrical positions and computational load by using unweighted or weighted recursive coordinate bisection. The experimental results reveal that taking computational load into account is essential. The performance of two iteration partitioning algorithms, atom decomposition and force decomposition, is also compared. A new irregular force decomposition algorithm is introduced and implemented. The CHAOS library is designed to facilitate parallelization of irregular applications. This library '1' couples partitioners to the application programs, '2' remaps data and partitions work among processors, and '3' optimizes interprocessor communications. This paper presents an application of CHAOS that can be used to support efficient execution of irregular problems on distributed memory machines.

DTIC

Architecture (Computers); Chaos; Computer Storage Devices; Distributed Memory; Distributed Processing; Libraries; Molecular Dynamics

20070035747 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Capabilities of NASA's Space Physics Data Facility as Resources to Enable the Heliophysics Virtual discipline Observatories (VxOs)

McGuire, Robert E.; Candey, Robert M.; [2007]; 1 pp.; In English; Virtual Observatories in Geosciences 2007, 12-15 Jun. 2007, Denver, CO, USA; No Copyright; Avail.: Other Sources; Abstract Only

SPDF now supports a broad range of data, user services and other activities. These include: CDAWeb current multi-mission data graphics, listings, file subsetting and supersetting by time and parameters; SSCWeb and 3-D Java client orbit graphics, listings and conjunction queries; OMNIWeb 1/5/60 minute interplanetary parameters at Earth; product-level SPASE descriptions of data including holdings of nssdcftp; VSPO SPASE-based heliophysics-wide product site finding and data use; standard Data format Translation Webservices (DTWS); metrics software and others. These data and services are available through standard user and application webservices interfaces, so middleware services such as the Heliophysics VxOs, and externally-developed clients or services, can readily leverage our data and capabilities. Beyond a short summary of the above, we will then conduct the talk as a conversation to evolving VxO needs and planned approach to leverage such existing and ongoing services.

Author

Applications Programs (Computers); Atmospheric Physics; Client Server Systems; Java (Programming Language); Translating

20070035848 Carnegie-Mellon Univ., Pittsburgh, PA USA

Progress Toward an Organic Software Architecture Capability in the U.S. Army

Blanchette, Jr, Stephen; Bergey, John; Jun 2007; 64 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): FA8721-05-C-0003

Report No.(s): AD-A470491; CMU/SEI-2007-TR-010; ESC-TR-2007-010; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The goal of the USA Army Strategic Software Improvement Program is to dramatically improve the acquisition of software-intensive systems. One of the initiatives undertaken by the program is to begin building a level of technical expertise

in modern software architecture practices within the Army acquisition community. This report describes the Software Architecture Initiative of the Army Strategic Software Improvement Program. Results to date are encouraging and serve as a guide for other acquisition organizations seeking to strengthen their technical competencies.

DTIC

Government Procurement; Organizations; Procedures

20070035974 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

On Automating Failure Mode Analysis and Enforcing its Integrity

Tai, Ann T.; Tso, Kam S.; Chau, Savio N.; May 16, 2005; 15 pp.; In English; 11th International Symposium of Pacific Rim Dependable Computing, 12-14 Dec. 2005, Hunan, China; Original contains black and white illustrations

Contract(s)/Grant(s): NAS3-02096; Copyright; Avail.: Other Sources

ONLINE: <http://hdl.handle.net/2014/40551>

This paper reports our experience on the development of a design-for-safety (DFS) workbench called Risk Assessment and Management Environment (RAME) for microelectronic avionics systems. Our objective is to transform DFS practice from an ad-hoc, inefficient, error-prone approach to a stringent engineering process such that DFS can keep up with the rapidly growing complexity of avionics systems. In particular, RAME is built upon an information infrastructure that comprises a fault model, a knowledge base, and a failure reporting/tracking system. This infrastructure permits systematic learning from prior projects and enables the automation of failure modes, effects and criticality analysis (FMECA). Among other unique features, the most important advantage of RAME is its capability of directly accepting design source code in hardware description languages (HDLs) for automated failure mode analysis, which enables RAME to be compatible and to evolve with most electronic-computer-aided-design systems. Through an initial experimental evaluation of the RAME prototype, we show that our approach to FMECA automation improves failure mode analysis turn-around-time, completeness, and accuracy.

Author

Failure Modes; Knowledge Based Systems; Risk; Safety; Microelectronics; Avionics; Computer Aided Design

20070036094 Army Research Lab., Aberdeen Proving Ground, MD USA

Wind Profiles in Gentle Terrains and Vegetative Canopies for a Three-Dimensional Wind Field (3DWF) Model

Wang, Yansen; Cionco, Ronald; Jul 2007; 40 pp.; In English; Original contains color illustrations

Report No.(s): AD-A470616; ARL-TR-4178; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470616>

The objective of this study is to establish a simple wind profile parameterization for the U.S. Army Research Laboratory's (ARL) diagnostic Three-Dimensional Wind Field (3DWF) Model in gentle terrain and vegetation canopies. The Project Wind in Non-uniform Domains (WIND) data was applied for the analysis of wind profiles in open terrain, forest edge, and the interior of forest. A wind profile parameterization scheme was proposed according to this analysis and additional information found in the literature of other studies. The 3DWF simulation results using this scheme were compared with the observations to establish the confidence level of this parameterization. The analysis and comparison indicated that the 3DWF using this parameterization gives a reasonable accurate wind field prediction in a gentle terrain with vegetation environment. The application of the parameterization for different scenarios of data availability was also discussed.

DTIC

Terrain; Three Dimensional Models; Velocity Distribution; Wind Profiles; Wind Velocity

20070036124 Army Command and General Staff Coll., Fort Leavenworth, KS USA

A Study of Simulation Effectiveness in Modeling Heavy Combined Arms Combat in Urban Environments

Jacquet, Carl R; May 2007; 67 pp.; In English; Original contains color illustrations

Report No.(s): AD-A470679; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470679>

During the Cold War, combined arms heavy force tactics dictated that forces should avoid urban areas when possible. However, since the beginning of Operation Iraqi Freedom, heavy forces have fought in every urban area in Iraq. The USA Army has clearly rediscovered combined arms heavy force tactics, but there currently exists no validated and effective live, virtual, or constructive training simulation to adequately prepare U.S. Army forces to deal with insurgents in urban terrain. This study examined selected simulations currently in use for training and analysis, compared them against urban warfare

requirements derived from key historical battles, and recommended requirements for future simulations that will better prepare the nation's soldiers for the urban battlefield of today and tomorrow.

DTIC

Cities; Combat; Computer Assisted Instruction; Simulation; Warfare

20070036134 SRI International Corp., Menlo Park, CA USA

Using Information Extraction to Improve Document Retrieval

Bear, John; Israel, David; Petit, Jeff; Martin, David; Jan 9, 1998; 12 pp.; In English

Contract(s)/Grant(s): N66001-94-C-6044

Report No.(s): AD-A470701; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470701>

The authors describe an approach to applying a particular kind of Natural Language Processing (NLP) system to the TREC routing task in Information Retrieval (IR). Rather than attempting to use NLP techniques in indexing documents in a corpus, they adapted an information extraction (IE) system to act as a post-filter on the output of an IR system. The IE system was configured to score each of the top 2000 documents as determined by an IR system and on the basis of that score to rerank those 2000 documents. One aim was to improve precision on routing tasks. Another was to make it easier to write IE grammars for multiple topics.

DTIC

Extraction; Information Retrieval; Natural Language (Computers); Natural Language Processing; Precision

20070036135 Carnegie-Mellon Univ., Pittsburgh, PA USA

Integrating Software Architecture Evaluation in a DoD System Acquisition

Bergey, John; Morrow, Timothy; Apr 2005; 20 pp.; In English

Report No.(s): AD-A470703; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470703>

These briefing charts demonstrate the integration of software architecture evaluation into a Department of Defense (DoD) system acquisition using the Common Link Integration Processing (CLIP) Program as an example. The presentation outline is as follows: CLIP Program Background, CLIP System and Software Concept, CLIP Challenges, Role of Architecture in RFP/contract, Current Acquisition Status, Proactive Application of Architecture Tradeoff and Analysis Method (Trademark) (ATAM (Trademark)) and Quality Attribute Workshop (Trademark) (QAW (Trademark)) to Reduce Software Acquisition Risk, and Impact of Work. The Common Link Integration Processing (CLIP) Program is a cooperative effort between the Air Force and Navy. CLIP integrates Tactical Data Links (TDLs) across platforms with a TDL requirement; provides message processing, gateway functionality, and a common interface; and enables the transition of new and legacy platforms to a Network Centric Warfare (NCW) environment. The demonstration reveals that QAW- and ATAM-based evaluations have been successfully integrated into an RFP/contract for a major DoD acquisition. The approach and RFP/contract language were approved by an independent assessment team and the CLIP contracting officer. Based on the CLIP experience, the authors have developed 'Guidance for Reducing Software Acquisition Risk through Architecture Evaluation.' This guidance is available to DoD programs that want to promote architecture-centric development and proactively perform software architecture evaluation in their system acquisition. The architecture evaluation approach and corresponding contract language and software deliverables will be described in a set of SEI Technical Notes.

DTIC

Clips; Computer Programming; Contract Management; Data Processing; Data Systems; Evaluation; Procurement; Risk; Software Engineering; System Effectiveness; Systems Integration

20070036275 Thinking Systems, Inc., Tucson, AZ, USA

Configuring Eclipse for GMAT Builds: Instructions for Windows Users, Rev. 0.3

Conway, Darrel J.; July 12, 2007; 9 pp.; In English; Original contains black and white illustrations; Copyright; Avail.:

CASI: A02, Hardcopy

This document provides instructions about how to configure the Eclipse IDE to build GMAT on Windows based PCs. The current instructions are preliminary; the Windows builds using Eclipse are currently a bit crude. These instructions are intended to give you enough information to get Eclipse setup to build wxWidgets based executables in general, and GMAT in particular.

Author

Windows (Computer Programs); Instruction Sets (Computers); Computer Programming

20070036296 Northrop Grumman Corp., Columbus, GA USA

Retention of Selected FBCB2 Operating Skills Among Infantry Captains Career Course (ICCC) Students

Goodwin, Gregory A; Leibrecht, Bruce C; Wampler, Richard L; Livingston, Stephen C; Dyer, Jean L; Jul 2007; 96 pp.; In English

Contract(s)/Grant(s): W74V8H-04-D-0045; Proj-A790

Report No.(s): AD-A470741; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This report describes an investigation of the retention of Force XXI Battle Command Brigade and Below (FBCB2) operator knowledge and skills. Infantry captains who attended a two-day training course participated in an end-of-course test followed by a retest eight weeks later. Participants answered questions about and performed tasks on FBCB2. Performance on the knowledge test showed no decay while performance on the hands-on test declined slightly (10%) but significantly. The majority of participants (72%) had used FBCB2 in combat. Interestingly, the best single predictor of performance on the hands-on test was a self-reported measure of general computer experience. In general, though, it was difficult to predict performance on the hands-on test. Multiple regression analyses using a variety of experience and knowledge measures accounted for only 25-30% of the variability in recall scores. Implications of these findings for trainers, training developers, and Army units are discussed.

DTIC

Computer Assisted Instruction; Education; Occupation; Students

20070036304 Naval War Coll., Newport, RI USA

Principles of Information Management for the Operational Commander

Hunter, Samaria M; May 10, 2007; 28 pp.; In English; Original contains color illustrations

Report No.(s): AD-A470765; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The vast amount of information available in today's network centric environment has increased the complexity and uncertainty of military operations. Leveraging the information domain to achieve a decisive advantage requires effective information management. In a globally connected world, where unilateral nation-state military operations are becoming less likely, mission success in the operational environment will largely depend on the interoperability of many diverse organizations. Information flow is the critical link that ties these organizations together and achieves unity of effort. However, information management at the operational level is less than optimum. With so much depending on the ability to get the right information to the right people at the right time, an effective information management strategy is a must. This paper will analyze the impact of information management missteps in past and current operations and show that fundamental tenets can be derived to effectively guide information management in the operational environment.

DTIC

Data Management; Information Management

20070036330 Cranfield Univ., Cranfield, UK

Interoperability Architectures

Searle, Jonathan; Brennan, John; Sep 1, 2006; 40 pp.; In English; Original contains color illustrations

Report No.(s): AD-A470849; No Copyright; Avail.: Defense Technical Information Center (DTIC)

No abstract available

Distributed Interactive Simulation; Interoperability

20070036350 Cranfield Univ., Cranfield, UK

Simulation Components

Searle, Jonathan; Brennan, John; Sep 1, 2006; 55 pp.; In English; Original contains color illustrations

Report No.(s): AD-A470883; No Copyright; Avail.: Defense Technical Information Center (DTIC)

No abstract available

Models; Simulation

20070036360 Anacapa Sciences, Inc., Santa Barbara, CA USA

SamePage: Development of a Team Training Tool to Promote Shared Understanding

Spiker, V A; Holder, Eric W; Walls, Wayne F; Campsey, William M; Bruce, Phillip D; Jul 2007; 91 pp.; In English

Contract(s)/Grant(s): DASW01-04-C-008; Proj-A790

Report No.(s): AD-A470896; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This research note describes the work conducted under a Phase II SBIR contract in which an online team training system

called SamePage was created. The goal of SamePage is to promote the development of knowledge and skills for enhancing shared understanding within a team. The training begins with individualized online training designed to help trainees learn about shared understanding concepts. Once trainees have been exposed to basic principles of shared understanding, they work together as a five-person team through an online scenario-based exercise to practice the principles learned during individualized instruction. The scenario exercise is periodically halted so that an instructor can bring the group together into roundtable discussions to talk about team processes and shared understanding concepts. Portions of SamePage were tested in a formative evaluation with battalion-level staff, and reactions to the system were generally positive. Six lessons learned about constructing online team-based training are presented in the last section of this note.

DTIC

Education; Training Devices

20070036748 Naval Postgraduate School, Monterey, CA USA

The 'Smarter Regression' Add-In for Linear and Logistic Regression in Excel

Buttrey, Samuel E; Jul 2007; 17 pp.; In English; Original contains color illustrations

Report No.(s): AD-A470645; NPS-OR-07-002; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470645>

The widely-used Excel spreadsheet program has a linear regression routine, but it has a number of drawbacks: it does not handle categorical predictors; it requires to the user to generate columns for interactions; it cannot compute logistic regressions; and it is limited to 16 predictor columns. We have developed an Excel add-in that does both logistic and linear regression, handles categorical and interaction variables in an obvious way, and removes the 16-column limit. We also support nested model tests and, for linear regression, transformations of the response variable. Although we do not claim that Excel is the proper tool for data analysis, our tool can make both small, quick analyses and introductory statistics courses simpler and more complete.

DTIC

Spreadsheets; Logistics; Regression Analysis; Software Engineering

20070036768 Organisatie voor Toegepast Natuurwetenschappelijk Onderzoek, The Hague, Netherlands

Using the Euclid RTP11.13 Repository in the SEC Environment

Langeslag, P J; Mar 2006; 45 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): Proj-015.34133

Report No.(s): AD-A470725; TNO-DV1-2005-A053; No Copyright; Avail.: Defense Technical Information Center (DTIC)

One of the tasks of the Simulation Expertise Centre of the Royal Netherlands Army is the implementation of a Modelling and Simulation Repository. The Repository developed in the Euclid RTP11-13 programme is preferred because of its possible NATO wide implementation. This document describes the installation and use of some Euclid RTP11.13 tools. As these tools are prototypes all problems encountered during installation procedures and the solutions for these problems are captured. However, because of the prototype nature of the tools, they turned out be unreliable and slow. Therefore, acceptance by users would be very difficult. For now it is recommended not using these tools in the SEC working, but using a simple web-based database instead.

DTIC

Software Development Tools; Prototypes; Architecture (Computers)

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.

20070034723 Defense Information Systems Agency, Arlington, VA USA

Architecture Engineering: An Essential Role for Net-Centric Enablement within NATO

Moxley, Frederick I; Blackman, Clinton P; Dec 1, 2005; 34 pp.; In English

Report No.(s): AD-A469708; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA469708>

No abstract available

Engineering; North Atlantic Treaty Organization (NATO)

20070035190 Naval Postgraduate School, Monterey, CA USA

A Hybrid, Large-Scale Wireless Sensor Network for Real-Time Acquisition and Tracking

Katopodis, Panagiotis; Jun 2007; 111 pp.; In English; Original contains color illustrations

Report No.(s): AD-A470111; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470111>

This thesis proposes a hybrid, large-scale wireless sensor network (WSN) designed to support real-time target detection and tracking of multiple ballistic missile threats. In particular, the proposed WSN consists of terrestrial as well as satellite nodes. The IR signatures presented by the target-background combination are explored and modern IR sensor technologies are examined in search of a suitable IR sensor for the proposed hybrid, large-scale WSN. A multicolor, Quantum-Well Infrared Photodetector (QWIP), step-stare, large-format Focal Plane Array (FPA) is proposed and evaluated through performance analysis. The thesis proposes an efficient data dissemination mechanism as well as a suitable medium access control (MAC) scheme for the proposed WSN that is designed to meet real-time and accuracy requirements without introducing excessive overhead and increased end-to-end time-delays. A clustering mechanism, called the 'Area of Interest' (AOI) is introduced, which combines the content-based feature of the data centric routing approach with the principles of in-network data aggregation and clustering. Simulation results verify that aggregation within the AOI improves the data throughput across the full range of network load. A contention-based MAC scheme, Carrier Sense Multiple Access (CSMA), and a contention-free approach, Time Division Multiple Access (TDMA), are examined. Performance analysis and simulation results indicate that a contention-free approach is suitable for implementation in wireless networks associated with large propagation delays and increased offered loads. Matlab and OPNET Modeler (copyrighted) software packages are used to simulate and evaluate the proposed schemes.

DTIC

Computer Networks; Focal Plane Devices; Infrared Signatures; Missile Detection; Missile Tracking; Photometers; Real Time Operation; Target Acquisition; Wireless Communication

20070035226 Naval Postgraduate School, Monterey, CA USA

Performance Analysis of IEEE 802.11g TCM Waveforms Transmitted over a Channel with Pulse-Noise Interference

Drivas, Athanasios; Jun 2007; 163 pp.; In English; Original contains color illustrations

Report No.(s): AD-A470160; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470160>

Trellis-coded modulation (TCM) is a technique that introduces forward error correction (FEC) coding without increasing the bandwidth of the channel signal. TCM combines binary convolution codes with M-ary signal constellation. The application of TCM combines FEC coding and M-ary modulation in one operation. The objective of this thesis is to investigate the performance of an orthogonal frequency-division multiplexing (OFDM) based IEEE 802.11g wireless local area network (WLAN) standard receiver when the waveform is transmitted over an additive white Gaussian noise (AWGN) environment combined with pulse-noise-interference (PNI), for the trellis-coded modulation (TCM) waveform specified by the WLAN standard. In addition to a TCM waveform consisting of a rate $r=2/3$, 4-state, 8-state and 16-state ($K=1$, $K=2$, $K=3$, and $K=4$ memory elements) convolution code with 8-phase-shift keying (8-PSK) modulation (analogous to the IEEE 802.11g TCM mode), improvements to the TCM system will be considered. Specifically, two rate $r=1/2$ convolution codes independently encoding data on the I and Q channels will be modulated with two 4-pulse amplitude modulation (4-PAM) waveforms. Both $K=1$ and $K=2$, $K=2$ and $K=3$, and $K=2$ and $K=4$ convolution codes (constant number of states and constant constraint length, respectively) will be considered.

DTIC

Coding; Frequency Division Multiplexing; Local Area Networks; Modulation; Orthogonality; Pulse Amplitude Modulation; Reliability Analysis; Signal Processing; Waveforms; Wireless Communication

20070035347 Harvard Univ., Cambridge, MA USA

Vulnerability Assessment Tools for Complex Information Networks

Cassandras, Christos G; Gong, Weibo; Pepyne, David L; Lee, Wenke; Liu, Hong; Ho, Yu-Chi; Pfeffer, Avrom; Nov 14, 2006; 27 pp.; In English

Contract(s)/Grant(s): DAAD19-01-1-0610

Report No.(s): AD-B329088; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The specific aims of this research is to develop theories, methodologies, tools, and implementable solutions for modeling, analyzing, designing, and securing information networks against information-based attack. Accomplishments during the current reporting period are documented in 49 publications and 1 patent application and include: New methods for the

optimization of complex systems; simulation-based methods for real-time decision making; proof-of-concept implementations of solutions for malware spreading and wireless data-link security; a feedback control approach for defense against DDoS; randomized protocols for managing the performance vs. security trade-off in wireless networks; automated Red Teaming tools and intrusion traceback methods for mobile ad-hoc wireless networks; a new dynamic Bayesian network based approach for detection and estimation in networked environments; and an adaptive defense architecture for fast spreading internet worms. Plans for the coming year will focus on further exploration of optimization, feedback and randomness in security; continued development of methods for security assessment, particularly in wireless settings; completion of the dynamic Bayesian framework for detection and estimation in networks; and a continued exploration of vulnerabilities and methods for military enterprise networks. These efforts will contribute new understanding and new approaches for securing and managing distributed, decentralized command and control systems.

DTIC

Communication Networks; Computer Information Security; Vulnerability

20070035476 Lucent Technologies, Murray Hill, NJ USA

Fundamentals of Combinatorial Optimization and Algorithm Design: Report for April 1 2006-March 31 2007

Shepherd, Bruce; Andrews, Matthew; Chekuri, Chandra; Wilfong, Gordon; Zhang, Lisa; Mar 2007; 14 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): N00014-06-1-0396

Report No.(s): AD-A470300; N00014-06-1-0396-F001; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The main research output this year included work on degree-constrained network flows which was accepted by STOC 2007. Shepherd will give a plenary talk on this topic at CANADAM. Lucent has also applied for a patent based on this work. Work was also done on protected buy-at-bulk network design problems by Antonakopoulos, Chekuri Shepherd, and Zhang resulting in a manuscript, April 2007. Work was done by Andrews and Zhang on scheduling in wireless networks resulting in a manuscript. Work was done on flow-cut gaps in series-parallel graphs by Chekuri and Shepherd.

DTIC

Algorithms; Combinatorial Analysis; Communication Networks; Computer Networks; Information Theory; Optimization

20070035568 Carnegie-Mellon Univ., Pittsburgh, PA USA

Introducing OCTAVE Allegro: Improving the Information Security Risk Assessment Process

Caralli, Richard A; Stevens, James F; Young, Lisa R; Wilson, William R; May 2007; 154 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): FA8721-05-C-0003

Report No.(s): AD-A470450; CMU/SEI-2007-TR-012; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This technical report introduces the next generation of the Operationally Critical Threat, Asset, and Vulnerability Evaluation (OCTAVE) methodology, OCTAVE Allegro. OCTAVE Allegro is a methodology to streamline and optimize the process of assessing information security risks so that an organization can obtain sufficient results with a small investment in time, people, and other limited resources. It leads the organization to consider people, technology, and facilities in the context of their relationship to information and the business processes and services they support. This report highlights the design considerations and requirements for OCTAVE Allegro based on field experience with existing OCTAVE methods and provides guidance, worksheets, and examples that an organization can use to begin performing OCTAVE Allegro-based risk assessments.

DTIC

Assessments; Octaves; Risk; Security; Threat Evaluation; Vulnerability

20070035583 Carnegie-Mellon Univ., Pittsburgh, PA USA

Transformation of a Software Development Organization Using Software Acquisition Principles: A Case Study

Borst, H; Sorrell, F; Oberndorf, P; Fritts, S; Hamilton, L; Wrubel, E; May 2006; 24 pp.; In English

Report No.(s): AD-A470493; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Air Force leadership requested in 2001 that the Software Engineering Institute (SEI) conduct a probe to investigate software quality problems with the newly released Military Personnel Data System (MilPDS). SEI conducted a six week

intensive study in 2002 and returned in 2004 for a follow on study. This briefing discusses the findings of those studies, the recommendations and the reorganization that followed.

DTIC

Computer Programming; Software Engineering

20070035605 Georgia Inst. of Tech., Atlanta, GA USA

High-Fidelity Modeling of Computer Network Worms

Perumalla, Kalyan S; Sundaragopalan, Srikanth; Jun 22, 2004; 12 pp.; In English

Contract(s)/Grant(s): N66001-00-1-8934

Report No.(s): AD-A470528; GIT-CERCS-04-23; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Abstract modeling, such as using epidemic models, has been the general method of choice for understanding and analyzing the high-level effects of worms. However, high-fidelity models, such as packet-level models, are indispensable for moving beyond aggregate effects, to capture finer nuances and complexities associated with known and future worms in realistic network environments. Here, we first identify the spectrum of available alternatives for worm modeling, and classify them according to their scalability and fidelity. Among them, we focus on three high-fidelity methods for modeling of worms, and study their effectiveness with respect to scalability. Employing these methods, we are then able to, respectively, achieve some of the largest packet-level simulations of worm models to date; implant and attack actual worm monitoring/defense installations inside large simulated networks; and identify a workaround for real-time requirement that fundamentally constrains worm modeling at the highest fidelity levels.

DTIC

Computer Networks; Computer Viruses; Worms

20070035885 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Reducing Development and Operations Costs using NASA's 'GMSEC' Systems Architecture

Smith, Dan; Bristow, John; Crouse, Patrick; June 15, 2007; 15 pp.; In English; 7th International Reducing the Costs of Spacecraft Ground Systems and Operations (RCSGSO) Symposium, 11-15 Jun. 2007, Moscow, Russia; Original contains black and white illustrations; No Copyright; Avail.: CASI: [A03](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20070035885>

This viewgraph presentation reviews the role of Goddard Mission Services Evolution Center (GMSEC) in reducing development and operation costs in handling the massive data from NASA missions. The goals of GMSEC systems architecture development are to (1) Simplify integration and development, (2) Facilitate technology infusion over time, (3) Support evolving operational concepts, and (4) All for mix of heritage, COTS and new components. First 3 missions (i.e., Tropical Rainforest Measuring Mission (TRMM), Small Explorer (SMEX) missions - SWAS, TRACE, SAMPEX, and ST5 3-Satellite Constellation System) each selected a different telemetry and command system. These results show that GMSEC's message-bus component-based framework architecture is well proven and provides significant benefits over traditional flight and ground data system designs. The missions benefit through increased set of product options, enhanced automation, lower cost and new mission-enabling operations concept options .

CASI

Cost Reduction; Data Acquisition; Data Systems; Architecture (Computers); Earth Observations (From Space); End-to-End Data Systems; Data Processing; Software Engineering; Computer Programs

20070035905 NASA Langley Research Center, Hampton, VA, USA

Model Checking a Byzantine-Fault-Tolerant Self-Stabilizing Protocol for Distributed Clock Synchronization Systems

Malekpour, Mahyar R.; [2007]; 36 pp.; In English

Contract(s)/Grant(s): WBS 645846.02.07.07.06

Report No.(s): NASA/TM-2007-215083; L-19408; No Copyright; Avail.: CASI: [A03](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20070035905>

This report presents the mechanical verification of a simplified model of a rapid Byzantine-fault-tolerant self-stabilizing protocol for distributed clock synchronization systems. This protocol does not rely on any assumptions about the initial state of the system. This protocol tolerates bursts of transient failures, and deterministically converges within a time bound that is a linear function of the self-stabilization period. A simplified model of the protocol is verified using the Symbolic Model Verifier (SMV) [SMV]. The system under study consists of 4 nodes, where at most one of the nodes is assumed to be Byzantine faulty. The model checking effort is focused on verifying correctness of the simplified model of the protocol in the

presence of a permanent Byzantine fault as well as confirmation of claims of determinism and linear convergence with respect to the self-stabilization period. Although model checking results of the simplified model of the protocol confirm the theoretical predictions, these results do not necessarily confirm that the protocol solves the general case of this problem. Modeling challenges of the protocol and the system are addressed. A number of abstractions are utilized in order to reduce the state space. Also, additional innovative state space reduction techniques are introduced that can be used in future verification efforts applied to this and other protocols.

Author

Fault Tolerance; Protocol (Computers); Time Synchronization; Mechanical Engineering; Mathematical Models

20070036048 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

POLARIS: Helping Managers Get Answers Fast!

Corcoran, Patricia M.; Webster, Jeffery; February 6, 2007; 33 pp.; In English; NASA Project Management Challenge, 6-7 Feb. 2007, Galveston, TX, USA; Original contains color illustrations; Copyright; Avail.: Other Sources

ONLINE: <http://hdl.handle.net/2014/40324>

This viewgraph presentation reviews the Project Online Library and Resource Information System (POLARIS) system. It is NASA-wide, web-based system, providing access to information related to Program and Project Management. It will provide a one-stop shop for access to: a searchable, sortable database of all requirements for all product lines, project life cycle diagrams with reviews, project life cycle diagrams with reviews, project review definitions with products review information from NPR 7123.1, NASA Systems Engineering Processes and Requirements, templates and examples of products, project standard WBSs with dictionaries, and requirements for implementation and approval, information from NASA's Metadata Manager (MdM): Attributes of Missions, Themes, Programs & Projects, NPR7120.5 waiver form and instructions and much more. The presentation reviews the plans and timelines for future revisions and modifications.

CASI

Project Management; Mission Planning; Management Information Systems; Information Systems; Systems Engineering

20070036052 Geological Survey, Flagstaff, AZ, USA; Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

The Challenges of Searching, Finding, Reading, Understanding and Using Mars Mission Datasets for Science Analysis

Johnson, Jeffrey R.; April 20, 2006; 16 pp.; In English; Mars Exploration Program Analysis Group, 19 Apr. 2006, Monrovia, CA, USA; Original contains color and black and white illustrations; Copyright; Avail.: Other Sources

ONLINE: <http://hdl.handle.net/2014/40333>

This viewgraph presentation reviews the problems that non-mission researchers have in accessing data to use in their analysis of Mars. The increasing complexity of Mars datasets results in custom software development by instrument teams that is often the only means to visualize and analyze the data. The solutions to the problem are to continue efforts toward synergizing data from multiple missions and making the data, s/w, derived products available in standardized, easily-accessible formats, encourage release of 'lite' versions of mission-related software prior to end-of-mission, and planetary image data should be systematically processed in a coordinated way and made available in an easily accessed form. The recommendations of Mars Environmental GIS Workshop are reviewed.

CASI

Mars Missions; Software Engineering; Standardization; Data Integration; Data Products; Data Systems

20070036106 Naval Postgraduate School, Monterey, CA USA

A Prototype Implementation of a Time Interval File Protection System in Linux

Chiang, Ken H; Sep 2006; 246 pp.; In English

Report No.(s): AD-A470632; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470632>

Control of access to information based on temporal attributes has many potential applications. Examples include student user accounts set to expire upon graduation; files marked as time-sensitive so that their contents can be protected appropriately and the period of access to them controlled; and cryptographic keys configured to automatically expire and be unusable beyond a specific time. This thesis implements a prototype of the Time Interval Access Control (TIAC) model in the context of a protected file system for the popular open-source Linux operating system. The Linux Security Module framework is used for the implementation, which includes temporal attributes associated both with the files and the users. The implementation includes modifications to the file system as well as low-level information access constructs. As part of the design process, testing and performance analysis were conducted. Since the temporal access control mechanism is built into the kernel rather

than the application, bypassing the mechanism becomes more difficult. Kernel level implementation also affords the same policy enforcement functionality to different applications, thus reducing human errors in their development. This thesis is relevant to the research on dynamic security services for information protection envisioned by the DoD Global Information Grid (GIG).

DTIC

Access Control; Numerical Control; Protection; Prototypes; Unix (Operating System)

20070036136 University of Central Florida, Orlando, FL USA

Collaborative Technologies and their Effect on Operator Workload in BMC2 Domains

Duley, Aaron R; Flynn, Jeremy; Abich, Julian; Drabik, Holly; Szalma, James; Hancock, Peter; Jun 2007; 78 pp.; In English
Contract(s)/Grant(s): FA8650-05-C-6651; Proj-7184

Report No.(s): AD-A470708; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470708>

A primary goal of this project is to understand how introduction of collaborative technologies affects performance and workload associated with C2 tasks. Accomplishing this goal requires multidimensional measurement of workload and analysis of the associations and dissociations that occur between workload and task performance (Matthews, 2001; O'Donnell & Eggemeier, 1986). Each methodology (performance, physiological measurement, and subjective response) offers a separate vista through which the interaction of workload and human performance can be viewed and therefore provide a more comprehensive and accurate assessment. We intend to transfer the techniques and developed methodologies derived for the measurement of the response of the individual to a companion method aimed at providing a comprehensive analysis of the operational context.

DTIC

Command and Control; Domains; Workloads (Psychophysiology)

20070036301 Naval War Coll., Newport, RI USA

Humanitarian Assistance and Disaster Relief Communications for the 21st Century

Daly, Charles; May 10, 2007; 27 pp.; In English

Report No.(s): AD-A470757; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Communication requirements for humanitarian assistance or disaster relief operations (HADR) differ from conventional combat operations -- the military commander requires an unclassified, information-sharing architecture to effectively collaborate and coordinate with the civilian agencies and organizations involved in such an operation. The military response is often at the operational level but this response can have strategic effects on U.S. prestige and credibility in a given region. All combatant commands must be ready to respond to a humanitarian crisis or natural disaster, and to do so effectively they must share information with civilian entities in the operating environment. This paper will do the following: analyze Operation Unified Assistance, the USA Pacific Command's response to the 2004 tsunami natural disaster; draw conclusion about the communications architecture used in this operation; and discuss the lessons learned for operational commanders who are involved in HADR communications and collaboration.

DTIC

Command and Control; Computer Networks; Disasters; Personnel; Tsunami Waves

20070036725 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

Content-Based Networking: DTN, AMS, Sharednet

Burleigh, Scott; August 9, 2006; 9 pp.; In English; DARPA DTN Phase 2 Kick Off, 9 Aug. 2006, Arlington, VA, USA; Original contains color illustrations; Copyright; Avail.: Other Sources

ONLINE: <http://hdl.handle.net/2014/40336>

A detailed viewgraph presentation on DTN, AMS, and Sharednet content-based networking is shown. The contents include: 1) DARPA Content-Based Networking Summary of Requirements; 2) Concept; 3) Key Features of AMS; 4) Overview of Sharednet; 5) SharedNet Deployment History; 6) SharedNet AMS DTN; 7) Detailed Structure; and 8) Bottom line.

CASI

Computer Networks; Protocol (Computers); Computer Systems Design; Communication Networks

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*.

20070035060 Naval Postgraduate School, Monterey, CA USA

Deployment of Shaped Charges by a Semi-Autonomous Ground Vehicle

Herkamp, John F; Jun 2007; 201 pp.; In English; Original contains color illustrations

Report No.(s): AD-A470035; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470035>

Neutralization of remotely operated Improvised Explosive Devices (IEDs) is a dangerous task risking human lives on a daily basis. BigFoot seeks to replace the local human component by deploying and remotely detonating shaped charges to destroy IEDs. This research developed a platform that can autonomously navigate GPS waypoints, avoid obstacles, and provide remote user controls for an onboard robotic arm to deploy and remotely detonate shaped charges. BigFoot incorporates improved communication range over previous Autonomous Ground Vehicles and an updated user interface that includes controls for the arm and camera by interfacing multiple microprocessors. BigFoot is capable of avoiding static and mobile obstacles as well handling most surfaces with minor slopes. BigFoot continues to be somewhat limited by communications range and GPS availability. However, BigFoot is an ideal platform for relatively short range deployment to neutralize roadside IEDs.

DTIC

Autonomy; Deployment; Robots; Shaped Charges

20070035147 Naval Postgraduate School, Monterey, CA USA

Deployment of Shaped Charges by a Semi-Autonomous Ground Vehicle

Herkamp, John F; Jun 2007; 201 pp.; In English; Original contains color illustrations

Report No.(s): AD-A470035; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470035>

Neutralization of remotely operated Improvised Explosive Devices (IEDs) is a dangerous task risking human lives on a daily basis. BigFoot seeks to replace the local human component by deploying and remotely detonating shaped charges to destroy IEDs. This research developed a platform that can autonomously navigate GPS waypoints, avoid obstacles, and provide remote user controls for an onboard robotic arm to deploy and remotely detonate shaped charges. BigFoot incorporates improved communication range over previous Autonomous Ground Vehicles and an updated user interface that includes controls for the arm and camera by interfacing multiple microprocessors. BigFoot is capable of avoiding static and mobile obstacles as well handling most surfaces with minor slopes. BigFoot continues to be somewhat limited by communications range and GPS availability. However, BigFoot is an ideal platform for relatively short range deployment to neutralize roadside IEDs.

DTIC

Autonomy; Deployment; Robots; Shaped Charges

20070035151 Naval Postgraduate School, Monterey, CA USA

Performance of Wireless Unattended Sensor Network in Maritime Applications

Casias, Juan F; Jun 2007; 101 pp.; In English; Original contains color illustrations

Report No.(s): AD-A470042; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470042>

Wireless, unattended sensor networks offer a superior monitoring capability with unparalleled flexibility. Traditional systems are typically restrictive in the rigidity of their positioning and topological design requirements. Ongoing research continues to expand the potential for the use of these un-tethered and autonomous systems ranging from the mundane, monitoring soil conditions for agricultural crops, to the extreme of military operations, providing valuable intelligence to commanders in a variety of battlespace conditions. This thesis investigated the use of this type of system in what may be the most hostile of environmental conditions from a wireless networking and communications point of view, the water. The network will be required to organize, establish and maintain itself in a variety of dynamic conditions in or on the water. Commercial off-the-shelf products developed by Crossbow Technologies were used in developing the wireless, unattended sensor network consisting of single and multiple nodes. Nodes were tested on a solid ground surface, on the surface of the water, below the surface of the water (not submerged), and fully submerged. The most significant findings were attained with

regard to range. Other findings with regard to link quality, network formation, and network stability support results attained in previous research.

DTIC

Adaptation; Wireless Communication

20070035454 City Univ. of New York, NY USA

Quality Measures Using Singular Value Decomposition: Comparison of Three Full-Reference Color Image Quality Measures

Girshtel, Eugene; Slobodyan, Vitaliy; Weissman, Jonathan S; Eskicioglu, Ahmet M; Nov 30, 2006; 36 pp.; In English

Contract(s)/Grant(s): FA9550-05-1-0400

Report No.(s): AD-A470271; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Image quality assessment plays a major role in many image processing applications. Although much effort has been made in recent years towards the development of quantitative measures, the relevant literature does not include many papers that have produced accomplished results. Ideally, a useful measure should be easy to compute, independent of viewing distance, and able to quantify all types of image distortions. In this paper, we will compare three full-reference full-color image quality measures (M-DFT, M-DWT, and M-DCT). Assume the size of a given image is $n \times n$. The transform (DFT, DWT, or DCT) is applied to the luminance layer of the original and degraded images. The transform coefficients are then divided into four bands, and the following operations are performed for each band. Finally, the mean of the four standard deviations is obtained to produce a single value representing the overall quality of the degraded image.

DTIC

Color; Image Resolution; Images; Quality

20070035516 Woods Hole Oceanographic Inst., MA USA

Stochastic Mapping for Chemical Plume Source Localization With Application to Autonomous Hydrothermal Vent Discovery

Jakuba, Michael V; Feb 2007; 330 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): NAF-OCE-0644290; NAF-OCE-0241913

Report No.(s): AD-A470354; MIT/WHOI-2007-04; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This thesis presents a stochastic mapping framework for autonomous robotic chemical plume source localization in environments with multiple sources. Potential applications for robotic chemical plume source localization include pollution and environmental monitoring, chemical plant safety, search and rescue, anti-terrorism, narcotics control, explosive ordinance removal, and hydrothermal vent prospecting. Turbulent flows make the spatial relationship between the detectable manifestation of a chemical plume source, the plume itself, and the location of its source inherently uncertain. Search domains with multiple sources compound this uncertainty because the number of sources as well as their locations is unknown a priori. Our framework for stochastic mapping is an adaptation of occupancy grid mapping where the binary state of map nodes is redefined to denote either the presence (occupancy) or absence of an active plume source. A key characteristic of the chemical plume source localization problem is that only a few sources are expected in the search domain. The occupancy grid framework allows for both plume detections and non-detections to inform the estimated state of grid nodes in the map, thereby explicitly representing explored but empty portions of the domain as well as probable source locations. However, sparsity in the expected number of occupied grid nodes strongly violates a critical conditional independence assumption required by the standard Bayesian recursive map update rule. While that assumption makes for a computationally attractive algorithm, in our application it results in occupancy grid maps that are grossly inconsistent with the assumption of a small number of occupied cells.

DTIC

Autonomy; Mapping; Plumes; Position (Location); Robotics; Stochastic Processes; Thermodynamic Properties; Vents

20070035551 Northwestern Univ., Evanston, IL USA

Incremental Learning of Perceptual Categories for Open-Domain Sketch Recognition

Lovett, Andrew; Deghani, Morteza; Forbus, Kenneth; Jan 2007; 7 pp.; In English

Report No.(s): AD-A470431; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Most existing sketch understanding systems require a closed domain to achieve recognition. This paper describes an incremental learning technique for opendomain recognition. Our system builds generalizations for categories of objects based upon previous sketches of those objects and uses those generalizations to classify new sketches. We represent sketches

qualitatively because we believe qualitative information provides a level of description that abstracts away details that distract from classification, such as exact dimensions. Bayesian reasoning is used in building representations to deal with the inherent uncertainty in perception. Qualitative representations are compared using SME, a computational model of analogy and similarity that is supported by psychological evidence, including studies of perceptual similarity. We use SEQL to produce generalizations based on the common structure found by SME in different sketches of the same object. We report on the results of testing the system on a corpus of sketches of everyday objects, drawn by ten different people.

DTIC

Classifications; Pattern Recognition

20070035833 Raytheon Co., Portsmouth, RI USA

Empirical Knowledge Transfer and Collaboration with Self-Regenerative Systems

Bracewell, Thomas; Jun 2007; 28 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): FA8750-04-C-0286; DARPA ORDER-T120; Proj-T120

Report No.(s): AD-A470099; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470099>

Raytheon collaborated with Cornell on the DARPA Self-Regenerative Systems program to develop new technologies supporting granular scalable redundancy. The key focus of Raytheon's effort was to research the operational hardening and application of these technologies in military information systems that can support joint combat environments and Network Centric Warfare (NCW), and to advise Cornell regarding the communications architectures and needs of major applications in these settings.

DTIC

Pattern Recognition; Information Systems; Military Technology

20070036005 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

The EPEC Algorithm for Vision Guided Manipulation: Analysis and Validation

DiCicco, Matthew A.; Bajracharya, Max; Nickels, Kevin; Backes, Paul; March 3, 2007; 10 pp.; In English; IEEE Aerospace Conference, 3-10 Mar. 2007, Big Sky, MT, USA; Original contains color and black and white illustrations

Report No.(s): IEEEAC Paper-1636; Copyright; Avail.: Other Sources

ONLINE: <http://hdl.handle.net/2014/40513>

This paper describes the simulated performance and experimental validation of a computationally efficient algorithm for improving positioning accuracy of robot arms using low speed feedback from fixed stereo cameras. The algorithm, called End-Effector Position Error Compensation (EPEC) is robust to visual occlusion of the end-effector and does not require high fidelity calibration of either the arm or stereo camera. The algorithm works by calculating an error vector between the locations of a fiducial on the arm's end-effector as predicted by arm kinematics and detected by a stereo camera triangulation. With this knowledge, the commanded target pose is adjusted to compensate for positioning errors. A simulation environment where arbitrary error can be introduced into arm-camera systems is introduced and used to provide an assessment of the performance of the algorithm under both ideal and degraded conditions.

Author

Algorithms; End Effectors; Position Errors; Robot Arms; Feedback; Kinematics

20070036126 Forschungsgesellschaft fuer Angewandte Naturwissenschaften e.V, Wachtberg-Werthhoven, Germany

Space-Time Adaptive Processing: Algorithms

Buerger, Wolfram; Sep 1, 2006; 13 pp.; In English; Original contains color illustrations

Report No.(s): AD-A470684; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470684>

No abstract available

Algorithms; Signal Processing

20070036127 Forschungsgesellschaft fuer Angewandte Naturwissenschaften e.V, Wachtberg-Werthhoven, Germany

Principles of Adaptive Array Processing

Nickel, Ulrich; Sep 1, 2006; 21 pp.; In English; Original contains color illustrations

Report No.(s): AD-A470687; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470687>

No abstract available

Adaptation; Antenna Arrays; Beamforming

20070036318 Illinois Univ., Chicago, IL USA

Natural Language Dialogue for Intelligent Tutoring Systems

Di Eugenio, Barbara; Aug 2, 2007; 15 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): N00014-00-1-0640

Report No.(s): AD-A470806; No Copyright; Avail.: Defense Technical Information Center (DTIC)

We study tutorial dialogue with two aims: understanding what promotes learning in one on one tutoring; developing language interfaces to Intelligent Tutoring Systems (ITSs). We worked in three different domains. Our work comprises: linguistic analysis, data mining, computational modeling (e.g., discourse planning) implementation, and empirical evaluation with human subjects. Our results show that interfaces developed on the basis of the tutorial dialogue analysis engender significantly more learning than other types of interfaces.

DTIC

Learning; Natural Language (Computers)

20070036389 Army Engineer Research and Development Center, Vicksburg, MS USA

Standards for the Mobility Common Operational Picture (M-COP): Elements of Ground Vehicle Maneuver

Richmond, Paul W; Blais, Curtis L; Nagle, Joyce A; Goerger, Niki C; Gates, Burhman Q; Burk, Robin K; Willis, John; Keeter, Robert; Jul 2007; 235 pp.; In English; Original contains color illustrations

Report No.(s): AD-A470946; ERDC-TR-07-4; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Information needed to support ground mobility decision making is critical to the success of ground operations. The ability to rapidly obtain and process relevant information in a network-centric environment will empower warfare planners. In addition, future network centric operations that will include autonomous unmanned ground vehicles as envisioned in the Future Combat Systems program will increasingly require the exchange of well-structured information between human forces and robotic systems. Addressing this operational challenge begins with a clear understanding of the information content needed for ground mobility planning. The purpose of the Mobility Common Operational Picture (M-COP) project is to specify a standardized vocabulary and conceptual relationships for the expression and transfer of ground vehicle maneuver data, planned routes, trafficability assessments, and other parameters associated with Future Force assured mobility across Modeling and Simulation (M&S) systems and Battle Command (BC) systems. The scope of the project was limited to ground vehicle mobility and ground vehicle maneuver information. The project identified terms and concepts across relevant data representations that will enable the M-COP capability to be achieved in the current and emerging network centric architecture.

DTIC

Mobility; Pixels

20070036426 Army Research Lab., Adelphi, MD USA

Discrimination of Objects Within Polarimetric Using Principal Component and Cluster Analysis

Felton, Melvin; Gurton, Kristan P; Ligon, David; Raglin, Adrienne; Aug 2007; 30 pp.; In English; Original contains color illustrations

Report No.(s): AD-A471003; ARL-TR-4216; No Copyright; Avail.: Defense Technical Information Center (DTIC)

We apply two multivariate image analysis techniques to several sets of spatially coincident, long-wave infrared (LWIR), polarimetric images to improve target contrast and/or aid in the identification of certain object features not present in the original image set. Principal component analysis (PCA) was used to obtain new representations of the scene that highlight target features based upon the variance of the variables used in the analysis. We show a representation of the scene that maintains the same level of target-to-background contrast (when compared to the conventional thermal and degree of linear polarization images), as well as additional information content contained in the resultant PCA analysis. Cluster analysis (CA) was used to group pixels of the image that have similar values for the variables chosen. We show that this method is an effective means for separating objects of interest from complex backgrounds, as well as subdividing different features of an object.

DTIC

Cluster Analysis; Far Infrared Radiation; Image Processing; Multivariate Statistical Analysis; Polarimetry; Principal Components Analysis; Thermal Mapping

20070036433 Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen, Germany
Introduction - Background, Goal and Content of the Lecture Series on Polarimetric SAR Interferometry
Keydel, Wolfgang; Feb 1, 2007; 13 pp.; In English; Original contains color illustrations
Report No.(s): AD-A471012; No Copyright; Avail.: Defense Technical Information Center (DTIC)

No abstract available

Interferometry; Lectures; Polarimetry; Synthetic Aperture Radar

20070036436 UIC-ECE Communications, Chicago, IL USA

Basics of SAR Polarimetry I

Boerner, Wolfgang-Martin; Feb 1, 2007; 41 pp.; In English; Original contains color illustrations
Report No.(s): AD-A471015; No Copyright; Avail.: Defense Technical Information Center (DTIC)

No abstract available

Polarimetry; Synthetic Aperture Radar

20070036437 Rennes Univ., France

Advanced Polarimetric Concepts - Part 1 (Polarimetric Target Description, Speckle filtering and Decomposition Theorems)

Pottier, Eric; Lee, Jong-Sen; Ferro-Famil, Laurent; Feb 1, 2007; 31 pp.; In English; Original contains color illustrations
Report No.(s): AD-A471016; No Copyright; Avail.: Defense Technical Information Center (DTIC)

No abstract available

Decomposition; Polarimetry; Synthetic Aperture Radar; Targets; Theorems

20070036438 Rennes Univ., France

Advanced Polarimetric Concepts - Part 2 (Polarimetric Target Classification)

Pottier, Eric; Lee, Jong-Sen; Ferro-Famil, Laurent; Feb 1, 2007; 41 pp.; In English; Original contains color illustrations
Report No.(s): AD-A471017; No Copyright; Avail.: Defense Technical Information Center (DTIC)

No abstract available

Classifications; Interferometry; Polarimetry; Synthetic Aperture Radar; Targets

20070036600 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

CLEaR: Closed Loop Execution and Recovery High-Level Onboard Autonomy for Rover Operations

Fisher, Forest W.; Estin, Tara; Nesnas, Issa; October 11, 2001; 18 pp.; In English; Demonstration of CLEaR software performed in the Mars Yard, JPL, 11 Oct. 2001, Pasadena, CA, USA; Original contains black and white illustrations; Copyright; Avail.: Other Sources

ONLINE: <http://hdl.handle.net/2014/40393>

This viewgraph presentation covers the following topics: Coupled Layer Architecture for Robotic Autonomy CLARAty system at the functional layer and the decision layer; and CLEaR - AI Planning and Schedule - Task Based Control, A demonstration of the operation of the system is given, with viewgraphs of the rover movement control.

CASI

Autonomy; Feedback Control; Roving Vehicles; Robotics; Control Systems Design; Unmanned Ground Vehicles

20070036631 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

Control in Unmanned NASA Missions

Ruoff, Carl F.; August 26, 2003; 31 pp.; In English; Advanced System Integration and Control for Life Support Workshop, 26-28 Aug. 2003, Monterey, CA, USA; Original contains black and white illustrations; Copyright; Avail.: Other Sources

ONLINE: <http://hdl.handle.net/2014/40421>

This viewgraph presentation reviews several general aspects of control for NASA space missions. Included in the review are the Entry, Descent and Landing (EDL) for both Mars Exploration Rover (MER), and Mars Science Laboratory (MSL); and the control of the MER Rover. Also included is discussion about control issues in relation to formation flying, adaptive optics and precision wavefront control, sensors for environmental control- ENose. Essential developments in the areas of

control are important for increase in Autonomy/Automation is essential for deep space manned missions. Other areas of concern are robustness and the need to address life support system control issues.

CASI

Autonomy; NASA Programs; Command and Control; Adaptive Control; Environmental Control

20070036645 Condition Monitoring and Diagnostic Engineering Management International, Birmingham, UK

International Journal of COMADEM: Volume 9, Number 3

Rao, B. K. N., Editor; July 2006; ISSN 1363-7681; 51 pp.; In English; See also 20070036646 - 20070036649; Original contains black and white illustrations; Copyright; Avail.: Other Sources

The following topics are discussed: a) Intelligent Systems; b) Optimisation of Heat Treatment Parameters using Artificial Intelligence Techniques; c) Induction Motor Fault Detection & Diagnosis using Artificial Neural Networks; and d) How to Diagnose the Wear of Rolling Element Bearings based on Indirect Condition Monitoring Methods.

Derived from text

Artificial Intelligence; Fault Detection; Induction Motors; Neural Nets; Diagnosis; Heat Treatment

20070036646 Technical Research Centre of Finland, Finland

How to Diagnose the Wear of Rolling Element Bearings based on Indirect Condition Monitoring Methods

Jantunen, Etkki; International Journal of COMADEM: Volume 9, Number 3; July 2006, pp. 24-38; In English; See also [20070036645](#); Copyright; Avail.: Other Sources

In maintenance it is of greatest importance to know what should be done and when. With condition monitoring it is possible to reduce the number of unplanned stoppages, which cost a lot of money compared to planned maintenance actions. Condition monitoring of rotating machinery, i.e. detection of wear of the components of the machinery, is usually based on indirect methods or monitoring because it is very difficult to monitor or measure wear as such in practice. The reason for this is simply that no such practical methods exist that could be used for measuring the wear of such machinery components as bearings or gears or impellers etc. because these are hidden behind supporting structure or covers. Today the diagnosis of the needed maintenance prior the component in question will break. The paper tries to tackle this question in case of rotating machinery and time there is before the component will suffer catastrophic failure. The paper starts with a discussion of the wear of rolling element bearings. How does it start, how does it proceed and how does it increase towards the end of the life of the components? The link between the indirect monitoring methods such as oil analysis techniques, vibration measurements and measurement of acoustic emission is covered into some extent. The developed approach starts from the idea of modelling the wear of the component. In case of rotating machinery components the wear often takes place progressively. The reason for this is that when a fault is initiated it increases with increasing speed because the loads that are the cause of wear increase as a function of the size of the fault. In the approach a limited number of condition monitoring parameters are used for diagnosis of the fault. These parameters are then used as input in higher order polynomial regression functions with a limited number of terms. The purpose of using higher order polynomial regression functions is to be able to mimic the development of the fault and also to be able to save the history, i.e. the trend of the development of these parameters, in a very compact form. The regression functions can give prognosis of the development of the fault. The severity of the situation is analyzed using simplified fuzzy logic. A number of measured and analyzed examples are given. All the examples concern rolling bearings, which are probably the most widely monitored component of rotating machinery in the industry. In the tested cases the bearing fault can be diagnosed when about three or four percent of the lifetime of the bearing still remains.

Author

Wear; Rotating Electrical Machines; Automatic Control; Mechanical Engineering; Roller Bearings

20070036647 Glamorgan Univ., Pontypridd, Glamorgan, UK

Intelligent Systems

Wilcox, S. J.; International Journal of COMADEM: Volume 9, Number 3; July 2006, pp. 2-6; In English; See also [20070036645](#); Copyright; Avail.: Other Sources

In this paper the nature of intelligence is explored briefly and artificial intelligence is introduced. Three techniques that can allow a computer to achieve limited intelligence are discussed and some examples are presented.

Author

Artificial Intelligence; Biometrics; Neural Nets; Neurology

20070036648 Glamorgan Univ., Pontypridd, Glamorgan, UK

Optimisation of Heat Treatment Parameters using Artificial Intelligence Techniques

Chong, Zyh Siong; Wilcox, Steven; Ward, John; International Journal of COMADEM: Volume 9, Number 3; July 2006, pp. 7-14; In English; See also [20070036645](#); Copyright; Avail.: Other Sources

This paper describes the work undertaken by the University of Glamorgan and CORUS Rotherham UK to apply artificial neural networks to model the cold alloy-steel bars and the heat treatment parameters with their end-product quality characteristics. Standard multi-layered feed forward artificial neural networks (ANNs) were employed to represent the functional mapping of inputs such as physical dimension, material composition and the parameters of the heat treatment cycles to the Brinell Hardness (HB) and the Ultimate Tensile Strength (UTS). The HB and UTS networks were validated with new data sets and demonstrated a satisfactory level of predictions over a range of conditions. These neural networks were then integrated into a Genetic Algorithm (GA) search strategy to identify the best material characteristics and furnace operating parameters in order that both the HB and UTS values are maximised. The results demonstrated that the hybrid strategy of combining the neural network based models with GA can deliver sensible results.

Author

Artificial Intelligence; Heat Treatment; Optimization; Steels; Neural Nets

20070036649 Queens Univ., Kingston, Ontario, Canada; Queens Univ., Kingston, Ontario, Canada

Induction Motor Fault Detection and Diagnosis using Artificial Neural Networks

Li, Lingxin; Mechevske, Chris K.; International Journal of COMADEM: Volume 9, Number 3; July 2006, pp. 15-23; In English; See also [20070036645](#); Copyright; Avail.: Other Sources

This paper investigates induction motor fault detection and diagnosis using Artificial Neural Networks (ANN). The ANN techniques used here include feedforward backpropagation networks (FFBPN) and self organizing maps (SOM), used individually and in combination. Common induction motor faults such as bearing faults, stator winding fault, unbalanced rotor and broken rotor bars are considered. The ANNs were trained and tested using dynamic measurements of stator currents and mechanical vibration signals. The effects of different network structures and the training set sizes on the performance of the ANNs are discussed. This study shows that, while the feedforward ANNs give satisfactory results and the SOMs can classify the type of motor fault during steady state working conditions, using a combination of SOM and FFBPN techniques yields superior fault detection and diagnostic accuracy. In addition, incipient motor fault detection has been investigated. The above results show that improved induction motor maintenance strategies may be possible through the use of comprehensive on-line induction motor condition monitoring and fault diagnosis systems.

Author

Artificial Intelligence; Fault Detection; Induction Motors; Neural Nets; Feedforward Control; Backpropagation (Artificial Intelligence)

20070036660 NASA Langley Research Center, Hampton, VA, USA

Assessing the Effects of Momentary Priming on Memory Retention During an Interference Task

Schutte, Paul C.; November 2007; 56 pp.; In English; Original contains black and white illustrations

Contract(s)/Grant(s): WBS 609866.02.07.07

Report No.(s): NASA/TM-2007-214318; L-19210; LAR-172220-1; No Copyright; Avail.: CASI: [A04](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20070036660>

A memory aid, that used brief (33ms) presentations of previously learned information (target words), was assessed on its ability to reinforce memory for target words while the subject was performing an interference task. The interference task required subjects to learn new words and thus interfered with their memory of the target words. The brief presentation (momentary memory priming) was hypothesized to refresh the subjects memory of the target words. 143 subjects, in a within subject design, were given a 33ms presentation of the target memory words during the interference task in a treatment condition and a blank 33ms presentation in the control condition. The primary dependent measure, memory loss over the interference trial, was not significantly different between the two conditions. The memory prime did not appear to hinder the subjects performance on the interference task. This paper describes the experiment and the results along with suggestions for future research.

Author

Memory; Retention (Psychology); Interference; Human Factors Engineering; Cognitive Psychology

20070036745 Norwegian Defence Research Establishment, Kjeller, Norway

Bi- and Multistatic Radar

Johnsen, Terje; Olsen, Karl E; Sep 1, 2006; 35 pp.; In English; Original contains color illustrations
Report No.(s): AD-A470685; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: <http://hdl.handle.net/100.2/ADA470685>

No abstract available

Multistatic Radar; Doppler Effect

20070036776 Forschungsgesellschaft fuer Angewandte Naturwissenschaften e.V, Wachtberg-Werthhoven, Germany

Space-Time Adaptive Processing: Fundamentals

Buerger, Wolfram; Sep 1, 2006; 15 pp.; In English; Original contains color illustrations
Report No.(s): AD-A470688; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: <http://hdl.handle.net/100.2/ADA470688>

No abstract available

Signal Processing; Radar Tracking; Moving Target Indicators; Space-Time Adaptive Processing

20070036777 Forschungsgesellschaft fuer Angewandte Naturwissenschaften e.V, Wachtberg-Werthhoven, Germany

Introduction to Synthetic Aperture Radar (SAR)

Berens, Patrick; Sep 1, 2006; 15 pp.; In English
Report No.(s): AD-A470686; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: <http://hdl.handle.net/100.2/ADA470686>

No abstract available

Synthetic Aperture Radar; Synthetic Apertures; Surveillance Radar

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NUMERICAL ANALYSIS

Includes iteration, differential and difference equations, and numerical approximation.

20070035074 NASA Langley Research Center, Hampton, VA, USA

The SMM Model as a Boundary Value Problem Using the Discrete Diffusion Equation

Campbell, Joel; [2007]; 13 pp.; In English; Original contains black and white illustrations
Contract(s)/Grant(s): WBS 810031.07.03; No Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: <http://hdl.handle.net/2060/20070035074>

A generalized single step stepwise mutation model (SMM) is developed that takes into account an arbitrary initial state to a certain partial difference equation. This is solved in both the approximate continuum limit and the more exact discrete form. A time evolution model is developed for Y DNA or mtDNA that takes into account the reflective boundary modeling minimum microsatellite length and the original difference equation. A comparison is made between the more widely known continuum Gaussian model and a discrete model, which is based on modified Bessel functions of the first kind. A correction is made to the SMM model for the probability that two individuals are related that takes into account a reflecting boundary modeling minimum microsatellite length. This method is generalized to take into account the general n-step model and exact solutions are found. A new model is proposed for the step distribution.

Author

Boundary Value Problems; Difference Equations; Mathematical Models; Mutations; Discrete Functions; Diffusion

20070035188 Naval Postgraduate School, Monterey, CA USA

Computational Modeling of the Spatial Distribution and Temporal Decay of Geomagnetically Trapped Debris of a High Altitude Nuclear Detonation

Cross, Jr, Christopher G; Jun 2007; 263 pp.; In English; Original contains color illustrations
Report No.(s): AD-A470109; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: <http://hdl.handle.net/100.2/ADA470109>

With the absence of nuclear weapons testing there has been an increase in the reliance on simulation and modeling for the analysis of nuclear weapons effects. The principal objective of this dissertation was to develop a particle code for modeling

the spatial distribution and temporal decay of ionized fission fragments and beta-decay electrons injected into the magnetic field of the earth. No known code existed for this explicit purpose. The code provides a robust, realistic computational capability to predict the persistent radiation environment produced for such an injection (most likely due to a nuclear detonation at high altitudes) into L-shells less than 1.5. The code can also be used to produce a source term for the weapons debris from a nuclear detonation at any high altitude location. Using the model, several of the free parameters are examined and reported to highlight the sensitivity of the persistent environment to the initial conditions fission fragment release. The parameters examined and reported here include the effects of ion release location (longitude, latitude, and altitude), the charge state of the fission fragments, the beta decay half-life, the initial pitch angle of the fission fragments, and the significance of neutral fission fragments. Additionally, the effects of the magnetic bubble on the dispersion and trapping efficiency of the particles is studied and reported.

DTIC

Debris; Detonation; High Altitude; Mathematical Models; Nuclear Explosions; Nuclear Weapons; Radiation Belts; Spatial Distribution

20070035196 Toledo Univ., OH USA

Aperture and Receiver Technology. Delivery Order 0002: Bandwidth Invariant Spatial Processing. Volume 1. Computational Requirement Analysis of Wide-Band Direction of Arrival (DOA) Algorithms

Jamali, Mohsin M; May 2007; 126 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): FA8650-05-D-1848-0002; Proj-7622

Report No.(s): AD-A470117; UT-DSPH-10; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470117>

This work performed a review of wide-band DOA algorithms in the literature which was accumulated for more than 30 years. We have reviewed the most relevant ones with the goal of implementing them in hardware for real time applications. We have discovered a class of computational requirements that would be required in all these algorithms. We have also given reviews and challenges. We were able to cut through all the mathematics and convert algorithms into simple arithmetic operations. This step is very useful in visualizing an architecture. We have filled a gap between the design of computer hardware especially special purpose parallel architectures and available algorithms for various wide-band DOA algorithms. This work was the first step in sorting out which algorithm is appropriate for further study and for its hardware implementation for real time applications.

DTIC

Algorithms; Analysis (Mathematics); Apertures; Architecture (Computers); Bandwidth; Broadband; Receivers; Signal Processing

20070035197 Naval Postgraduate School, Monterey, CA USA

Oscillations of a Multi-String Pendulum

Dendis, Alexandros; Jun 2007; 155 pp.; In English; Original contains color illustrations

Report No.(s): AD-A470118; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470118>

The mathematical pendulum is one of the most widely studied problems in engineering physics. This is, however, primarily limited to the classical pendulum with a single bar and mass configuration. Extensions to this include multi-degree of freedom systems, but many of the classical assumptions, such as a single bar per mass, are preserved. Several designs used in practice utilize multiple or trapezoidal configurations to enhance stability. Such designs have not been studied in great detail and there is a need for additional work to fully analyze their response characteristics. The two-string pendulum design characteristics are initially investigated, both in terms of oscillation characteristics and string tension. Analytical and numerical methodologies are applied to predict the response of the two-string pendulum in free and forced oscillations. Validation of the results is performed by comparisons to simulations conducted with a standard commercial software package. A preliminary optimization study is conducted for a driven two-string pendulum. Finally, it is shown how to apply the results of the analysis and optimization studies developed in this work in a typical design case.

DTIC

Differential Equations; Dynamic Response; Equations of Motion; Nonlinear Equations; Oscillations; Pendulums; Strings

20070035281 Naval Research Lab., Bay Saint Louis, MS USA

A Numerical Simulation of the East Asian Seas in March 2002: Effect of Vertical Grid Choice

Mask, Andrea C; Preller, Ruth H; Oct 26, 2004; 17 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): NRL/JA/7300-04-5019

Report No.(s): AD-A470266; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470266>

The sensitivity of vertical grid choice in the hybrid Navy Coastal Ocean Model (NOOM) is discussed for the Yellow Sea, East Asian Sea, Japan/East Sea domain. In particular, the logarithmically stretched hybrid vertical profile used operationally at the Naval Research Laboratory is compared to six variations. The variations include a full z-level run, a full sigma coordinate run, and other hybrid constructs that modify the hybrid's transition depth or the structure of the operational grid. The results are compared to each other and some limited observations in the framework of setting up a rapidly relocatable ocean model. The comparisons show that the operational vertical grid structure is a good first guess design for a rapidly relocatable ocean model.

DTIC

Asia; Numerical Analysis; Ocean Models; Seas; Selection

20070035323 California Univ., San Diego, La Jolla, CA USA

Enhanced Interface Mechanics for Multimaterial FEM

Benson, David J; Jun 6, 2007; 44 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAAD19-02-1-0266

Report No.(s): AD-B329044; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Multi-material Eulerian and arbitrary Lagrangian-Eulerian methods were originally developed for solving hypervelocity impact problems, but they are attractive for solving a broad range of problems having large deformations, the evolution of new free surfaces, and chemical reactions. The contact, separation, and slip between two surfaces have traditionally been addressed by the mixture theory, however the accuracy of this approach is severely limited. To improve the accuracy, an extended finite element formulation is developed and example calculations are presented. As a side benefit, the mixture theory is eliminated from the multi-material formulation, eliminating the issues associated with the equilibration time between adjacent materials. By design, the new formulation is relatively simple to implement in existing multi-material codes, parallelizes without difficulty, and has a low memory burden.

DTIC

Finite Element Method; Mathematical Models

20070035511 Naval Undersea Warfare Center, Newport, RI USA

Stability Analysis of a Tensioned String With Periodic Supports

Hull, Andrew J; Cray, Benjamin A; Nuttall, Albert H; May 21, 2007; 28 pp.; In English; Original contains color illustrations

Report No.(s): AD-A470346; NUWC-NPT-TR-11814; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This report analyzes the zero-pole locations of an infinite length of tensioned string that has attached periodic supports. The dynamic response of the system is derived for distributed wave number forcing and discrete point forcing acting on the string. These wave number-frequency transfer functions are then written in zero-pole format by a mathematical transformation of their infinite series. Once this is accomplished, the locations of the system's poles and zeros become apparent, and they can be plotted in the wave number frequency plane. It is shown that there are specific regions where an infinite number of poles can exist and specific regions where poles cannot exist. For the system with wave number forcing, the system zeros correspond very closely to the system poles except in the area of the fundamental unsupported string resonance. For the system with point forcing, the zeros can exist in the entire wave number frequency plane except at the fundamental resonance. A numerical example is included, and the different zones of the system are demonstrated.

DTIC

Stability; Stability Tests; Strings

20070035520 Naval Research Lab., Bay Saint Louis, MS USA

Spectral Models Based on Boussinesq Equations

Veeramony, Jay; Kaihatu, James M; Oct 3, 2006; 13 pp.; In English; Original contains color illustrations

Report No.(s): AD-A470361; NRL/PP/7320-05-5277; No Copyright; Avail.: Defense Technical Information Center (DTIC)

For a stationary wave field, spectral models represent the surface wave motion sufficiently accurately. There are however

two drawbacks in using nonlinear spectral models: a) The computational time involved when simulating the random wave field; the number of operations needed is $O(N^2)$ (N is the number of frequency components). b) Spectral models are usually one-equation reduction of the two-equation time domain model, which does not then have the same characteristics of the original model. Here we explore two approaches to solve these problems. First, we use the hybrid FFT technique (Bredmose et al. 2004) both to speed up the calculations and to incorporate higher order nonlinear terms. Second, we look at frequency domain transformation without reducing the model to one equation. Significant improvement in computational speed was obtained with the hybrid FFT approach. The models also show good agreement to the data reported by Mase and Kirby (1992).

DTIC

Equations; Spectra

20070035544 Naval Postgraduate School, Monterey, CA USA

Finite Element and Molecular Dynamics Modeling and Simulation of Thermal Properties

Kidd, Daniel C; Jun 2007; 69 pp.; In English; Original contains color illustrations

Report No.(s): AD-A470416; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This study incorporated two approaches to determine the thermal conductivity of nanocomposite material using numerical modeling and simulation. The first was to look at the nanocomposite material at the macro level using a continuum model. The second approach broke the problem down to the atomic level and addressed the inter-atomic reactions using the Molecular Dynamics model. The continuum model was used to determine the optimal placement and alignment of the nanoparticles within a nanocomposite to provide the largest enhancement of thermal conductivity for the composite. During this process the effects of the particle size and spacing were investigated to determine the function that interparticle spacing and particle size plays in the thermal conductivity of the composite. The Molecular Dynamics model was also used to calculate the thermal conductivity of nanocomposites given the thermal conductivity of the nanoparticles and the base material.

DTIC

Finite Element Method; Molecular Dynamics; Nanocomposites; Simulation; Thermal Conductivity; Thermodynamic Properties

20070035564 Carnegie-Mellon Univ., Pittsburgh, PA USA

Graph-Based Algorithms for Boolean Function Manipulation

Bryant, Randal E; Jan 2001; 29 pp.; In English

Contract(s)/Grant(s): ARPA ORDER-3771; ARPA ORDER-3597

Report No.(s): AD-A470446; No Copyright; Avail.: Defense Technical Information Center (DTIC)

In this paper we present a new data structure for representing Boolean functions and an associated set of manipulation algorithms. Functions are represented by directed, acyclic graphs in a manner similar to the representations introduced by Lee and Akers, but with further restrictions on the ordering of decision variables in the graph. Although a function requires, in the worst case, a graph of size exponential in the number of arguments, many of the functions encountered in typical applications have a more reasonable representation. Our algorithms have time complexity proportional to the sizes of the graphs being operated on, and hence are quite efficient as long as the graphs do not grow too large. We present experimental results from applying these algorithms to problems in logic design verification that demonstrate the practicality of our approach.

DTIC

Algorithms; Boolean Algebra; Boolean Functions; Computers; Logic Design

20070035565 Brown Univ., Providence, RI USA

Strong Stability Preserving Property of the Deferred Correction Time Discretization

Liu, Yuan; Shu, Chi-Wang; Zhang, Mengping; Jan 2007; 29 pp.; In English

Contract(s)/Grant(s): W911NF-04-1-0291

Report No.(s): AD-A470447; BU-DAM-SCG-2007-10; No Copyright; Avail.: Defense Technical Information Center (DTIC)

In this paper, we study the strong stability preserving 'SSP' property of a class of deferred correction time discretization methods, for solving the method-of-lines schemes approximating hyperbolic partial differential equations.

DTIC

Partial Differential Equations; Stability

20070035566 Brown Univ., Providence, RI USA

Radiation Boundary Conditions for Maxwell's Equations: A Review of Accurate Time-Domain Formulations

Hagstrom, Thomas; Lau, Stephen; Jan 2007; 34 pp.; In English

Contract(s)/Grant(s): DAAD19-03-1-0146

Report No.(s): AD-A470448; BU-DAM-SCG-2007-11; No Copyright; Avail.: Defense Technical Information Center (DTIC)

We review time-domain formulations of radiation boundary conditions for Maxwell's equations, focusing on methods which can deliver arbitrary accuracy at acceptable computational cost. Examples include fast evaluations of nonlocal conditions on symmetric and general boundaries, methods based on identifying and evaluating equivalent sources, and local approximations such as the perfectly matched layer and sequences of local boundary conditions. Complexity estimates are derived to assess work and storage requirements as a function of wavelength and simulation time.

DTIC

Boundary Conditions; Maxwell Equation

20070035567 Army Research Office, Research Triangle Park, NC USA

A High Order ENO Conservative Lagrangian Scheme for the Compressible Euler Equations

Cheng, Juan; Shu, Chi-Wang; Jan 2007; 50 pp.; In English

Contract(s)/Grant(s): W911NF-04-1-0291

Report No.(s): AD-A470449; BU-DAM-SCG-2007-12; No Copyright; Avail.: Defense Technical Information Center (DTIC)

We develop a class of Lagrangian schemes for solving the Euler equations of compressible gas dynamics both in the Cartesian and in the cylindrical coordinates. The schemes are based on high order essentially non-oscillatory 'ENO' reconstruction. They are conservative for the density, momentum and total energy, can maintain formal high order accuracy both in space and time and can achieve at least uniformly second order accuracy with moving and distorted Lagrangian meshes, are essentially non-oscillatory, and have no parameters to be tuned for individual test cases. One and two dimensional numerical examples in the Cartesian and cylindrical coordinates are presented to demonstrate the performance of the schemes in terms of accuracy, resolution for discontinuities, and non-oscillatory properties.

DTIC

Differential Equations; Essentially Non-Oscillatory Schemes; Gas Dynamics; Lagrangian Function

20070035577 Georgia Inst. of Tech., Atlanta, GA USA

An Image Morphing Technique Based on Optimal Mass Preserving Mapping

Zhu, Lei; Yang, Yan; Haker, Steven; Tannenbaum, Allen; Jun 2007; 16 pp.; In English

Contract(s)/Grant(s): U54-EB005149

Report No.(s): AD-A470478; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Image morphing, or image interpolation in the time domain, deals with the metamorphosis of one image into another. In this paper, a new class of image morphing algorithms is proposed based on the theory of optimal mass transport. The L2 mass moving energy functional is modified by adding an intensity penalizing term, in order to reduce the undesired double exposure effect. It is an intensity-based approach and, thus, is parameter free. The optimal warping function is computed using an iterative gradient descent approach. This proposed morphing method is also extended to doubly connected domains using a harmonic parameterization technique, along with finite-element methods.

DTIC

Algorithms; Interpolation

20070035615 Georgia Inst. of Tech., Atlanta, GA USA

Distributed Global Identification for Sensor Networks

Ould-Ahmed-Vall, ElMoustapha; Blough, Douglas M; Heck, Bonnie S; Riley, George F; Jan 2005; 17 pp.; In English

Contract(s)/Grant(s): N66002-00-1-8934

Report No.(s): AD-A470551; No Copyright; Avail.: Defense Technical Information Center (DTIC)

A sensor network consists of a set of battery-powered nodes, which collaborate to perform sensing tasks in a given environment. It may contain one or more base stations to collect sensed data and possibly relay it to a central processing and storage system. These networks are characterized by scarcity of resources, in particular the available energy. We present a distributed algorithm to solve the unique ID assignment problem. The proposed solution starts by assigning long unique IDs

and organizing nodes in a tree structure. This tree structure is used to compute the size of the network. Then unique IDs are assigned using the minimum number of bytes. Globally unique IDs are useful in providing many network functions, e.g. configuration, monitoring of individual nodes, and various security mechanisms. Theoretical and simulation analysis of the proposed solution have been performed. The results demonstrate that a high percentage of nodes 'more than 99%' are assigned globally unique IDs at the termination of the algorithm when the algorithm parameters are set properly. Furthermore, the algorithm terminates in a relatively short time that scales well with the network size. For example, the algorithm terminates in about 5 minutes for a network of 1,000 nodes.

DTIC

Algorithms; Networks

20070035784 University of Southern California, Marina del Rey, CA USA

Automated Story Capture From Internet Weblogs

Gordon, Andrew S; Cao, Qun; Swanson, Reid; Jan 2007; 3 pp.; In English

Report No.(s): AD-A470419; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Among the most interesting ways that people share knowledge is through the telling of stories, i.e. first-person narratives about real-life experiences. Millions of these stories appear in Internet weblogs, offering a potentially valuable resource for future knowledge management and training applications. In this paper we describe efforts to automatically capture stories from Internet weblogs by extracting them using statistical text classification techniques. We evaluate the precision and recall performance of competing approaches. We describe the large-scale application of story extraction technology to Internet weblogs, producing a corpus of stories with over a billion words.

DTIC

Information Management; Internets; Machine Learning; Pattern Recognition

20070036016 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Particle Analysis Pitfalls

Hughes, David; Dazzo, Tony; [2007]; 23 pp.; In English; Particle Analysis Pitfalls, 17-19 Jul. 2007, Columbia, MD, USA; Original contains color illustrations; Copyright; Avail.: CASI: [A03](#), Hardcopy

This viewgraph presentation reviews the use of particle analysis to assist in preparing for the 4th Hubble Space Telescope (HST) Servicing mission. During this mission the Space Telescope Imaging Spectrograph (STIS) will be repaired. The particle analysis consisted of Finite element mesh creation, Black-body viewfactors generated using I-DEAS TMG Thermal Analysis, Grey-body viewfactors calculated using Markov method, Particle distribution modeled using an iterative Monte Carlo process, (time-consuming); in house software called MASTRAM, Differential analysis performed in Excel, and Visualization provided by Tecplot and I-DEAS. Several tests were performed and are reviewed: Conformal Coat Particle Study, Card Extraction Study, Cover Fastener Removal Particle Generation Study, and E-Graf Vibration Particulate Study. The lessons learned during this analysis are also reviewed.

CASI

Finite Element Method; Imaging Techniques; Monte Carlo Method; Particulates; Spectrographs; Thermal Analysis

20070036017 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

A Priori Analysis of Subgrid-Scale Models for Large Eddy Simulations of Supercritical Binary-Species Mixing Layers

Okong'o, Nora; Bellan, Josette; January 10, 2005; 15 pp.; In English; American Institute of Aeronautics and Astronautics Sciences Meeting, 10-15 Jan. 2005, Reno, NV, USA; Copyright; Avail.: Other Sources

ONLINE: <http://hdl.handle.net/2014/40504>

Models for large eddy simulation (LES) are assessed on a database obtained from direct numerical simulations (DNS) of supercritical binary-species temporal mixing layers. The analysis is performed at the DNS transitional states for heptane/nitrogen, oxygen/hydrogen and oxygen/helium mixing layers. The incorporation of simplifying assumptions that are validated on the DNS database leads to a set of LES equations that requires only models for the subgrid scale (SGS) fluxes, which arise from filtering the convective terms in the DNS equations. Constant-coefficient versions of three different models for the SGS fluxes are assessed and calibrated. The Smagorinsky SGS-flux model shows poor correlations with the SGS fluxes, while the Gradient and Similarity models have high correlations, as well as good quantitative agreement with the SGS fluxes when the calibrated coefficients are used.

Author

Large Eddy Simulation; Scale Models; Direct Numerical Simulation; Heptanes; Nitrogen; Gradients

20070036071 College of William and Mary, Williamsburg, VA USA

Development of Algorithms for Nonlinear Physics on Type-II Quantum Computers

Vahala, George; Jul 2007; 12 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): FA9550-04-1-0044

Report No.(s): AD-A470585; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470585>

Using CAP resources we have been able to uncover lattice geometry effects in the entropic lattice Boltzmann algorithm that had not been expected from lower grid resolution runs. In the entropic formulation, one is working with a generalized BGK collision operator that has within it the germs of detailed balance. Thus, the unconditionally stable algorithm is achieved with a variable transport coefficient, not unlike Large Eddy Simulations (LES) in CFD. Indeed, we have explored this connection in some detail but will report those findings elsewhere due to space limitations here. Another unexpected result unearthed by the CAP runs was the dependence of the ELB on the Mach number. A low Mach number expansion has to be performed to analytically evaluate the Lagrange multipliers arising in the extremization of the H-function subject to local collisional constraints. We have found that the Qi 5-bit model is less sensitive to the flow Mach number than the Q27-bit model. Another somewhat unexpected finding was the importance of maintaining the distribution function correlations in the mesoscopic description. To perform the long-time 1 600 ~grid runs we needed to perform continuation runs. In the early stages of CAP we tried to minimize the amount of i/o read-out/read-in and to reconstruct the relaxation distribution function from its moments rather than keeping the full correlation information. While this did not affect the energy decay, there were significant discontinuities introduced into the enstrophy and higher energy spectral moments. The parallelization strength of ELB arises from the modeling of the macroscopic nonlinear derivatives by local moments. Chapman-Enskog asymptotics will then, on projecting back into physical space, yield these nonlinear derivatives.

DTIC

Algorithms; Bose-Einstein Condensates; Computational Fluid Dynamics; Lagrangian Function; Large Eddy Simulation; Nonlinear Systems; Nonlinearity; Physics; Quantum Computers; Turbulence

20070036286 Naval Research Lab., Bay Saint Louis, MS USA

Model-Based Directed Drifter Launches in the Adriatic Sea: Results from the DART Experiment

Haza, A C; Griffa, A; Martin, P; Molcard, A; Oezgoekmen, T M; Poje, A C; Barbanti, R; Book, J W; Poulain, P M; Rixen, M; May 23, 2007; 6 pp.; In English

Report No.(s): AD-A470723; NRL/JA/7320-07-7085; No Copyright; Avail.: Defense Technical Information Center (DTIC)

A high-resolution numerical model of the Adriatic Sea is used to predict Lagrangian coherent structure boundaries, quantified by finite-size Lyapunov exponents (FSLE), for flow features in the region of the Gargano Peninsula during the course of the Dynamics of the Adriatic in Real Time (DART) observational program. FSLE fields computed from two-day model forecasts of the surface velocity indicate distinct regions of high relative drifter dispersion. Model predictions of such regions located on available ship-tracks were used to direct the launching of pairs of surface drifters on three days during March 2006, with the goal of maximizing coverage of the sampling area. For two of the three launches, the observed trajectories separated at locations and along directions closely approximated by those predicted from the model FSLE fields. The third case acted as an inadvertent control experiment. Model predictions at release-time showed minimal FSLE structure at the launch locations and the observed drifter pair advected in a coherent fashion for two days. While there are considerable differences between individual drifter observations and trajectory envelopes computed from ensembles of synthetic drifters, the experiment confirms the model's ability to approximate the location and shape of energetic flow features controlling the near-time fate of quasi-Lagrangian particles. Overall, the combined use of FSLEs with realistic coastal circulation models appears to be a promising avenue to aid real-time-directed drifter launches in observational programs.

DTIC

Adriatic Sea; Launching; Models; Real Time Operation

20070036290 Naval Research Lab., Bay Saint Louis, MS USA

Evidence of Multimodal Structure of the Baroclinic Tide in the Strait of Gibraltar

Vazquez, A; Stashchuk, N; Vlasenko, V; Bruno, M; Izquierdo, A; Gallacher, P C; Sep 8, 2006; 7 pp.; In English

Contract(s)/Grant(s): Proj-73-6836-B6

Report No.(s): AD-A470733; NRL/JA/7330-06-6230; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The multimodal structure of the baroclinic tides in the Strait of Gibraltar is studied using observations and numerical simulations. Observational data and model results revealed the presence of two types of tidal internal waves generated over Camarinal Sill (CS). One propagates toward the Mediterranean and disintegrates into a series of nonlinear short internal waves

with amplitudes of 50 m and more. The second type, behind the first, propagates slower and has a longer wavelength. The vertical structure with both upward and downward displacements of isopycnals can be identified as a manifestation of higher baroclinic modes. Analysis of the empirical orthogonal functions of the ADCP measurements performed over CS and model time series has shown that the second baroclinic mode predominates in the second type of internal wave. Its amplitude can reach one-third that of the first baroclinic mode of the leading waves of depression.

DTIC

Baroclinity; Gibraltar; Internal Waves; Mathematical Models; Ocean Surface; Oceans; Straits; Tides; Water Waves

20070036315 California State Univ., Long Beach, CA USA

Characterization and Detection of Delamination in Smart Composite Structures

Chen, Hsin-Piao; Chattopadhyay, Aditi; Dec 31, 2006; 50 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAAD19-02-1-0355

Report No.(s): AD-A470797; No Copyright; Avail.: Defense Technical Information Center (DTIC)

A multidisciplinary procedure has been developed for damage diagnosis or interrogation based on the concept of analyzing temporal relations between values of critical variables. Some observable variable of the system is traced through time from a specific initial state. The dynamics of the degradation process can be described by a time-variant mathematical model of this relationship. A novel neural-network-based approach to damage diagnosis and prognosis for nonlinear dynamic systems has been developed. High quality response surface approximations are developed to the progressive damage model. A neural network is trained to model the multi-dimensional response surface that relates the dependent variables to the independent variables. The main advantage of neural networks is that much more complex nonlinear relationships can be modelled, potentially incorporating high order interactions between predictive variables. A distinct feature of the proposed technique for constructing the response surface approximations is that it permits explicit treatment of the dynamics of the process under observation - in this case, structural damage that evolves in time. Assessing and quantifying existing damage may be treated as a static problem and its solution can be summarized by a mapping from parametric descriptions of damage attributes and measured structural response data.

DTIC

Composite Structures; Delaminating; Smart Structures

20070036324 California Univ., Santa Barbara, CA USA

A Robust Stability and Control Theory for Hybrid Dynamical Systems

Teel, Andrew R; Hespanha, Joao P; Sep 30, 2006; 12 pp.; In English

Contract(s)/Grant(s): DAAD19-03-1-0144

Report No.(s): AD-A470821; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The objectives of this work are 1) to develop a robust stability theory for hybrid dynamical systems, both in continuous time and discrete time, including a complete theory on the existence of smooth Lyapunov functions (which are the major workhorse for the analysis of non-hybrid dynamical systems) for hybrid systems; 2) to exploit this theory in developing tools for the design of robust feedback control algorithms for hybrid dynamical systems; and 3) to apply the developed control concepts to problems relevant to the Army's mission, ie.g., autonomous vehicles and network centric control.

DTIC

Autonomous Navigation; Control Theory; Dynamical Systems; Liapunov Functions; Stability

20070036775 Naval Research Lab., Bay Saint Louis, MS USA

Directional Validation of Wave Predictions

Rogers, W E; Wang, David W; Mar 2007; 18 pp.; In English

Report No.(s): AD-A470714; NRL/JA/7320-05-5179; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470714>

A methodology for quantitative, directional validation of a long-term wave model hindcast is described and applied. Buoy observations are used as ground truth and the method does not require the application of a parametric model or data-adaptive method to the observations. Four frequency ranges, relative to the peak frequency, are considered. The validation of the hindcast does not suggest any systematic bias in predictions of directional spreading at or above the spectral peak. Idealized simulations are presented to aid in the interpretation of results.

DTIC

Wave Propagation; Proving

STATISTICS AND PROBABILITY

Includes data sampling and smoothing; Monte Carlo method; time series analysis; and stochastic processes.

20070035153 Iowa State Univ. of Science and Technology, Ames, IA USA

Controlled Stochastic Dynamical Systems

Weerasinghe, Ananda P; Apr 18, 2007; 17 pp.; In English

Contract(s)/Grant(s): W911NF-05-1-0032

Report No.(s): AD-A470046; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470046>

In section 1, we describe our results on optimal control of a long term average cost rate problem. A new method, 'an Abelian limit approach is developed to solve this singular control problem. Abelian limit relations between three types of value functions are also developed. Results on two singular control problems arising from queueing networks in heavy traffic are described in section 2. There we derive an 'optimal buffer size' for the singular control problem and it will yield asymptotically optimal buffer lengths for the corresponding queueing networks in heavy traffic. In section 3, the results on a combined control and stopping problem is described. Novelty feature here is that the diffusion coefficient is controlled and it is allowed to take the value zero. A martingale characterization is derived. Also, an explicit optimal strategy is obtained when the drift coefficient is linear. A stochastic differential game with degenerate variance control is described.

DTIC

Control Systems Design; Dynamical Systems; Queueing Theory; Stochastic Processes

20070035487 Woods Hole Oceanographic Inst., MA USA

Applied Stochastic Eigen-Analysis

Nadakuditi, Rajesh R; Feb 2007; 202 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DMS-0411962

Report No.(s): AD-A470318; MIT/WHOI-2007-01; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The first part of the dissertation investigates the application of the theory of large random matrices to high-dimensional inference problems when the samples are drawn from a multivariate normal distribution. A longstanding problem in sensor array processing is addressed by designing an estimator for the number of signals in white noise that dramatically outperforms that proposed by Wax and Kailath. This methodology is extended to develop new parametric techniques for testing and estimation. Unlike techniques found in the literature, these exhibit robustness to high-dimensionality, sample size constraints and eigenvector misspecification. By interpreting the eigenvalues of the sample covariance matrix as an interacting particle system, the existence of a phase transition phenomenon in the largest ('signal') eigenvalue is derived using heuristic arguments. This exposes a fundamental limit on the identifiability of low-level signals due to sample size constraints when using the sample eigenvalues alone.

DTIC

Eigenvalues; Stochastic Processes

20070035534 Naval Postgraduate School, Monterey, CA USA

Performance Analysis of a Variable Data Rate TCM Waveform Transmitted Over a Channel with AWGN and Pulse-Noise Interference

Katzourakis, Ioannis; Jun 2007; 121 pp.; In English; Original contains color illustrations

Report No.(s): AD-A470398; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Trellis-coded modulation (TCM) is a technique where forward error correction coding and modulation are treated in a single operation without increasing the channel bandwidth. In this thesis the performance of a variable data rate TCM waveform transmitted over a channel is investigated. In general, TCM systems with rate 1/2 and rate 2/3 convolutional codes and Quadrature-phase-shift keying (QPSK) and 8-phase-shift keying (PSK) modulation, respectively, are considered for two cases. In the first case, the number of memory elements K remains constant as the code rate increases. In the second case, the number of memory elements increases linearly with code rate, so that the total number of memory elements for 8-PSK, $r=2/3$ TCM is given by $1/2 \cdot 2 \cdot K \cdot K = K^2$, where $1/2 \cdot K$ is the number of memory elements for the QPSK, $r=1/2$ convolutionally encoded TCM. The effects of pulse-noise interference (PNI) in addition to additive white Gaussian noise (AWGN) are considered. It was

found that TCM systems have significant resistance to PNI when K is large enough.

DTIC

Coding; Computer Storage Devices; Error Correcting Codes; Modulation; Pulse Code Modulation; Random Noise; Rates (Per Time); Reliability Analysis; Waveforms

20070035548 Northwestern Univ., Evanston, IL USA

Constructing Spatial Representations of Variable Detail for Sketch Recognition

Lovett, Andrew; Dehghani, Morteza; Forbus, Kenneth; Jan 2007; 7 pp.; In English

Report No.(s): AD-A470425; No Copyright; Avail.: Defense Technical Information Center (DTIC)

We describe a system which constructs spatial representations of sketches drawn by users. These representations are currently being used as the input for a spatial reasoning system which learns classifiers for performing sketch recognition. The spatial reasoning system requires representations at a level of detail sparser than that which the representation constructor normally builds. Therefore, we describe how the representation constructor ranks the expressions in its output so that the number of expressions in the representation can be decreased with minimal loss of information. We evaluate the overall system, showing that it is able to learn and utilize classifiers for complex sketches even when the representation size is sharply diminished.

DTIC

Classifications; Pattern Recognition; Spatial Distribution

20070035561 Boston Univ., Boston, MA USA

Multi-scale 3D Scene Flow from Binocular Stereo Sequences (Preprint)

Li, Rui; Sclaroff, Stan; Jun 2007; 30 pp.; In English

Contract(s)/Grant(s): N00014-03-1-0108; CNS-0202067

Report No.(s): AD-A470442; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Scene flow methods estimate the three-dimensional motion field for points in the world using multi-camera video data. Such methods combine multi-view reconstruction with motion estimation. This paper describes an alternative formulation for dense scene flow estimation that provides reliable results using only two cameras by fusing stereo and optical flow estimation into a single coherent framework. Internally, the proposed algorithm generates probability distributions for optical flow and disparity. Taking into account the uncertainty in the intermediate stages allows for more reliable estimation of the 3D scene flow than previous methods allow. To handle the aperture problems inherent in the estimation of optical flow and disparity, a multi-scale method along with a novel region-based technique is used within a regularized solution. This combined approach both preserves discontinuities and prevents over-regularization - to problems commonly associated with the basic multi-scale approaches. Experiments with synthetic and real test data demonstrate the strength of the proposed approach.

DTIC

Sequencing

20070036747 Naval Postgraduate School, Monterey, CA USA

System Availability

Gaver, Donald P; Jacobs, Patricia A; Jul 2007; 17 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DTAM70006

Report No.(s): AD-A470646; NPS-OR-07-003; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470646>

Availability quantifies the propensity of a system to be functionally operative upon demand. It increases if operating times between failures ('up times') are long, and decreases if, following failure or anticipatory removal, logistics delays and repair ('down times') are protracted. This chapter summarizes the general availability concept and discusses the limitation of operational availability suggesting that mission availability is often more useful and appropriate.

DTIC

Reliability; Systems Engineering; Statistical Analysis

SYSTEMS ANALYSIS AND OPERATIONS RESEARCH

Includes mathematical modeling of systems; network analysis; mathematical programming; decision theory; and game theory.

20070035155 Lund Inst. of Tech., Sweden

Enhancement and Development of Numerical Models for Simulating Coastal Sediment Transport and Morphology Evolution

Hanson, Hans; Jul 2007; 21 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): N62558-07-C-0003

Report No.(s): AD-A470048; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470048>

Background Sediment exchange between the subaerial and sub-aqueous portion of the beach occurs primarily across-shore, driven by wave motion in the swash zone. Water level is a leading factor in this process because it defines the starting point of the swash zone and to what elevation the uprushing waves may reach. Over longer time periods, wind-blown sand may also be an important factor for the cross-shore sediment exchange on the subaerial portion of the beach. This exchange takes place between the dune and the broad, flat berm often present on the seaward side of the dune. Since Cascade simulates coastal evolution over decades to centuries, it is important to include wind-blown sand in models of cross-shore sediment exchange. Depending on the morphology of the subaerial beach, different types of response to transport by incident waves and wind-blown sand are expected, implying supply or depletion of sediment from the sub-aqueous beach with associated advance or recession of the shoreline, respectively. Erosion of dunes or soft cliffs supplies the beach with sediment, whereas transport by wind moves sediment from the berm to the dune. Also, during severe storms, the dunes might overwash, causing transport of sediment onshore over the dune crest and deposition on the landward side of the dune crest (Donnelly et al. 2006). Thus, a physics-based approach to model the sediment exchange between the subaerial and sub-aqueous portion of the beach requires description of dunes subject to erosion by wave impact and overwash, as well as to build-up by wind-blown sand.

DTIC

Augmentation; Coasts; Mathematical Models; Models; Morphology; Sediment Transport; Simulation; Splashing

20070035164 Naval Postgraduate School, Monterey, CA USA

Game Theory: Toolkit and Workbook for Defense Analysis Students

Feix, Miroslav; Jun 2007; 89 pp.; In English; Original contains color illustrations

Report No.(s): AD-A470073; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470073>

The purpose of this thesis is to provide a workbook of the game theory topics covered in the course 'SO4410 Models of Conflict.' The thesis also provides a software toolkit that enables students to solve the problems easier and faster, thereby focusing more on analysis of the situation than on the mathematical side of the problem. The workbook gives a basic review of the fundamental concepts and a detailed explanation for solving simple game theory problems using pen and paper. Topics cover two- and three-person games. Two-person games include the following: (1) zero-sum games and their solutions in the pure or mixed strategy, (2) partial-sum games without communication among the players, and (3) communication among players and its effect on the game. Three-person games focus on likely coalitions among the players. The toolkit covers two-person zero-sum games, the Nash arbitration scheme, strategic moves, prudential and equalizing strategies in partial-sum games, three-person games, and a supplemental template for linear programming problems with up to 10 variables and 30 constraints.

DTIC

Game Theory; Problem Solving; Software Development Tools; Students; War Games

20070035205 Naval Postgraduate School, Monterey, CA USA

Design of Experiment and Analysis for the Joint Dynamic Allocation of Fires and Sensors (JDAFS) Simulation

Freye, Jeffrey T; Jun 2007; 165 pp.; In English; Original contains color illustrations

Report No.(s): AD-A470129; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470129>

The U.S. Army Training and Doctrine Command (TRADOC) Analysis Center's Joint Dynamic Allocation of Fires and Sensors (JDAFS) model, a low-resolution, Discrete Event Simulation Model with embedded optimization enables the analysis

of many scenarios and factors to explore Joint Intelligence, Surveillance, and Reconnaissance (ISR) missions. JDAFS is a powerful model that combines both discrete event simulation and the optimization of a linear objective function to generate realistic, reasonable, and consistent solutions to difficult ISR scheduling problems. Given a scenario and a mix of ISR platforms, JDAFS optimizes a flight schedule and executes the missions. This research develops a Joint ISR scenario, explores scenario simulation results, and provides a proof-of-principle analysis that aids in the ISR decision making process. This study examines 274 design points in each of two scenarios, a non-penetrating scenario that allows only standoff collection and a penetrating scenario that allows country of interest overflight. The use of an efficient design of experiment methodology enables the exploration of the interior and exterior of the response surface for the two experimental scenarios. Analysis of the simulation output suggests that the optimization interval significantly impacts total coverage. In the nonpenetrating scenario, shorter optimization intervals ensure better coverage; however, in the penetrating scenario, longer optimization intervals provide for improved coverage. The disparity is explained by reduced likelihood of assignment saturation in the penetrating scenario due to the increased number of mission areas. Sensor range, sensor package configuration, and platform dwell time also affect the level of coverage. This is clearly demonstrated by the superior coverage provided by the most capable ISR platforms.

DTIC

Allocations; Experiment Design; Fires; Simulation

20070035245 Brown Univ., Providence, RI USA

Uncertainty-Based Design Methods for Flow-Structure Interactions

Karniadakis, George E; Jun 2007; 9 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): N00014-04-1-0007

Report No.(s): AD-A470197; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470197>

The long-term goal of this project is to develop advanced tools for efficient simulations of flow-structure interactions that account for random excitation and uncertain input, with emphasis on realistic three-dimensional nonlinear representation of the structures of interest. This capability will set the foundation for the development of new effective tools for uncertainty-based multidisciplinary design and optimization procedures of naval systems, in general, and flow-structures in particular, operating under uncertainty.

DTIC

Coding; Flow Characteristics

20070035322 Michigan Univ., Ann Arbor, MI USA

Sequential Adaptive Multi-Modality Target Detection and Classification Using Physics Based Models

Sarabandi, K; Hero, A O; Yagle, A E; Sep 2006; 15 pp.; In English

Contract(s)/Grant(s): DAAD19-02-1-0262

Report No.(s): AD-B329043; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This project's focus is on sensor management and associated issues in modeling, estimation, image reconstruction, and classification, for radar sensing. The central thesis of our original proposal was that intelligent sensor management can provide gains in performance and in operational requirements (energy consumption, deployment time, or exposure to hostile fire). We believe that we have demonstrated this thesis for several key application areas of interest to the army. These areas include minesweeping and detection of UXO, radar multiple target tracking, and energy-aware radar imaging through walls, earth or other attenuating media.

DTIC

Classifications; Detection; Radar; Systems Management; Target Acquisition

20070035467 Army Research Lab., Aberdeen Proving Ground, MD USA

The Application of Models of Decision Making During Uncertainty to Simulations of Military Command and Control Systems

Middlebrooks, Sam E; Stankiewicz, Brian J; Jul 2007; 56 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): Proj-62716AH70

Report No.(s): AD-A470286; ARL-TR-4192; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Most military decision making requires a sequence of actions. These actions may include aspects of intelligence gathering, troop movement, artillery fire, etc. Typically, these actions are tied to a specific goal that might include securing a region or

disrupting the enemy forces. Furthermore, when one is making the necessary decisions to reach the specific goal, there may be much uncertainty about the situation. Where exactly are the enemy troops? What is their objective? The use of Bayesian statistics makes it possible to compute optimal performance for military-like situations. This research develops a model that provides the theoretical best performance that can be achieved in the task. The current paradigm for the description and understanding of the nature of command and control (C2) system (C2S) operations and performance within the U.S. Army is undergoing a radical change. Tactical battlefield C2 is extremely complicated to orchestrate and conduct in an effective manner. With the introduction of a myriad of new information systems, sophisticated new weapons with unprecedented capabilities for lethality, new requirements for battlefield integration, and the total reorganization of force structures into a new modular concept, the need for effective understanding of how this force structure can work effectively as a system entity increases dramatically. The C2S has become complicated to the point as to escape the ability for intuitive understanding of how individual components or subsystems can improve or degrade the operation of the overall system. The goal of this research is to understand the cognitive limitations associated with sequential decision making with uncertainty in these types of situations through predictive computer simulation. When empirical research investigating optimal decision making during uncertainty is combined with evolving simulations of military C2, the potential now exists to correlate optimal decision making performance with actual

DTIC

Bayes Theorem; Command and Control; Computerized Simulation; Decision Making; Simulation

20070035546 Carnegie-Mellon Univ., Pittsburgh, PA USA

Architecture Aspects of Long-Lived Ground Systems

Hammons, Charles B; Jan 2006; 12 pp.; In English

Report No.(s): AD-A470420; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Programs and goals include mission-critical satellite-based packet and circuit communications for the warfighter. Quality of service, information assurance, communications on the move. Seamless integration into the Global Information Grid (GIG), and complex interactions with military planners and systems.

DTIC

Interoperability; Systems Integration; Telecommunication

20070035563 Carnegie-Mellon Univ., Pittsburgh, PA USA

Advanced Risk Analysis for High-Performing Organizations

Alberts, Christopher; Dorofee, Audrey; Jan 2006; 38 pp.; In English

Report No.(s): AD-A470445; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The operational environment for many types of organizations is changing. Changes in operational environments are driving the need for advanced risk analysis techniques. Many types of risk prevalent in today's operational environments (e.g., event risks, inherited risk) are not readily identified using traditional risk analysis techniques. Mission Assurance Analysis Protocol (MAAP) is one technique that high performers can use to identify and mitigate the risks arising from operational complexity.

DTIC

Organizations; Risk

20070035766 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Input Range Testing for the General Mission Analysis Tool (GMAT)

Hughes, Steven P; July 12, 2007; 59 pp.; In English; Original contains black and white illustrations; No Copyright;

Avail.: CASI: A04, Hardcopy

ONLINE: <http://hdl.handle.net/2060/20070035766>

This document contains a test plan for testing input values to the General Mission Analysis Tool (GMAT). The plan includes four primary types of information, which rigorously define all tests that should be performed to validate that GMAT will accept allowable inputs and deny disallowed inputs. The first is a complete list of all allowed object fields in GMAT. The second type of information, is test input to be attempted for each field. The third type of information is allowable input values for all objects fields in GMAT. The final piece of information is how GMAT should respond to both valid and invalid information. It is VERY important to note that the tests below must be performed for both the Graphical User Interface and

the script!! The examples are illustrated using a scripting perspective, because it is simpler to write up. However, the test must be performed for both interfaces to GMAT.

Derived from text

Graphical User Interface; Risers; Analyzing; Software Development Tools

20070035768 Lockheed Martin Mission Services Co., Greenbelt, MD, USA; NASA Goddard Space Flight Center, Greenbelt, MD, USA

EOS Operations Systems: EDOS Implemented Changes to Reduce Operations Costs

Cordier, Guy R.; Gomez-Rosa, Carlos; McLemore, Bruce D.; [2007]; 33 pp.; In English; 7th International Symposium Reducing the Costs of Spacecraft Ground Systems and Operations (RCSGSO), 11-15 Jun. 2007, Moscow, Russia; Original contains color illustrations

Contract(s)/Grant(s): NNG04DA01C; No Copyright; Avail.: CASI: [A03](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20070035768>

The authors describe in this paper the progress achieved to-date with the reengineering of the Earth Observing System (EOS) Data and Operations System (EDOS), the experience gained in the process and the ensuing reduction of ground systems operations costs. The reengineering effort included a major methodology change, applying to an existing schedule driven system, a data-driven system approach.

Author

Earth Observing System (EOS); Cost Reduction; Data Systems; Ground Operational Support System

20070035803 Army Research Inst., Alexandria, VA USA

Task Difficulty and Prior Videogame Experience: Their Role in Performance and Motivation in Instructional Videogames

Orvis, Karin A; Horn, Daniel B; Belanich, James; Jun 2007; 29 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): Proj-A792

Report No.(s): AD-A470218; TR-1202; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470218>

Video game-based environments are an increasingly popular medium for training Soldiers. This research investigated how various strategies for modifying task difficulty over the progression of an instructional video game impact learner performance and motivation. Further, the influence of prior video game experience on these learning outcomes was examined, as well as the role prior experience played in determining the optimal approach for adjusting task difficulty. Participants completed a game-based training task under one of four task difficulty conditions: static, increasing, adaptive-low and adaptive-high. All participants completed an identical pre-training trial, 10 practice trials varying in difficulty level according to condition, and a final performance trial. Results demonstrate that learner performance and motivation significantly improved in all difficulty conditions. Yet, contrary to expectations, no single condition maximized these outcomes relative to others. There was a significant 3-way interaction between performance, condition, and prior video game experience. Further, prior experience was found to significantly influence these learning outcomes. Learners with greater experience consistently performed better regardless of condition. Experienced gamers also initially reported high task self-efficacy and set higher performance goals for the training task. The results of this research provide information useful to training game developers and instructors utilizing video games as training tools.

DTIC

Game Theory; Games; Military Personnel; Motivation; Task Complexity; Training Devices

20070035926 Organisatie voor Toegepast Natuurwetenschappelijk Onderzoek, Rijswijk, Netherlands

The Dutch Program for the Simulation of Missile Intercept Effects

Abadjieva, E.; Sterkenburg, R. P.; Bouquet, F.; Doup, P. W.; July 2007; 2 pp.; In Dutch; Original contains color illustrations
Report No.(s): TD2007-0128; TNO-DV 2007 A257; Copyright; Avail.: Other Sources

A national program in The Netherlands on Joint Air Defence (JAD) includes the development of a chain of models called HAPPIE (Hazard Area Prediction by Perturbations in Ensembles). It simulates ballistic missile intercepts and the consequence effects on the ground. The hazard area is calculated as a function of the ATP-45 compliant MXi (Missile Intercept Report), CDR (Chemical Downwind Report) and BWR (Basic Wind Report) messages. The program will be used for both real-time warning purposes and for JAD planning purposes, to optimize the configuration in the battle field of the air defence weapon systems. HAPPIE will be extended with several new submodels, describing the debris behavior and the drop break-up at

altitudes above 200 km after an intercept. This paper aims to provide an overview of the physical models which describe the chemical agents' behaviour during descending after an intercept.

Author

Air Defense; Antimissile Defense; Computerized Simulation; Mathematical Models

20070036347 Universidad de Navarra, Pamplona, Navarra, Spain

Quantitative Robust Control Engineering: Theory and Applications

Garcia-Sanz, Mario; Sep 1, 2006; 45 pp.; In English; Original contains color illustrations

Report No.(s): AD-A470878; No Copyright; Avail.: Defense Technical Information Center (DTIC)

No abstract available

Control; Control Theory; Engineering

20070036353 Strathclyde Univ., Glasgow, UK

Advanced Control Law Tuning and Performance Assessment

Grimble, Michael J; Majecki, Pawel; Dec 1, 2006; 43 pp.; In English; Original contains color illustrations

Report No.(s): AD-A470887; No Copyright; Avail.: Defense Technical Information Center (DTIC)

No abstract available

Control; Control Theory; Tuning

20070036354 Florence Univ., Italy

Control of Uncertain Systems under Constraints: Switching Horizon Predictive Control of Persistently Disturbed Input-Saturated Plants

Mosca, Edoardo; Dec 1, 2006; 15 pp.; In English

Report No.(s): AD-A470888; No Copyright; Avail.: Defense Technical Information Center (DTIC)

No abstract available

Control; Horizon; Predictions; Switching; Uncertain Systems

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THEORETICAL MATHEMATICS

Includes algebra, functional analysis, geometry, topology, set theory, group theory and number theory.

20070035240 Naval Postgraduate School, Monterey, CA USA

Realizable Triples in Dominator Colorings

Fletcher, Douglas M; Jun 2007; 43 pp.; In English; Original contains color illustrations

Report No.(s): AD-A470182; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470182>

Given a graph G and its vertex set $V(G)$, the chromatic number, $\chi(G)$, represents the minimum number of colors required to color the vertices of G so that no two adjacent vertices have the same color. The domination number of G , $\gamma(G)$, the minimum number of vertices in a set S , where every vertex in the set $(\) \ V \ G \ S$ is adjacent to a vertex in S . The dominator chromatic number of the graph, $\chi_{\text{subd}}(G)$ represents the smallest number of colors required in a proper coloring of G with the additional property that every vertex dominates a color class. The ordered triple, (a, b, c) , is realizable if a connected graph G exists with $\gamma(G) = a$, $\chi(G) = b$, and $\chi_{\text{subd}}(G) = c$. For every ordered triple, (a, b, c) of positive integers, if either (a) $a=1$ and $b=c$ greater or equal 2 or (b) 2 less than or equal a , $b < c$ and c less than or equal $a+b$, previous work has shown that the triple is realizable. The bounds do not consider the case $a=b=c$. In an effort to realize all the ordered triples, we explore graphs and graph classes with $a=b=c=k$ greater or equal 2.

DTIC

Color

20070035847 Department of Defense, Fort Meade, MD USA

Acquaintance: Language-Independent Document Categorization by N-Grams

Huffman, Stephen; Nov 1995; 14 pp.; In English

Report No.(s): AD-A470523; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Acquaintance is the name of a novel vector-space n-gram technique for categorizing documents. The technique is completely language-independent, highly garble-resistant, and computationally simple. An unoptimized version of the algorithm was used to process the TREC database in a very short time. Acquaintance is the name of a technique for information processing that combines the robustness of an n-gram-based algorithm with a novel vector-space model. Acquaintance gauges similarity among documents on the basis of common features, permitting document categorization based on a common language, a common topic, or common subtopics. The algorithm is completely language- and topic-independent, and is resistant to garbling even at the 10% to 15% (character) level. Acquaintance is fully described in Damashek, 1995. The TREC-3 conference provided the first public demonstration and evaluation of this new technique, and TREC-4 provided an opportunity to test its usefulness on several types of text retrieval tasks.

DTIC

Vector Spaces; Languages; Texts

20070036101 Air Force Research Lab., Kirkland AFB, NM USA

Cost Cumulant-Based Control for a Class of Linear Quadratic Tracking Problems

Pham, Khanh D; Jan 2007; 7 pp.; In English

Report No.(s): AD-A470626; AFRL-VS-PS-TP-2007-1015; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470626>

The topic of cost-cumulant control is currently receiving substantial research from the theoretical community oriented toward stochastic control theory. For instance, the present paper extends the application of cost-cumulant controller design to control of a wide class of linear-quadratic tracking systems where output measurements of a tracker follow as closely as possible a desired trajectory via a complete statistical description of the associated integral-quadratic performance-measure. It is shown that the tracking problem can be solved in two parts: one, a feedback control whose optimization criterion representing a linear combination of finite cumulant indices of an integral-quadratic performance-measure associated to a linear tracking stochastic system over a finite horizon, is determined by a set of Riccati-type differential equations; and two, an affine control which takes into account of dynamics mismatched between a desired trajectory and tracker states, is found by solving an auxiliary set of differential equations (incorporating the desired trajectory) backward from a stable final time.

DTIC

Control Theory; Costs; Financial Management; Problem Solving; Quadratic Equations; Tracking Problem

20070036287 Naval Research Lab., Bay Saint Louis, MS USA

Cycling the Representer Algorithm for Data Assimilation with the Lorenz Attractor

Ngodock, H E; Smith, S R; Jacobs, G A; Feb 2007; 15 pp.; In English

Report No.(s): AD-A470724; NRL/JA/7320-05-5286; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Realistic dynamic systems are often strongly nonlinear, particularly those for the ocean and atmosphere. Applying variational data assimilation to these systems requires a tangent linearization of the nonlinear dynamics about a background state for the cost function minimization. The tangent linearization may be accurate for limited time scales. Here it is proposed that linearized assimilation systems may be accurate if the assimilation time period is less than the tangent linear accuracy time limit. In this paper, the cycling representer method is used to test this assumption with the Lorenz attractor. The outer loops usually required to accommodate the linear assimilation for a nonlinear problem may be dropped beyond the early cycles once the solution (a forecast used as the background in the tangent linearization) is sufficiently accurate. The combination of cycling the representer method and limiting the number of outer loops significantly lowers the cost of the overall assimilation problem. In addition, this study shows that weak Constraint assimilation corrects tangent linear model inaccuracies and allows extension of the limited assimilation period. Hence, the weak constraint outperforms the strong constraint method. Assimilated solution accuracy at the first cycle end is computed as a function of the initial condition error, model parameter perturbation magnitude, and outer loops. Results indicate that at least five outer loops are needed to achieve solution accuracy in the first cycle for the selected error range.

DTIC

Algorithms; Assimilation; Cycles; Linearization; Multisensor Fusion

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PHYSICS (GENERAL)

Includes general research topics related to mechanics, kinetics, magnetism, and electrodynamics. For specific areas of physics see *categories 71 through 77*. For related instrumentation see *35 Instrumentation and Photography*; for geophysics, astrophysics, or solar physics see *46 Geophysics, 90 Astrophysics, or 92 Solar Physics*.

20070035202 Naval Postgraduate School, Monterey, CA USA

Independent Component Analysis by Entropy Maximization (INFOMAX)

Garvey, Jennie H; Jun 2007; 125 pp.; In English; Original contains color illustrations

Report No.(s): AD-A470123; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470123>

This thesis explores the 'Infomax' method of Independent Component Analysis (ICA) to accomplish blind source separation (BSS). The Infomax method separates unknown source signals from a number of signal mixtures by maximizing the entropy of a transformed set of signal mixtures and is accomplished by performing gradient ascent in MATLAB. The thesis specifically focuses on small numbers of two types of signals: audio signals and simple communications signals (polar non-return to zero signals). The Infomax method is found to be successful and efficient only for small numbers of signals, and improvements to the gradient ascent algorithm should be made for the Infomax algorithm to succeed for more than three signal mixtures. MATLAB implementation code is included as appendices.

DTIC

Algorithms; Demodulation; Entropy; Radio Signals; Signal Processing; Signal Transmission; Sound Waves; Wireless Communication

20070035203 El Arroyo Enterprises, Sedona, AZ USA

Measures of Bulk and Grain Strain in Deformation Processes(PREPRINT)

Hartley, Craig S; Spowart, Jonathan E; Apr 2007; 38 pp.; In English; Original contains color illustrations

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

Report No.(s): AD-A470126; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470126>

Many instances of severe plastic deformation produce a heterogeneous distribution of strain through a material. Common methods of describing the severity of deformation based on changes in the external dimensions of a specimen masks this heterogeneity, which is difficult to measure directly. This study describes a method of measuring internal strain based on the observation that networks of internal boundaries within a polycrystalline material deform locally in a manner congruent with the local metal flow. Appropriate measurements of the development of the spatial anisotropy of such networks with increasing deformation provide a basis for defining several measures of the local total strain. These quantities, called 'grain strains' when the boundaries observed are grain boundaries, can serve as an experimental measure of the internal total strain in various locations in a specimen for comparison with computations based on finite element models using various constitutive relations.

DTIC

Deformation; Plastic Deformation

20070035257 Virginia Diodes, Inc., Charlottesville, VA USA

All Solid-State Source Technology for Terahertz Applications

Kurtz, David; Jun 20, 2007; 25 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W31P4Q-07-C-0111; ARPA ORDER-U051-72

Report No.(s): AD-A470221; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470221>

Existing and emerging applications for terahertz technology motivate the need for improved terahertz sources. With the Submillimeter-wave technology gap, terahertz sources lag the performance found in other regions of the spectrum. Many applications such as imaging, chemical agent detection, and spectroscopy would benefit from narrowing the technology gap. This SBIR focuses on improving key aspects of terahertz sources including power, spectral purity, and noise while maintaining good bandwidth, sweep speed, and size for output frequencies from 0.1-1 Terahertz. For the interim technical report, Virginia Diodes Inc. (VDI) reported power and bandwidth results for two different sources. One source uses all broadband components to achieve the maximum bandwidth, while the other source uses a mixture of high powered and broadband components to achieve the maximum amount of power over 100 GHz of bandwidth. VDI has delivered the high powered version for

completion of phase I. The source operates from 660-760 GHz with greater than 100 microwatts of power.
DTIC

Bandwidth; Solid State; Spectroscopy; Technology Utilization

20070035272 Naval Research Lab., Bay Saint Louis, MS USA

Spectral Signature Wave Breaking in Surface Wave Components of Intermediate-Length Scale

Hwang, Paul A; Jan 2007; 11 pp.; In English; Original contains color illustrations

Report No.(s): AD-A470242; NRL/JA/7330-05-5262; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470242>

This paper investigates the length scale of ocean surface breaking waves in the spectral range of intermediate wavelength components a few centimeters to a few meters long. The spectral properties of wave breaking are examined first with the dissipation function of the wave action density conservation equation. The analysis reveals a strong breaking signature in wave components between 0.15 and 1.5 m long in the form of a quasi-singular behavior of the dissipation function using the present formulation of the wind-generation and breaking dissipation functions. Independent studies of more-direct breaking observations of radar tracking of sea spikes in the past have shown close correlation between sea spiked and scatterers traveling at the speed of surface waves a few meters long and much shorter than the dominant wavelength. The intermediate-scale waves are the primary contributor of the ocean surface mean-square slope. The close correlation between the gas transfer rate and the mean-square slope has been demonstrated repeatedly. A better understanding of the wave dynamics of intermediate-scale waves is important for clarification of various gas transfer mechanisms.

DTIC

Ocean Surface; Seas; Signatures; Spectra; Spectral Signatures; Surface Waves

20070035299 Rochester Univ., NY USA

Charge Transport and Optical Properties in Silicon Quantum Dot Arrays

Fauchet, Philippe; Jun 2007; 6 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAAD19-03-1-0267

Report No.(s): AD-B329011; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The size dependence of the dielectric function of silicon quantum dots and quantum sheets has been determined using spectroscopic ellipsometry in the photon energy range from 0.73 eV to 4.58eV. The quantum dot/sheet size was varied from greater than 10nm (where the dielectric function is expected to be close to that of bulk silicon) to below 2nm (where theory predicts a decrease due to quantum confinement and/or breaking of polarizable bonds at the dot surface). The ellipsometric measurements were performed at room temperature and correlated with several techniques. A dramatic lowering in the real and imaginary parts of the dielectric function was observed for sized below 3.3 nm. The decrease is much more pronounced than predicted by theory and must be considered when designing optical and electrical devices such as light emitting devices, non-volatile memory devices and single electron transistors.

DTIC

Charge Transfer; Dielectric Properties; Optical Properties; Quantum Dots; Silicon; Transport Properties

20070035325 Boston Univ., Boston, MA USA

Complexity Bounds for Quantum Computation

Homer, Steven; Jun 22, 2007; 16 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAAD19-02-1-0058

Report No.(s): AD-B329046; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This project focused on upper and lower bounds for quantum computability using constant depth quantum circuits, and on the complexity theory of such circuits. It established significant differences between resource bounded quantum and classical computation models, particularly emphasizing new examples of where quantum circuits are more powerful than their classical counterparts. A second focus and outgrowth of this work was the creation of efficient quantum algorithms for specific problems and central combinatorial functions. Recent findings include upper bounds for the computational power of constant depth circuits composed of single qubit and CNOT gates, and lower bounds for the computational power of constant depth circuits with single qubit, CNOT and fanout gates. These results represent the power and the limits of small, possibly realizable quantum circuits. Also examined were bounds on computations with additional storage qubits (ancillae), and natural simple

functions (realized by small depth circuits) which require ancillae for their computation.

DTIC

Quantum Computation; Quantum Electronics

20070035606 State Univ. of New York, Buffalo, NY USA

Scalable Video Transmission Over Multi-Rate Multiple Access Channels

Kondi, Lisimachos P; Jun 2007; 20 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): FA8750-04-1-0057; Proj-CITE

Report No.(s): AD-A470529; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This effort demonstrated the interference mitigation capabilities of the auxiliary vector (AV) receiver for video transmission over direct-sequence code division multiple access (DS-CDMA) systems. The proposed receiver design is compared to the conventional RAKE matched-filter (RAKE-MF) and sample-matrix-inversion minimum-variance-distortionless-response (SMI-MVDR) receivers. The DS-CDMA video data stream is transmitted over an RF channel under realistic Rayleigh-faded multipath channel conditions, emulating open and/or urban battlefield environments.

DTIC

Code Division Multiple Access; Multipath Transmission; Multiple Access; Video Signals

20070035801 Office of the Assistant Secretary of Defense for Networks and Information Integration, Washington, DC USA

Department of Defense Electromagnetic Spectrum Management Strategic Plan

May 2007; 24 pp.; In English

Report No.(s): AD-A470338; No Copyright; Avail.: Defense Technical Information Center (DTIC)

In the future, warfighters will operate in a dynamic, multi-layered, multi-dimensional battlespace. In this environment, they will rely on robust, secure connectivity between globally dispersed sanctuary locations and positions in theater down to the 'last tactical mile'. This type of capability will only be attained through a broad array of interconnected networks supporting sensors, shooters, and command, control, communications, computers and intelligence (C4I) systems. Secure net-centric links interconnecting people and systems, independent of time or location, will provide improved military situational awareness, better access to Department of Defense (DOD) information, and shortened decision cycles. Net-Centricity depends on an environment that provides full connectivity and interoperability to produce and share a common understanding of all dimensions of the battlespace. The key enabler for net-centricity is the DOD Global Information Grid (GIG). The GIG is supported by a seamless communications environment that includes both commercial and military networks accommodating a range of transmission media, standards, and protocols. Extension of the GIG down to the lowest warfighting echelons will be made possible through coupling integrated wireless architectures with spectrum-dependent systems such as communications, weapons, precision munitions, sensors, geo-location, and other wireless devices. As these wireless architectures become reality, the DOD requirement for throughput is increasing dramatically while worldwide competition for electromagnetic (EM) spectrum continues to put pressure on U.S. military spectrum access. Future access to sufficient spectrum will only be achieved through both the application of technologies that increase channel efficiencies and supplements to spectrum available to DOD through the sharing of access to other government and commercial networks worldwide.

DTIC

Command and Control; Defense Program; Electromagnetic Spectra; Management Planning; Spectra

20070036073 Massachusetts Inst. of Tech., Cambridge, MA USA

Small-Qubit-Number Methods for Superconductive Quantum Computation

Berggren, Karl K; Orlando, Terry P; Jun 30, 2007; 12 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): FA9550-04-1-0221

Report No.(s): AD-A470587; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470587>

We have developed two experimental schemes that can be used to implement the Factorized Quantum Lattice-Gas Algorithm for the 1 D Diffusion Equation with Persistent-Current Qubits. One scheme involves biasing the PC Qubit at multiple flux bias points throughout the course of the algorithm. An implementation analogous to that done in Nuclear Magnetic Resonance Quantum Computing is also developed. Errors due to a few key approximations utilized and differences between the PC Qubit and NMR systems were studied. Adiabatic quantum computation (AQC) is an approach to universal quantum computation in which the entire computation is performed in the ground state of a suitably chosen Hamiltonian. To make feasible a large-scale AQC experiment, we have proposed a scalable architecture for AQC based on the superconducting

qubits. We have developed a set of processes that address the theoretically predicted need for extremely well-matched Josephson junction qubits in quantum computers. The work has focused on novel fabrication approaches such as nanoimprint lithography, which is able to replicate patterns with an extremely high degree of uniformity, and on methods of electron-beam lithography that achieve exceptional resist contrast, and thus high resolution, low line-edge roughness, and a correspondingly high degree of dimensional control in the resulting figures. We have accomplished this feat using two complimentary methods, one for negative-tone resist using cold development, the other for positive-tone resist using salt in the development solution. We have also demonstrated a method of Al/AlO(x)/Al junction fabrication that uses lithographically-defined reentrant resist profiles.

DTIC

Algorithms; Electron Beams; Hamiltonian Functions; Quantum Computation; Superconductivity

20070036105 Texas Univ., Austin, TX USA

High-Frequency Muzzle Voltage Measurements

Levinson, S; Stefani, F; Aug 2007; 9 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAAD17-01-D-0001-0012

Report No.(s): AD-A470631; IAT.R-0446; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470631>

The muzzle voltage in solid-armature railguns is an important diagnostic because it can provide information about the state of the rail-armature interface. Sudden jumps in the muzzle voltage can indicate that an armature has made a transition from low voltage to arcing contact. However, in many tests, the muzzle voltage increases gradually, and the onset of transition as indicated by the muzzle voltage is ambiguous. This report describes research aimed at developing alternative approaches for detecting the onset of arcing contact in solid armature railguns. The work, conducted at the IAT in the early part of 2006, sought to determine whether there is information in the 20 kHz-500 MHz range of the power spectrum that correlates strongly with the onset of transition to arcing contact. To this end, we analyzed two types of signals collected during railgun tests for information that might indicate the onset of arcing. One was a high-frequency muzzle voltage measurement recorded with a 1 GHz sampling rate. The other signal was broad band electromagnetic (EM) radiation (also sampled at 1 GHz) collected using a 2-meter dipole antenna in the vicinity of the railgun. The results show that there is some correlation between the high-frequency and conventional muzzle voltage measurements, and there is little correlation between the broadband EM radiation measurement and the conventional muzzle voltage measurement. The high-frequency muzzle voltage measurement does not appear to contain information about the electrical state of the rail-armature interface that could be used to indicate the presence of arcing.

DTIC

Armatures; Electric Arcs; Electric Potential; Electrical Measurement; Guns (Ordnance); Railgun Accelerators

20070036292 Melbourne Univ., Victoria, Australia

Toward generalized continuum models of granular soil and granular soil-tire interaction: A combined discrete element and thermomechanical continuum analysis of densely packed assemblies

Tordesillas, Antoinette; Apr 30, 2007; 12 pp.; In English

Contract(s)/Grant(s): DAAD190210216

Report No.(s): AD-A470736; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Under this research program, we pioneered the development of a new breed of high-resolution micromechanical continuum models of granular materials - with experimentally proven predictive capabilities for emergent structures spanning the length scales from only a few particles through to the macroscopic scale of engineering systems and processes. This breakthrough is underpinned by four disciplines of Mechanics, woven together for the first time into one complete methodology for constitutive model development: Micromechanics (the multiscale analysis of behaviour of heterogeneous media from the microscale to observable macroscopic level); Contact Mechanics (the study of interaction between deformable solids in contact); Thermomechanics (the branch of Mechanics devoted to Thermodynamics); and Micropolar or Cosserat Theory (the study of continuum bodies whose kinematics and kinetics have been enriched by the addition of rotational degrees of freedom to each material point). Unique aspects of this approach are: 'high-resolution' predictive capability; clear link between macro and micro behaviour; input parameters being identical to those used in particle-based simulations thereby permitting direct comparison of model predictions with simulation and experiments; guaranteed compliance with the laws of thermodynamics. Comparison with experiments show the model can capture emergent internal structures whose characteristic

length scales are only a few particles wide, e.g. shear bands. The model can also capture the evolution of novel anisotropies inside the shear band, (e.g. force chains).

DTIC

Continuum Modeling; Continuums; Granular Materials; Microstructure; Soils; Tires

20070036305 Nevada Univ., Reno, NV USA

Research on Non-Lethal Stunning/Immobilizing Weapons

Craviso, Gale L; Chatterjee, Indira; Apr 2007; 13 pp.; In English

Contract(s)/Grant(s): FA9550-05-1-0308; Proj-2301

Report No.(s): AD-A470768; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The overall goal of the research is to lay the foundation for developing non-lethal stunning/immobilizing weaponry based on radiofrequency (RF)/microwave(MW) radiation. Our approach is to identify RF/MW parameters that can selectively, and without producing heating of tissue, alter processes underlying neurotransmitter release and contraction of skeletal muscle. Major accomplishments included 1) completing the design, construction, characterization and testing of a temperature control setup for studying effects of rapid increases in temperature so that we can distinguish thermal versus non-thermal effects of the exposures; 2) completing thermal modeling of the cell perfusion system used for on-line monitoring of catecholamine release from chromaffin cells during RF/MW exposure; and 3) designing, fabricating and characterizing an exposure system for real-time imaging of intracellular effects on chromaffin cells and skeletal muscle fibers in response to high electric field RF/MW pulse modulated radiation. The research has been presented at four international meetings, culminated in two peer-reviewed papers, and involved a neurobiologist and an electrical engineer as principal investigators, an associate engineer, four research assistants and four graduate students.

DTIC

Biological Effects; Catecholamine; Electric Fields; Immobilization; Muscles; Muscular Function; Musculoskeletal System; On-Line Systems; Skeletal Muscle; Weapons

20070036399 Colorado Univ., Colorado Springs, CO USA

Magnetization Reversal in an Fe Film with an Array of Elliptical Holes on a Square Lattice

Guedes, I; Grimsditch, M; Metlushko, V; Vavassori, P; Camley, R; Ilic, B; Neuzil, P; Kumar, R; Jan 2006; 9 pp.; In English

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

Report No.(s): AD-A470962; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The reversal mechanism for the magnetization in an Fe film with an array of elliptical holes is investigated using the diffracted magneto-optic Kerr effect (D-MOKE) technique. D-MOKE results are obtained as a function of temperature and the angle between the applied magnetic field and an ellipse axis. The transverse and longitudinal magnetization components and minor magnetization loops are also explored in order to understand the reversal process. The experimental results are interpreted using micromagnetic simulations. The simulations account for the strong angular dependence of the hysteresis loops and provide a detailed picture of how the local magnetization evolves during reversal. The actual reversal process occurs neither by coherent rotation of domains nor by clear domain-wall motion: domain smearing appears to be a more suitable description of the phenomenon.

DTIC

Holes (Mechanics); Kerr Magneto-optical Effect; Magnetization; Thin Films

20070036440 Ohio State Univ., Columbus, OH USA

Single Spin Readout for the Silicon-Based Quantum Computer

Hammel, P C; Jan 3, 2007; 13 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAAD19-02-1-0310

Report No.(s): AD-A471023; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This report presents research funded under ARO grant DAAD19-02-1-0310 and conducted during the time period of 07/15/2002 - 07/14/2006. In the course of this research we have made major advancements in the development of Magnetic Resonance Force Microscopy (MRFM) on the way towards its application as a single spin readout for the silicon-based quantum computer. The main achievement of this work is the demonstration of electron spin resonance (ESR) signal detection using MRFM with a sensitivity of better than ten fully polarized electron spins. This exceptional sensitivity was enabled by several advances in ultra sensitive MRFM detection: detection of ESR signal with sensitivity of less than ten fully polarized electron spins, detection of the ESR signal of phosphorus donors in doped Si, demonstration of high magnetic field gradients

from rare-earth nanomagnetic probe tips, fabrication of ultrasensitive MRFM force sensing cantilevers, development of light-free cantilever displacement-detection techniques, theoretical understanding of cantilever induced spin relaxation and of the MRFM probe-sample interaction, construction of novel MRFM equipment, and preparation of patterned samples for detection of phosphorus ESR in Si.

DTIC

Electron Paramagnetic Resonance; Imaging Techniques; Magnetic Resonance; Readout

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*.

20070035066 NASA Langley Research Center, Hampton, VA, USA

Real-Time Feedback Control of Flow-Induced Cavity Tones, Part 1, Fixed-Gain Control

Kegerise, M. A.; Cabell, R. H.; Cattafesta, L. N., III; March 21, 2006; 30 pp.; In English; Original contains black and white illustrations

Contract(s)/Grant(s): WBS 23-065-10-61; Copyright; Avail.: CASI: [A03](#), Hardcopy

A generalized predictive control (GPC) algorithm was formulated and applied to the cavity flow-tone problem. The control algorithm demonstrated multiple Rossiter-mode suppression at fixed Mach numbers ranging from 0.275 to 0.38. Controller performance was evaluated with a measure of output disturbance rejection and an input sensitivity transfer function. The results suggest that disturbances entering the cavity flow are collocated with the control input at the cavity leading edge. In that case, only tonal components of the cavity wall-pressure fluctuations can be suppressed and arbitrary broadband pressure reduction is not possible with the present sensor/actuator arrangement. In the control-algorithm development, the cavity dynamics were treated as linear and time invariant (LTI) for a fixed Mach number. The experimental results lend support to that treatment.

Author

Cavity Flow; Actuators; Feedback Control; Pressure Oscillations; Transfer Functions; Real Time Operation

20070035067 NASA Langley Research Center, Hampton, VA, USA

Real-Time Feedback Control of Flow-Induced Cavity Tones, Part 2, Adaptive Control

Kegerise, M. A.; Cabell, R. H.; Cattafesta, L. N., III; March 21, 2006; 29 pp.; In English; Original contains black and white illustrations

Contract(s)/Grant(s): WBS 23-065-10-61; Copyright; Avail.: CASI: [A03](#), Hardcopy

An adaptive generalized predictive control (GPC) algorithm was formulated and applied to the cavity flow-tone problem. The algorithm employs gradient descent to update the GPC coefficients at each time step. Past input-output data and an estimate of the open-loop pulse response sequence are all that is needed to implement the algorithm for application at fixed Mach numbers. Transient measurements made during controller adaptation revealed that the controller coefficients converged to a steady state in the mean, and this implies that adaptation can be turned off at some point with no degradation in control performance. When converged, the control algorithm demonstrated multiple Rossiter mode suppression at fixed Mach numbers ranging from 0.275 to 0.38. However, as in the case of fixed-gain GPC, the adaptive GPC performance was limited by spillover in sidebands around the suppressed Rossiter modes. The algorithm was also able to maintain suppression of multiple cavity tones as the freestream Mach number was varied over a modest range (0.275 to 0.29). Beyond this range, stable operation of the control algorithm was not possible due to the fixed plant model in the algorithm.

Author

Adaptive Control; Cavity Flow; Feedback Control; Trajectory Control; Real Time Operation; Algorithms

20070035072 NASA Glenn Research Center, Cleveland, OH, USA

Shock Characteristics Measured Upstream of Both a Forward-Swept and an Aft-Swept Fan

Podboy, Gary G.; Krupar, Martin J.; Sutliff, Daniel L.; Horvath, Csaba; November 2007; 28 pp.; In English; ASME Turbo Expo 2007, 14-17 May 2007, Montreal, Canada; Original contains color illustrations

Contract(s)/Grant(s): WBS 561581.02.08.03.01

Report No.(s): NASA/TM-2007-214935; GT2007-27338; E-16112; Copyright; Avail.: CASI: [A03](#), Hardcopy

Three different types of diagnostic data-blade surface flow visualization, shroud unsteady pressure, and laser Doppler

velocimeter (LDV)--were obtained on two fans, one forward-swept and one aft-swept, in order to learn more about the shocks which propagate upstream of these rotors when they are operated at transonic tip speeds. Flow visualization data are presented for the forward-swept fan operating at 13831 rpm(sub c), and for the aft-swept fan operating at 12500 and 13831 rpm(sub c) (corresponding to tip rotational Mach numbers of 1.07 and 1.19, respectively). The flow visualization data identify where the shocks occur on the suction side of the rotor blades. These data show that at the takeoff speed, 13831 rpm(sub c), the shocks occurring in the tip region of the forward-swept fan are further downstream in the blade passage than with the aft-swept fan. Shroud unsteady pressure measurements were acquired using a linear array of 15 equally-spaced pressure transducers extending from two tip axial chords upstream to 0.8 tip axial chords downstream of the static position of the tip leading edge of each rotor. Such data are presented for each fan operating at one subsonic and five transonic tip speeds. The unsteady pressure data show relatively strong detached shocks propagating upstream of the aft-swept rotor at the three lowest transonic tip speeds, and weak, oblique pressure disturbances attached to the tip of the aft-swept fan at the two highest transonic tip speeds. The unsteady pressure measurements made with the forward-swept fan do not show strong shocks propagating upstream of that rotor at any of the tested speeds. A comparison of the forward-swept and aft-swept shroud unsteady pressure measurements indicates that at any given transonic speed the pressure disturbance just upstream of the tip of the forward-swept fan is much weaker than that of the aft-swept fan. The LDV data suggest that at 12500 and 13831 rpm(sub c), the forward-swept fan swallowed the passage shocks occurring in the tip region of the blades, whereas the aft-swept fan did not. Due to this difference, the flows just upstream of the two fans were found to be quite different at both of these transonic speeds. Nevertheless, despite distinct differences just upstream of the two rotors, the two fan flows were much more alike about one axial blade chord further upstream. As a result, the LDV data suggest that it is unwise to attempt to determine the effect that the shocks have on far field noise by focusing only on measurements (or CFD predictions) made very near the rotor. Instead, these data suggest that it is important to track the shocks throughout the inlet.

Author

Wind Tunnel Tests; Fan Blades; Mechanical Shock; Turbofan Engines; Swept Forward Wings; Aeroacoustics

20070035247 Scripps Institution of Oceanography, La Jolla, CA USA

North Pacific Acoustic Laboratory - Underway CTD and SeaSoar Observations

Rudnick, Daniel L; Jul 23, 2007; 6 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): N00014-03-1-0838

Report No.(s): AD-A470201; UCSD-20031746R1; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470201>

As the limits of long-range sonar are affected by ocean variability, the overarching goal of this work is to characterize, understand, and -predict sound-speed variability in the upper ocean. Sound speed is a function of the ocean state variables temperature T, salinity S, which are themselves affected by such processes as stirring, mixing and internal waves. A long-range goal is thus the inversion of acoustic data to measure these processes.

DTIC

Internal Waves; Ocean Data Acquisitions Systems

20070035446 Department of the Navy, Washington, DC USA

A Method for Determining Signal Direction Using Artificial Doppler Shifts

Ruffa, Anthony A, Inventor; Jul 3, 2007; 25 pp.; In English; Original contains color illustrations

Report No.(s): AD-D020297; No Copyright; Avail.: Other Sources

ONLINE: <http://hdl.handle.net/100.2/ADD020297>

A method for determining the direction of an incoming signal is provided in which each of a plurality of receivers arranged in a linear array is sampled in sequence to simulate a single receiver moving along an aperture defined by the linear array at a simulated speed. This generates a simulated time series data from which a simulated Doppler shift in the incident angle is measured. The simulated Doppler shift is used to determine the incident angle between the incident signal and the linear array of receivers. By adjusting the simulated speed to eliminate artifacts in the power spectral density of the data obtained from the receivers, the incident angle can be obtain from the expression of the simulated Doppler shift.

DTIC

Doppler Effect; Linear Arrays; Signal Processing

20070035448 Department of the Navy, Washington, DC USA

Marine Acoustic Sensor Assembly

Ruffa, Anthony A, Inventor; Jul 3, 2007; 12 pp.; In English; Original contains color illustrations

Report No.(s): AD-D020299; No Copyright; Avail.: Other Sources

ONLINE: <http://hdl.handle.net/100.2/ADD020299>

A marine acoustic sensor assembly includes an acoustic panel having a forward surface and an after surface, a laser scanner oriented so as to project a laser beam onto the acoustic panel after surface, and a sensor oriented so as to receive reflections of the laser beam off the acoustic panel and to transmit data from which a position of a sound generating source can be determined, wherein the acoustic panel is provided with an absorber layer extending over the after surface thereof, and the absorber layer is provided with holes extending therethrough, the holes being of a size sufficient to permit passage of the laser beams to the acoustic panel after surface and the reflections to pass to the sensor, whereby to minimize reflections and noise originating from aft of the after surface, while permitting sound incoming from forward of the acoustic panel to be measured.

DTIC

Acoustics; Marine Technology; Patent Applications; Signal Detectors

20070035449 Department of the Navy, Washington, DC USA

Inductive Coupling Method for Remote Powering of Sensors

Medeiros, Paul, Inventor; Jul 3, 2007; 20 pp.; In English; Original contains color illustrations

Report No.(s): AD-D020300; No Copyright; Avail.: Other Sources

ONLINE: <http://hdl.handle.net/100.2/ADD020300>

Means and methods of remotely powering a plurality of sensor coils are described. The plurality of sensor coils can be inductively coupled to a single, primary coil so as to bias the active circuitry of the sensors. The primary and sensor coils can have a separation on the order of inches, such that the sensors can be mounted exterior to a vessel and the primary coil can be mounted interior to the vessel. In some embodiments, the primary coil can be a wire coil. In other embodiments, the primary coil can be a planar coil pattern etched onto a printed circuit board.

DTIC

Acoustics; Patent Applications; Remote Sensors; Signal Detectors

20070035450 Department of the Navy, Washington, DC USA

An Inverse Method to Calculate Material Properties Using a Non-Resonant Technique

Hull, Andrew J, Inventor; Jul 2, 2006; 31 pp.; In English; Original contains color illustrations

Report No.(s): AD-D020301; No Copyright; Avail.: Other Sources

ONLINE: <http://hdl.handle.net/100.2/ADD020301>

A method for calculating material properties of a material includes determining a dilatational wavespeed and a shear wave speed. The dilatational wavespeed is determined by conducting vertical vibration tests of two specimens of the material, one specimen being twice as thick as the other. Transfer functions are obtained from these tests and used to calculate the dilatational wavespeed. The shear wavespeed is determined by conducting horizontal vibration tests of two specimens with one specimen being twice as thick as the other. The shear wavespeed can be calculated from transfer functions obtained from these tests and the dilatational wavespeed. Other material properties can be calculated from the dilatational and shear wavespeeds. Frequency dependence of the properties can be determined by conducting the tests at different frequencies.

DTIC

Measurement; Patent Applications; Shock Waves

20070035613 Naval Undersea Warfare Center, Newport, RI USA

Array Plate Apparatus Having Tunable Isolation Characteristics

Dubois, Neil J, Inventor; Jun 26, 2007; 24 pp.; In English; Original contains color illustrations

Report No.(s): AD-A470543; No Copyright; Avail.: Other Sources

It is therefore a primary object and general purpose of the present invention to provide an apparatus for use on an underwater vehicle in which the apparatus significantly reduces the amount of vehicle self-noise that travels to an array plate of the undersea vehicle. It is a further object of the present invention to significantly reduce the noise floor at which acoustic transducers operate. An apparatus having an array plate and an isolation section joined to the perimetrical edge of the plate. The isolation section has a plurality of isolation layers and a plurality of intermediate layers alternately arranged wherein an

intermediate layer is positioned between consecutive isolation layers. An innermost isolation layer is joined to the perimetrical edge of the array plate and an outermost isolation layer is adapted to be joined to a hull structure of an underwater vehicle. Each isolation layer is made from energy absorbing material and each intermediate layer is made from generally rigid material. The isolation section substantially reduces vehicle self-noise from traveling to the array plate. Interchangeable depth stop members having various geometries are used to adjust the stiffness of the isolation section so as to maximize the isolation characteristics of the isolation section at particular water depths at which the underwater vehicle operates.

DTIC

Isolation; Sonar; Underwater Vehicles

20070035909 NASA Langley Research Center, Hampton, VA, USA

Air Coupled Acoustic Thermography (ACAT) Inspection Technique

Zalameda, Joseph; Winfree, William P.; Yost, William T.; [2007]; 9 pp.; In English; 34th Annual Review of Progress in Quantitative Nondestructive Evaluation (QNDE 2007), 22-27 Jul. 2007, Golden, CO, USA; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 23-762-60-61; No Copyright; Avail.: CASI: [A02](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20070035909>

The scope of this effort is to determine the viability of a new heating technique using a noncontact acoustic excitation source. Because of low coupling between air and the structure, a synchronous detection method is employed. Any reduction in the out of plane stiffness improves the acoustic coupling efficiency and as a result, defective areas have an increase in temperature relative to the surrounding area. Hence a new measurement system, based on air-coupled acoustic energy and synchronous detection is presented. An analytical model of a clamped circular plate is given, experimentally tested, and verified. Repeatability confirms the technique with a measurement uncertainty of plus or minus 6.2 percent. The range of frequencies used was 800-2,000 Hertz. Acoustic excitation and consequent thermal detection of flaws in a helicopter blade is examined and results indicate that air coupled acoustic excitation enables the detection of core damage in sandwich honeycomb structures.

Author

Acoustic Coupling; Acoustic Excitation; Heating; Inspection; Mathematical Models; Thermography; Air

20070035910 NASA Langley Research Center, Hampton, VA, USA

Acoustic Receptivity of Mach 4.5 Boundary Layer with Leading- Edge Bluntness

Malik, Mujeeb R.; Balakumar, Ponnampalam; [2007]; 27 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): WBS 599489; No Copyright; Avail.: CASI: [A03](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20070035910>

Boundary layer receptivity to two-dimensional slow and fast acoustic waves is investigated by solving Navier-Stokes equations for Mach 4.5 flow over a flat plate with a finite-thickness leading edge. Higher order spatial and temporal schemes are employed to obtain the solution whereby the flat-plate leading edge region is resolved by providing a sufficiently refined grid. The results show that the instability waves are generated in the leading edge region and that the boundary-layer is much more receptive to slow acoustic waves (by almost a factor of 20) as compared to the fast waves. Hence, this leading-edge receptivity mechanism is expected to be more relevant in the transition process for high Mach number flows where second mode instability is dominant. Computations are performed to investigate the effect of leading-edge thickness and it is found that bluntness tends to stabilize the boundary layer. Furthermore, the relative significance of fast acoustic waves is enhanced in the presence of bluntness. The effect of acoustic wave incidence angle is also studied and it is found that the receptivity of the boundary layer on the windward side (with respect to the acoustic forcing) decreases by more than a factor of 4 when the incidence angle is increased from 0 to 45 deg. However, the receptivity coefficient for the leeward side is found to vary relatively weakly with the incidence angle.

Author

Boundary Layers; Acoustics; Receiving; Numerical Analysis; Supersonic Speed; Blunt Leading Edges

20070036103 Scripps Institution of Oceanography, La Jolla, CA USA

2006 Progress Report on Acoustic and Visual Monitoring for Cetaceans along the Outer Washington Coast

Oleson, Erin M; Hildebrand, John A; Calambokidis, John; Schorr, Greg; Falcone, Erin; Aug 2007; 30 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): N00244-06-C-0025

Report No.(s): AD-A470629; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470629>

An acoustic and visual monitoring effort for cetaceans was initiated within the boundaries of the proposed expansion area for the Quinalt Underwater Tracking Range in July 2004. Acoustic data collection consisted of recordings at a site on the continental shelf to the west of Cape Elizabeth and another in deep water within Quinalt Canyon. An analysis plan for acoustic data is included. Results for 32 visual surveys are presented as tables and charts for pinnipeds, dolphins, porpoises, and whales. Time series of vocalizations detected in acoustic recordings are presented for killer whales, white-sided dolphins, Risso's dolphins, unclassified dolphins, humpback whales, and sperm whales. Visual sightings show clear differences in locations, reflecting preferred habitats as well as providing information on seasonal occurrence of some species. Preliminary comparison of acoustic and visual data sets reveals interesting patterns. For example, humpback whales are most commonly seen in summer and fall throughout the visual survey region, yet song and feeding calls of these whales are heard almost exclusively in fall and winter. First steps in the development of a predictive habitat model for cetaceans are described. Continued visual and acoustic data collection is recommended. Brief summaries of papers given at four scientific meetings are included.

DTIC

Acoustic Properties; Coasts; Detection; Marine Mammals; Optical Measurement

20070036122 Washington Univ., Seattle, WA USA

NPAL Modeling-Internal Wave Effects/Theory and Modeling of Internal Wave Effects on Acoustic Propagation

Heney, Frank S; Feb 8, 2007; 3 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): N00014-99-1-0715

Report No.(s): AD-A470676; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470676>

North Pacific Acoustic Laboratory (NPAL) is the name for a set of experiments on long-range acoustic propagation through the ocean. For a sound to travel far in the ocean, its frequency must be low; sound at 70HZ was frequently used in NPAL experiments. It is common for the propagation of sound to be described in terms of ray tracing, a theory that assumes the frequency is high. An obvious question is whether NPAL frequencies used in experiments are high enough to allow use of ray tracing. The PI wrote a ray trace program and an internal wave simulation program, more realistic than other programs in existence. The research showed that rays could not be correct for the effects of internal waves, but did not find out in what way they were wrong. This research has been continued on ONR grant N00014-05-1-0282.

DTIC

Acoustic Propagation; Acoustics; Internal Waves; Wave Propagation

20070036351 New Mexico State Univ., Las Cruces, NM USA

Acoustic Tomography of the Atmosphere

Ostashev, V E; Goedecke, G H; May 31, 2007; 16 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAAD19-03-1-0104

Report No.(s): AD-A470885; No Copyright; Avail.: Defense Technical Information Center (DTIC)

In this project, theoretical foundations for construction and operation of the state-of-the-art array for acoustic tomography of the atmosphere were developed. (The array was built at the Boulder Atmospheric Observatory under the ARO sponsorship, project DAAD19-03-1-0341.) First, the travel times of sound propagation between different pairs of sources and receivers of the array were expressed in terms of the temperature and wind velocity fields within the tomographic volume. Then, a solution of the inverse problem - the reconstruction of the temperature and velocity fields from the measured travel times - was studied in detail. A new inverse algorithm for solution of the inverse problem in acoustic tomography of the atmosphere, time-dependent stochastic inversion (TDSI), was developed. Numerical simulations of acoustic tomography of the atmosphere showed that TDSI gives much better reconstruction of temperature and velocity fields than other inverse algorithms known in the literature. Then, TDSI was used in 2D outdoor and indoor tomography experiments carried out by scientists from the University of Leipzig, Germany. As a result, the temperature and velocity fields within tomographic areas were reconstructed

and monitored in time. The developed TDSI algorithm will be used in operation of the state-of-the-art array for acoustic tomography of the atmosphere.

DTIC

Stochastic Processes; Time Dependence; Tomography; Wind Velocity

20070036373 Army Construction Engineering Research Lab., Champaign, IL USA

Acoustic Propagation Through a Forest Edge: Data Report for Camp Ripley, Minnesota

Swearingen, Michelle E; White, Michael J; Guertin, Patrick J; Mifflin, Jeffrey A; Onder, Timothy E; Albert, Donald G; Decato, Stephen N; Tunick, Arnold; Jul 2007; 66 pp.; In English; Original contains color illustrations

Report No.(s): AD-A470913; ERDC-SR-07-3; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Acoustic propagation and diffraction of high-amplitude, short duration signals through a forest edge have implications for noise mitigation and battlefield acoustic sensors. While the acoustic significance of this unique environment has been noted in the past, it has not been studied in any detail. Acoustic signals that have propagated through a forest edge yield complicated pressure-time histories for receivers both within and outside the forest. Several physical processes contribute to this complexity, including the physical structures of the biomass and ground and the microclimate. A deep understanding of acoustic propagation through this unique environment may lead to strategic placement of fire breaks for noise mitigation and improved signal processing algorithms for use with acoustic detection, and direction-finding and range-finding sensors. Because of the broad scope of issues that could be addressed once acoustic propagation and diffraction at a forest edge is understood, it is important to study this unique environment in detail. This report provides documentation of a field experiment conducted as part of a study of the acoustic properties of the forest edge environment.

DTIC

Acoustic Propagation; Acoustic Properties; Forests; Minnesota; Sound Transmission

20070036622 Department of the Navy, Washington, DC USA

System and Method for Calculating the Directivity Index of a Passive Acoustic Array

Welch, John R, Inventor; Jul 27, 2007; 40 pp.; In English

Report No.(s): AD-D020303; No Copyright; Avail.: Other Sources

A software system and method is presented that calculates the sensor directivity at all spatial angles, and stores these values in a two dimensional matrix. These values are then used as additional 'weighting' coefficients in the equation for the pressure detected by an array of directive sensors. The azimuthal and polar angles of a particular sensor normal vector are used to 'rotate' the sensor directivity matrix to account for the angular orientation of each sensor within the array. The software system receives as input sensor and array geometry, shading functions, sensor shape, array structure baffling, steering, and shading. A sensor can have the shape of a point, line, plane, volume, baffled ring, or circular plane piston. The sensors within the array can either be baffled by the array structure or retain their free field directivity response, and array as a whole can have steering or no steering.

DTIC

Acoustic Measurement; Arrays; Directivity; Patent Applications

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*.

20070035149 Princeton Univ., NJ USA

Accumulation of Large Amounts of Hyperpolarized Xe-129 & Applications to Xe-129 Spectroscopy

Happer, William; Jan 15, 2007; 11 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAAD19-02-1-0229

Report No.(s): AD-A470040; PU-245-6151; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470040>

We have studied the physics underlying the production, accumulation, and cryogenic separation of hyperpolarized xenon-129. This research has led to a dramatically improved understanding of the physics behind nuclear relaxation in solid xenon and resolved long-standing discrepancies between theoretical predictions and experimental observation. The information gained from these experiments allowed us to produce greater quantities of hyperpolarized 129Xe with higher

nuclear polarization. This in turn permitted us to begin cutting-edge studies applying hyperpolarized ^{129}Xe nuclear magnetic resonance (NMR) spectroscopy to samples of biological interest. Specifically, we performed preliminary experiments which demonstrated that hyperpolarized ^{129}Xe spectroscopy may be useful in the diagnosis of atherosclerosis.

DTIC

Nuclear Magnetic Resonance; Spectroscopy; Xenon; Xenon 129

20070035186 Air Force Research Lab., Edwards AFB, CA USA

An Inversion Method for Reconstructing Hall Thruster Plume Parameters from the Line Integrated Measurements (Postprint)

Matlock, Taylor S; Larson, C W; Hargus, Jr , William A; Nakles, Michael R; Jul 2007; 20 pp.; In English

Contract(s)/Grant(s): Proj-33SP

Report No.(s): AD-A470106; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470106>

Utilizing symmetry and extensive datasets, it is possible to extract three-dimensional distributions from two dimensional data. Numerically, these inversions are unstable and prone to magnify noise. However, noise amplification can be controlled by careful addition of artificial smoothing within the numerical inversion algorithm. The precept of Tikhonov regularization is that a unique, stable solution to a deconvolution may be achieved by minimizing a constrained smoothing function. Fundamentally, this will generate a stable, single valued solution only so long as the uncertainty of the iterated solution does not exceed the uncertainty (noise) of the original data. Within these constraints, the algorithm is relatively insensitive to noise. Using Tikhonov deconvolution, it is possible to determine radial profiles from line integrated measurements. A preliminary evaluation of the deconvolution scheme was made with a biased tungsten wire acting as a Faraday probe. After the deconvolution method was assessed, it was applied to a spectroscopic survey of relative xenon neutral line intensities in the near infrared. The radially resolved emission ratios provide a three-dimensional estimate of the plume electron temperature using a published xenon collisional radiative model.

DTIC

Exhaust Gases; Hall Thrusters; Inversions; Plumes

20070035757 Massachusetts Inst. of Tech., Cambridge, MA USA

NMR System for a Type II Quantum Computer

Cory, David G; Jun 2007; 399 pp.; In English

Contract(s)/Grant(s): FA9550-04-1-0212

Report No.(s): AD-A470310; ISRN-MIT-2007-6895936-F; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This project was to use liquid state nuclear magnetic resonance (NMR) as a test-bed to explore the control of information for Type-II quantum computing (QC) and for quantum information processing approaches to quantum simulations. During the first stages of the project we demonstrated NMR based implementations of type-II QC algorithms including the diffusion equation and Burger's equation. These demonstrations relied on a spatial encoding of non-interacting quantum systems. One of the challenges of quantum simulations is the growth of errors during a lattice type calculation. We demonstrated that we could reduce the errors by introducing random operations that commute with the map. This improved the simulation fidelity but important errors still remained. We then attacked these errors directly by exploring both the transients in our implementation (which led to the largest errors) and a series of more robust optimal control pulses. Finally during this last period we focused on quantum simulations of exchange operations over lattices and demonstrated that quantum interference effects involving multiple paths between the exchanging qubits can lead to higher fidelity operations.

DTIC

Nuclear Magnetic Resonance; Quantum Computation

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*.

20070035064 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

Absolute Distance Measurement with the MSTAR Sensor

Lay, Oliver P.; Dubovitsky, Serge; Peters, Robert; Burger, Johan; Ahn, Seh-Won; Steier, William H.; Fetterman, Harrold R.; Chang, Yian; August 3, 2003; 12 pp.; In English; The International Society for Optical Engineering (SPIE), International Symposium on Optical Science and Technology, 3-8 Aug. 2003, San Diego, CA, USA; Original contains black and white illustrations; Copyright; Avail.: Other Sources

ONLINE: <http://hdl.handle.net/2014/40465>

The MSTAR sensor (Modulation Sideband Technology for Absolute Ranging) is a new system for measuring absolute distance, capable of resolving the integer cycle ambiguity of standard interferometers, and making it possible to measure distance with sub-nanometer accuracy. The sensor uses a single laser in conjunction with fast phase modulators and low frequency detectors. We describe the design of the system - the principle of operation, the metrology source, beamlaunching optics, and signal processing - and show results for target distances up to 1 meter. We then demonstrate how the system can be scaled to kilometer-scale distances.

Author

Metrology; Distance; Signal Processing; Rangefinding; Low Frequencies; Modulation

20070035123 Boeing Co., Huntsville, AL, USA; NASA Marshall Space Flight Center, Huntsville, AL, USA

Effects of Optical Artifacts in a Laser-Based Spacecraft Navigation Sensor

LeCroy, Jerry E.; Hallmark, Dean S.; Howard, Richard T.; April 09, 2007; 11 pp.; In English; SPIE Devense and Security Symposium, 9-13 Apr. 2007, Orlando, FL, USA; Original contains black and white illustrations; Copyright; Avail.: CASI:

A03, Hardcopy

Testing Of the Advanced Video Guidance Sensor (AVGS) used for proximity operations navigation on the Orbital Express ASTRO spacecraft exposed several unanticipated imaging system artifacts and aberrations that required correction, to meet critical navigation performance requirements. Mitigation actions are described for a number of system error sources, including lens aberration, optical train misalignment, laser speckle, target image defects, and detector nonlinearity/noise characteristics. Sensor test requirements and protocols are described, along with a summary of test results from sensor confidence tests and system performance testing.

Author

Navigation Instruments; Space Navigation; Video Communication; Guidance Sensors; Astro Vehicle; Artifacts; Lasers; Optics

20070035231 Maryland Univ., College Park, MD USA

Dynamics and Synchronization of Nonlinear Oscillators with Time Delays: A Study with Fiber Lasers

Franz, Anthony L; Jul 19, 2007; 128 pp.; In English

Report No.(s): AD-A470168; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470168>

The effect of time delay on nonlinear oscillators is an important problem in the study of dynamical systems. Erbium-doped fiber ring lasers have an internal time scale set by the length of the laser's electromagnetic cavity. Long cavities allow thousands of modes to experience gain making it very difficult to model the lasers. We examine the effect of adding external time delays through feedback and coupling. In the first experiment an external time delay is added to a laser by adding a feedback loop to the cavity. These delay times are varied over four orders of magnitude by changing the length of fiber in the feedback loop. The laser intensity dynamics are examined using time series, power spectra, time delay embeddings, and spatiotemporal representations. We apply Karhunen-Lo'eve (KL) decomposition on the spatiotemporal representations and use the Shannon entropy as calculated from the KL eigenvalue spectra as a measure of the complexity of the dynamics. For long delays we find that the complexity increases as expected, but also that the fluctuation size increases. In the second experiment two lasers are mutually coupled together with a coupling time delay that is varied over four orders of magnitude. The analysis is repeated and we find the surprising result that the dynamical complexity decreases for short coupling delays as compared to the uncoupled lasers. Measurements of the optical spectra indicate a narrowing of the spectra indicating that the simplification in dynamics could be due to the reduction in the number of electromagnetic modes experiencing gain. The fluctuation size increases for all delay times and is largest when the internal and external time delays match. Lag-synchrony

is also observed for the mutually coupled lasers. Recent modeling using Ikeda ring oscillators showed that stable isochronal synchrony could be achieved if a third drive

DTIC

Erbium; Fiber Lasers; Nonlinear Systems; Nonlinearity; Oscillators; Synchronism

20070035261 Washington Univ., Seattle, WA USA

Observing and Modeling the Surface Scattering Layer of First-Year Arctic Sea Ice

Moritz, Richard; Light, Bonnie; Jul 2007; 8 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): N00014-03-1-0120

Report No.(s): AD-A470226; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470226>

The goal of this work is to increase our quantitative understanding of the partitioning of incident solar (shortwave) radiation by sea ice. The partitioning of shortwave radiation into components backscattered to the atmosphere, absorbed by the ice, and transmitted to the ocean is central to the ice-albedo feedback mechanism, the mean annual cycle of ice thickness, mechanical properties of the ice, and the quality and quantity of light available to under-ice biological communities. This partitioning is known to depend on the presence of surface scattering layers (SSLs). We conducted field observations and model simulations of radiative transfer within the surface layer and interior layers of sea ice. Results have been used to improve characterization of the properties of bare and ponded ice for the purpose of understanding the surface energy and mass balances of sea ice during summer. Three broad concepts have emerged from this work: (i) a 3-layer structure for specifying the vertical variation of optical properties of both bare and ponded sea ice, (ii) the optical properties found in the ice interior are independent of time, and (iii) a picture of the evolution of scattering near the surface of bare and ponded ice as the melt season progresses.

DTIC

Albedo; Arctic Ocean; Feedback; Ice; Optical Properties; Radiative Transfer; Scattering; Sea Ice; Surface Layers

20070035509 Naval Research Lab., Bay Saint Louis, MS USA

An Experimental Investigation of Wave Measurements Using a Dual-Beam Interferometer: Gulf Stream as a Surface Wave Guide

Hwang, Paul A; Toporkov, Jakov V; Sletten, Mark A; Lamb, Douglas; Perkovic, Dragana; Sep 13, 2006; 16 pp.; In English; Original contains color illustrations

Report No.(s): AD-A470343; NRL/JA/7330-06-6082; No Copyright; Avail.: Defense Technical Information Center (DTIC)

A dual-beam interferometric synthetic aperture radar measures remotely two radial components of the ocean surface current from a single flight pass. Combining two passes over the same area, all three orthogonal components of the surface velocity can be retrieved. An experiment is conducted near the Gulf Stream (CS) boundary. A sharp change of the surface velocity of about 1 in/s over a 500 m lateral distance is measured. The wind and wave condition is dominated by a 14-s swell system and low wind velocity. The wave variance inside CS is about twice the wave variance outside the CS in the present data set. The difference in the wave variance is considerably higher than that can be expected from wave-current interaction. An ocean current system with strong shears such as the CS is a wave guide and can trap waves with the right combinations of wavelengths and propagation directions. Numerical calculations suggest that the wave properties of the data set may satisfy the conditions of wave trapping by the CS. The standing wave pattern on the CS side of the sharp velocity front, indicative of the long swell bouncing off the current front, also offers support for the wave guide hypothesis. In this respect, the Gulf Stream can be considered the nature's hydraulic breakwater that can attenuate about 50% of the incident wave energy generated by storms. Its role in protecting the U.S. coastlines in the Atlantic Ocean cannot be overstated.

DTIC

Gulf Stream; Interferometers; Surface Waves

20070035967 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

A New Large-Well 1024x1024 Si:As Detector for the Mid-Infrared

Mainzer, Amanda K.; Hong, John H.; Stapelbroek, M. G.; Hogue, Henry; Molyneux, Dale; Ressler, Michael E.; Watkins, Ernie; Reekstin, John; Werner, Mike; Young, Erick; July 31, 2005; 5 pp.; In English; SPIE Optics and Photonics Symposium, 31 Jul. - 4 Aug. 2005, San Diego, CA, USA; Original contains black and white illustrations; Copyright; Avail.: Other Sources

ONLINE: <http://hdl.handle.net/2014/40532>

We present a description of a new 1024x1024 Si:As array designed for ground-based use from 5 - 28 microns. With a

maximum well depth of $5e6$ electrons, this device brings large-format array technology to bear on ground-based mid-infrared programs, allowing entry to the mega-pixel realm previously only accessible to the near-IR. The multiplexer design features switchable gain, a 256×256 windowing mode for extremely bright sources, and it is two-edge buttable. The device is currently in its final design phase at DRS in Cypress, CA. We anticipate completion of the foundry run in October 2005. This new array will enable wide field, high angular resolution ground-based follow up of targets found by space-based missions such as the Spitzer Space Telescope and the Wide-field Infrared Survey Explorer (WISE).

Author

Near Infrared Radiation; Multiplexing; High Resolution; Angular Resolution; Arrays

20070036011 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

A Wafer Transfer Technology for MEMS Adaptive Optics

Yang, Eui-Hyeok; Wiberg, Dean V.; November 16, 2001; 6 pp.; In English; ASME MEMES Symposium/International Mechanical Engineering Congress and Exposition, 16 Nov. 2001, New York, NY, USA; Original contains color and black and white illustrations; Copyright; Avail.: Other Sources

ONLINE: <http://hdl.handle.net/2014/40510>

Adaptive optics systems require the combination of several advanced technologies such as precision optics, wavefront sensors, deformable mirrors, and lasers with high-speed control systems. The deformable mirror with a continuous membrane is a key component of these systems. This paper describes a new technique for transferring an entire wafer-level silicon membrane from one substrate to another. This technology is developed for the fabrication of a compact deformable mirror with a continuous facet. A $1 \text{ } (\mu\text{m})$ thick silicon membrane, 100 mm in diameter, has been successfully transferred without using adhesives or polymers (i.e. wax, epoxy, or photoresist). Smaller or larger diameter membranes can also be transferred using this technique. The fabricated actuator membrane with an electrode gap of $1.5 \text{ } (\mu\text{m})$ shows a vertical deflection of $0.37 \text{ } (\mu\text{m})$ at 55 V.

Author

Adaptive Optics; Wave Fronts; Deformable Mirrors; High Speed; Membranes; Substrates; Silicon

20070036311 Virginia Univ., Charlottesville, VA USA

Realization of an Ultrasensitive Heisenberg-Limited Interferometer

Pfister, Olivier; Jul 31, 2006; 16 pp.; In English

Contract(s)/Grant(s): DAAD19-01-1-0721

Report No.(s): AD-A470784; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The goal of the project 'Realization of an Ultrasensitive Heisenberg-Limited Interferometer,' supported by ARO grant DAAD19-01-1-0721 from August 1, 2001 to July 31, 2006, was the investigation of quantum interferometry with bright nonclassical light beams emitted by an ultrastable optical parametric oscillator (OPO). Theoretical studies of the Holland-Burnett Bayesian detection scheme were conducted for realistic experimental implementation in photonic quantum optics. The main result, applicable to any boson wave (eg. matter waves), is that the ultimate Heisenberg limit $1/N$ (N being the average number of photons detected in the measurement) can still be reached in the presence of losses for Bayesian detection, if the losses do not exceed $1/N$. The main experimental results were the first demonstration of macroscopic Hong-Ou-Mandel quantum interference at a beam splitter and the demonstration of heterodyne polarimetry with a noise floor 4.8 dB below the interferometric shot noise limit ($1/\sqrt{N}$). The latter can be applied to enhancing the sensitivity of chiral molecule detection. Realistic extensions of this study are larger amounts of squeezing (-10 dB and beyond) as well as RF broadband phase measurements, which are a direct consequence of the stability performance of our OPO and for which we also present preliminary results.

DTIC

Interferometers; Interferometry; Nonlinear Optics; Parametric Amplifiers; Quantum Optics

20070036388 National Inst. of Standards and Technology, Gaithersburg, MD USA

High Accuracy Dual Lens Transmittance Measurements

Cheung, Jessica; Gardner, James L; Migdall, Alan; Polyakov, Sergey; Ware, Michael; Aug 1, 2007; 10 pp.; In English

Contract(s)/Grant(s): DAAD19-03-1-0199

Report No.(s): AD-A470939; No Copyright; Avail.: Defense Technical Information Center (DTIC)

We show how to determine the transmittance of short focal length lenses (f 19 mm and f 25 mm, in this case) with a combined uncertainty of 3 parts in 104 or better by measuring transmittances of lens pairs of a set of three or more lenses with

the same nominal focal length. Uncertainties are minimized by optimizing the radiometric design of the setup and the measurement procedure. The technique is particularly useful in systems where the detector acceptance angle limits the beam geometry to relatively collimated beams.

DTIC

Counting; Lenses; Metrology; Transmittance

20070036397 National Inst. of Standards and Technology, Gaithersburg, MD USA

A Broadband High Spectral Brightness Fiber Based Two-Photon Source

Fan, Jingyun; Migdall, Alan L; Mar 19, 2007; 8 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAAD19-03-1-0199

Report No.(s): AD-A470959; No Copyright; Avail.: Defense Technical Information Center (DTIC)

After characterizing the Raman scattering in a fused silica polarization-maintaining microstructure optical fiber, we built a fiber-based two-photon light source of high spectral brightness, broad spectral range, and very low noise background at room temperature. The resulting bright low-noise two-photon light can be used for a number of quantum information applications.

DTIC

Brightness; Broadband; Emittance; Fiber Optics; Light Sources; Photons; Spectra

20070036398 National Inst. of Standards and Technology, Gaithersburg, MD USA

Increased Cross-Correlation in Cascaded Four-Wave Mixing Processes

Fan, Jingyun; Migdall, Alan L; Wang, L J; Jun 11, 2007; 8 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAAD19-03-1-0199

Report No.(s): AD-A470960; No Copyright; Avail.: Defense Technical Information Center (DTIC)

We report the measurement of increased noise cross-correlation between stokes and anti-stokes beams created in cascaded four-wave mixing processes with dual pump wavelengths. This method may be useful in creating highly correlated twin beams for various applications including quantum information processing.

DTIC

Cross Correlation; Fiber Optics; Four-Wave Mixing

20070036690 National Inst. of Information and Communications Technology, Tokyo, Japan

Journal of the National Institute of Information and Communications Technology, Volume 53, No. 3

Kurihara, Noriyuki, Editor; Tawara, Yasuo, Editor; Okano, Naoki, Editor; Wakana, Hiromitsu, Editor; September 2006; ISSN 1349-3205; 118 pp.; In English; See also 20070036691 - 20070036701; Original contains black and white illustrations; Copyright; Avail.: Other Sources

Our Optical and Quantum Communications Unit has been working toward the creation of an ultra-high-density light-wave communication technology that will ultimately control the wave nature of light, as well as quantum info-communications technology that will enable control of even the particle nature of light. Currently, however, links are missing between networking technology, light-wave control technology, and quantum-control technology, preventing integration of the three. The obstacle has also been highlighted as an obstruction to the technical application and commercialization of the outcomes of basic research. Nevertheless, NICT continues to apply diverse research and development promotion methods to foster a consistent workflow from the basics to technical applications and beyond. NICT has been taking full advantage of these methods to develop collaborative activities among industry, academia, and government. In this special issue, we present an overall picture of the present field and the latest achievements in two separate chapters. First, regarding ultra-high-density light-wave communication, we discuss the technological achievements in high-speed, stable control of amplitude, frequency, and phase of the light wave. The discussion focuses mainly on NICT's unique device fabrication technology, optical non-linearity technology, and high-performance optical modulation technology. As for quantum info-communications, after we present an overview of the overall picture and discuss strategic problems in quantum infocommunications technology-both in terms of increasing capacity and ensuring security-we report on quantum cryptography, quantum signal control and detection, and new quantum network technologies.

Derived from text

Optical Communication; Quantum Cryptography; Technologies; Photonics; Fabrication

20070036691 National Inst. of Information and Communications Technology, Tokyo, Japan

Novel Photonic Devices Based on Electro-optic Modulation Technologies

Sakamoti, Takahdie; Kawanishi, Tetsuya; Yu, Paul Kit Lai; Shinda, Satoshi; Tsuchiya, Masahiro; Izutsu, Masayuki; Journal of the National Institute of Information and Communications Technology, Volume 53, No. 3; September 2006, pp. 25-32; In English; See also [20070036690](#); Copyright; Avail.: Other Sources

Recent progresses in optical modulation using electro-optic effects have renewed photonic signal processing technologies crucial in future advanced optical communication systems. NICT is now exploring a novel functional photonic devices and subsystems based on electro-optic modulation technologies. In this paper, we review on recent research activities in NICT around these exotic technologies, picking up following three topics: (1) optical modulator array with patch antennas for weak radio-wave detection, (2) optical ring filter based on Ti-diffused LiNbO₃ wave-guide loop for high efficient modulation, (3) photonic-electronic oscillator for self-oscillating optical comb generation.

Author

Electro-Optics; Modulation; Technologies; Photonics; Patch Antennas

20070036692 National Inst. of Information and Communications Technology, Tokyo, Japan

Fabrication Technique of Ultra-high Density Semiconductor Quantum Dot

Akahane, Kouichi; Gozu, Shinichiro; Ohtani, Naoki; Yamamoto, Naokatsu; Ueta, Akio; Tsuchiya, Masahiro; Journal of the National Institute of Information and Communications Technology, Volume 53, No. 3; September 2006, pp. 3-12; In English; See also [20070036690](#); Copyright; Avail.: Other Sources

Strain-compensation methods were developed to multiply quantum dot (QD) layer. Although self-assembled technique in lattice mismatched material systems have been attracted much attentions to fabricate semiconductor nano-structures, for example, semiconductor QD, it is difficult to fabricate high density QD because of accumulation of is research, we fabricated ultra-high density QD which was stacking by using strain compensation methods. The density of QDs exceeds $5 \times 10^{12}/\text{cm}^2$ which is world's highest density. A strong emission from this sample was observed at around temperature. The emission wavelength is suitable for fiber-optic communications systems. Therefore, our technique for growing stacked QDs has potential in applications ing novel high-performance QD devices for these communications systems.

Author

Fabrication; Quantum Dots; Semiconductors (Materials); Telecommunication

20070036693 National Inst. of Information and Communications Technology, Tokyo, Japan

Dense Multiplexing and Transmission Technique of Millimeter-Wave-Band Radio-on-Fiber Signals

Kuri, Toshiaki; Kitayama, Ken-ichi; Toda, Hiroyuki; Journal of the National Institute of Information and Communications Technology, Volume 53, No. 3; September 2006, pp. 41-48; In English; See also [20070036690](#); Copyright; Avail.: Other Sources

Optical-frequency-interleaved dense wavelength division multiplexing (DWDM) transmission of millimeter-wave-band subcarrier-multiplexed (SCM) radio-on-fiber (RoF) signals with a photonic downconversion technique is described. The photonic downconversion technique is carried out for a lump of all multiplexed RoF signals at the receiver side. Error-free 25-GHz-spacing DWDM transmission and demultiplexing of two 60-GHz-band SCM RoF signals carrying a 155-Mb/s differential phase-shift-keying data over 25-km-long standard single-mode fiber are experimentally demonstrated without serious fiber dispersion. effect.

Author

Fiber Optics; Radio Signals; Wavelength Division Multiplexing; Microwave Transmission; Optical Fibers; Phase Shift Keying; Demultiplexing

20070036694 National Inst. of Information and Communications Technology, Tokyo, Japan

Optical Amplification and Switches in Silicon Based Photonic Devices for Future Networks

Liang, Tak-Keung; Tsang, Hon Ki; Nunes, Luis Romeu; Tsuchiya, Masahiro; Journal of the National Institute of Information and Communications Technology, Volume 53, No. 3; September 2006, pp. 13-24; In English; See also [20070036690](#); Copyright; Avail.: Other Sources

Silicon photonics technology has attracted immense research interest because it offers low cost electronics solutions for telecommunications applications. In silicon-on-insulator optical waveguides, light is confined in a single-crystal silicon layer separated from the substrate by a thin layer of buried silicon dioxide. The large step in refractive index enables a tight confinement of light in a small waveguide area, which can be exploited to achieve high optical intensity propagation. Thus

many practical nonlinear optical devices can be realized in these waveguides. In this paper we study optical nonlinearities in silicon waveguides, including two-photon sorption and stimulated Raman scattering. Several silicon-based photonic devices have been developed for future communications systems, including waveguide two-photon absorption autocorrelator, ultrafast optical silicon optical switches and waveguide optical Raman amplifier.

Author

Amplification; Optical Waveguides; Photonics; Switches; Communication Networks

20070036695 National Inst. of Information and Communications Technology, Tokyo, Japan

Overview of Quantum Info-Communications and Research Activities in NICT

Sasaki, Masahide; Journal of the National Institute of Information and Communications Technology, Volume 53, No. 3; September 2006, pp. 49-57; In English; See also [20070036690](#); Copyright; Avail.: Other Sources

Present optical communication relies on the intensity control of light. By exploiting the wave nature of light, transmission with higher capacity and multi-functions must be possible. Its performance, however, will be bounded at the shot noise limit in the near future. In quantum info-communications, where one directly controls quantum states of photons, information security based on physical principle and ultra-high capacity beyond the shot noise limit could be realized. In this article, we present an overview of quantum info-communications, and review the research activities in NICT.

Author

Optical Communication; General Overviews; Quantum Cryptography; Photons

20070036696 National Inst. of Information and Communications Technology, Tokyo, Japan

Supercontinuum Generation and its Applications

Sotobayashi, Hideyuki; Journal of the National Institute of Information and Communications Technology, Volume 53, No. 3; September 2006, pp. 33-40; In English; See also [20070036690](#); Copyright; Avail.: Other Sources

In this paper, a design theory for the supercontinuum spectrum generation in an optical fiber is firstly described. To generate a wideband supercontinuum spectrum, the balance between fiber nonlinearity and the amount of group velocity dispersion is important. Secondly, the experimental results of supercontinuum generation are shown. A few kinds of optical fibers such as a highly nonlinear dispersion-shifted fiber and a highly nonlinear bismuth-oxide fiber are tested. Finally several applications of supercontinuum light are described. We demonstrate multi-wavelength light source, multiplexing format conversion, and optical characterization using a supercontinuum light-source.

Author

Photonics; Nonlinearity; Optical Fibers; Light Sources; Bismuth Oxides; Velocity Distribution

20070036697 Nippon Telegraph and Telephone Public Corp., Japan

Generation of Telecom-band Quantum Entangled Photon Pairs and its Application to Quantum Key Distribution

Takesue, Hiroki; Journal of the National Institute of Information and Communications Technology, Volume 53, No. 3; September 2006, pp. 69-76; In English; See also [20070036690](#); Copyright; Avail.: Other Sources

Generation of quantum entangled photon pair in the 1.5-micron telecom band is important technology for realizing quantum communication systems over optical fiber networks. This paper reports generation of 1.5-micron entangled photon pairs using spontaneous four-wave mixing in an optical fiber conducted by NTT Basic Research Laboratories. A new entanglement-based quantum key distribution scheme is also briefly described.

Author

Quantum Communication; Telecommunication; Four-Wave Mixing; Optical Fibers

20070036698 National Inst. of Information and Communications Technology, Tokyo, Japan

Quantum Network Consisting of Laser-cooled Ions and Photons

Hayasaka, Kazuhiro; Keller, Matthias; Lance, Wolfgang; Lange, Birgit; Walther, Herbert; Journal of the National Institute of Information and Communications Technology, Volume 53, No. 3; September 2006, pp. 99-109; In English; See also [20070036690](#); Copyright; Avail.: Other Sources

Peculiar states, such as superposition, quantum entanglement, have no counterparts in classical mechanics, and are a characteristic of quantum mechanics. Quantum networks are those in which the quantum states are faithfully communicated. Applications of quantum networks include distributed quantum computation connecting small-sized quantum computers, quantum bit commitment based on quantum entanglement, and quantum authentication that enables votes and transactions

with assured security on personal information. We report studies at NICT towards a working prototype of quantum network consisting of laser-cooled ions and photons.

Author

Classical Mechanics; Quantum Computation; Quantum Mechanics; Quantum Computers

20070036699 National Inst. of Information and Communications Technology, Tokyo, Japan

Manipulation and Measurement of Quantum Signals via Non-Gaussian Operation

Kitagawa, Akira; Takeoka, Masahiro; Sasaki, Masahide; Chefles, Anthony; Lutkenhaus, Norbet; Journal of the National Institute of Information and Communications Technology, Volume 53, No. 3; September 2006, pp. 87-97; In English; See also [20070036690](#); Copyright; Avail.: Other Sources

On the current communication scheme, Gaussian coherent state signals play an important role. To make use of the potential of coherent state signals going beyond the shot noise limit, not only Gaussian operations, but also non-Gaussian operations, described as the third or higher order interactions with respect to the electric field amplitude, must essentially be applied. In this manuscript, we discuss our recent results on the enhancement of entanglement and quantum signal discrimination via the measurement-induced non-Gaussian operation with photon detector and linear optics.

Author

Electric Fields; Signal Measurement; Shot Noise

20070036700 Mitsubishi Electric Corp., Japan

Secure Communication with Quantum Cryptography

Hasegawa, Toshio; Ishizuka, Hirokazu; Tomita, Akihisa; Nishioka, Tsuyoshi; Nambu, Yoshihiro; Tajima, Akio; Journal of the National Institute of Information and Communications Technology, Volume 53, No. 3; September 2006, pp. 59-68; In English; See also [20070036690](#); Copyright; Avail.: Other Sources

Quantum cryptography, which has the advantage of being able to detect eavesdropping on communication channels and security guaranteed by a fundamental physical law, is expected as an absolutely unbreakable cryptography. In 2001, Mitsubishi, NEC and the University of Tokyo started the NICT project 'Research and Development on Quantum Cryptography', which includes four research themes: single photon generation, single photon detection, random number generation, and quantum key distribution system. In this paper, we introduce our research activities and some recent results. In Mitsubishi's part, we report the long-distance field trial in a 96-km installed fiber (JGN II) and the integrated quantum cryptosystem with existing cryptosystem. In NEC's part, we show fortnight continuous key generation field trial over the 16.3-km commercial access fibers and novel backscattering-free unidirectional QKD system based on planar lightwave circuit platforms.

Author

Quantum Cryptography; Channels (Data Transmission); Security; Detection; Backscattering

20070036701 National Inst. of Information and Communications Technology, Tokyo, Japan

Status of Development of Photon Number Resolving Detectors

Fujiwara, Mikio; Akiba, Makoto; Tsujino, Kenji; Sasaki, Masahide; Journal of the National Institute of Information and Communications Technology, Volume 53, No. 3; September 2006, pp. 77-85; In English; See also [20070036690](#); Copyright; Avail.: Other Sources

Photon number resolving detectors that can count number of photons in the pulses precisely are the important devices for developing universal photonic quantum gates, by combination with non-classical light. This technology will be used to establish quantum decoders that offer a significant upsurge in the capacity of communications channel. We describe our research activities for developing of photon number resolving detectors.

Author

Quantum Communication; Photons; Decoders; Quantum Numbers; Quantum Cryptography

20070036763 Organisatie voor Toegepast Natuurwetenschappelijk Onderzoek, Soesterberg, Netherlands

[ATHENA: The Combination of a Clarity Amplifier and Thermal Viewer with Colour Reproduction]

Toet, A.; Hogervorst, M. A.; Lensen, H. A.; Benoist, K. W.; deRooy, R.; August 2007; 2 pp.; In Dutch; Original contains color and black and white illustrations

Contract(s)/Grant(s): TNO Proj. 013.45404

Report No.(s): TNO-DV 2007 A329; TD2007-0158; Copyright; Avail.: Other Sources

In the national Technology Project ATHENA we developed a combined image intensifier and thermal imaging device for

observation, target detection and navigation in conditions with low visibility. The ATHENA, system provides a fused colour image. The colouring setting can be adapted to the nature of the task. For instance, natural daytime colors can be selected for navigation and surveillance purposes, whereas false colours may be used to break camouflage. This report presents the ATHENA system, the optimized color transformations, the data that have been collected with the system during several field trials, and identifies conditions in which the system proved its added value.

Author

Color; Image Intensifiers; Imaging Techniques; Light Amplifiers

75

PLASMA PHYSICS

Includes magnetohydrodynamics and plasma fusion. For ionospheric plasmas see *46 Geophysics*. For space plasmas see *90 Astrophysics*.

20070036054 Stanford Univ., Stanford, CA USA

Ion Velocity Measurements in a Linear Hall Thruster (Postprint)

Gascon, Nicolas; Cappelli, Mark A; Hargus, William A; Jun 14, 2005; 8 pp.; In English

Report No.(s): AD-A470559; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470559>

This work presents the general operation and the near exit plane ion velocity field of the Stanford Linear Hall Thruster in a high vacuum environment. The ionized propellant velocities were measured using laser induced fluorescence of the excited state xenon ionic transition at 834.7 nm. Ion velocities were interrogated from the channel exit plane to a distance 30 mm from it. Both axial and cross-field (along the electron Hall current direction) velocities were measured. The results presented here, combined with those of previous work, highlight the high sensitivity of electron mobility inside and outside the channel, depending on the background gas density, type of wall material, or magnetic field intensity. When operated with a low background pressure, the particular Hall discharge studied here creates an ion accelerating electrostatic field mainly outside of the channel, in a narrow zone located 5-20 mm away from the exit plane.

DTIC

Hall Thrusters; Plumes; Velocity Measurement

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*.

20070035179 Universal Energy Systems, Inc., Dayton, OH USA

Initial Examination of the Strength of Single-Ended Sources in Micrometer-Sized Single Crystals (Preprint)

Rao, S I; Dimiduk, D M; Tang, M; Parthasarathy, T A; Uchic, M D; Woodward, C; Apr 2007; 36 pp.; In English

Contract(s)/Grant(s): FA8650-04-D-5233; Proj-2311

Report No.(s): AD-A470093; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470093>

A recent study indicated that the behavior of single-ended dislocation sources contributes to the flow strength of micrometer-scale crystals. In this study 3D discrete dislocation dynamics simulations are used to calculate the effects of anisotropy of dislocation line tension on the strength of single-ended dislocation sources in micrometer-sized volumes with free surfaces, and to compare them with the strength of double-ended sources of equal length. This is done by directly modeling their plastic response within a 1-micron cubed volume composed of a single crystal FCC metal. In general, double-ended sources are stronger than single-ended sources of an equal length and exhibit no significant effects from truncating the long-range elastic fields at this scale. The double-ended source strength increases with Poisson ratio, exhibiting an increase of about 50% at $\nu = 0.38$ (value for Ni) as compared to the value at $\nu = 0$. Independent of dislocation line direction, for ν greater than 0.20, the strengths of single-ended sources depend upon the sense of the stress applied.

DTIC

Crystals; Single Crystals

20070035461 Delaware Univ., Newark, DE USA

Magnetostatically-Coupled Anisotropic Composite Magnets with Enhanced Remanence

Hadjipanayis, George C; Jul 2007; 9 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): N00173-06-1-G018; Proj-6300

Report No.(s): AD-A470279; PHYS-33212306000; 06000921; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The computer simulation confirmed a magnetostatic coupling between R-Fe-B matrix and thick Fe layers in hot-deformed composite magnets. However, enhancement in the remanence and maximum energy product of the hard-soft composites requires at least a partial inter-phase exchange coupling. The combination of a complete magnetostatic coupling and a partial exchange coupling may facilitate the development of anisotropic composite magnets with superior performance. The experimental studies found that (1) magneto-statically coupled soft magnetic phase increases the temperature dependence of the hard magnetic properties; (2) re-distribution of elements during thermomechanical treatment is a significant factor affecting the properties of anisotropic composite magnets; (3) though the refinement of the precursor powders enables certain control over the morphology and thickness of the soft inclusions, the expected advantages are overcome by the increased oxidation of the R-rich phase and/or increased inter-phase diffusion.

DTIC

Anisotropy; Computerized Simulation; Magnets; Remanence

20070036059 Delaware Univ., Newark, DE USA

Embedded Millimeter Wave Photonic Crystals as Processing Elements in Shipboard Superstructures

Prather, Dennis W; Jul 2007; 13 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): N00014-06-1-0247

Report No.(s): AD-A470573; ELEG332216-011407; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470573>

The ability to rapidly and accurately detect signals is essential in the modern warfare environment. However, the ever increasing use of the spectrum places great demand on current technology and, requires significant technological developments to overcome current limitations. Also, the nearly ubiquitous miniaturization of military systems requires a concomitant reduction in the size of radiating apertures. Therefore, in order to deal with these challenges, advanced artificial materials are used, namely, photonic crystals (PhCs) and meta-materials, to construct an advanced signal sensing head with miniaturized antennas. This sensor can directly detect and process signals in terms of their frequency channelization and direction of arrival and does so at essentially the speed of light. In addition, PhC based devices are electromagnetically transparent, which leads to a dramatic reduction of the scattering cross-section. Perhaps the most significant advantage of the PhC approach is that its underlying devices are on the wavelength scale, which results in ultra-compact systems. This report summarizes our work in this regard and presents an experimentally demonstrated hybrid lattice PhC channelizer and its associated Schottky diodes. Based on these devices, millimeter wave correlator was designed, which is composed of the channelizer, Schottky diode mixers and spiral antennas. Also presented are the design and simulation results of ultra-compact meta-material based split-ring resonators (SRRs) for the realization of physically small, yet electrically large antennas.

DTIC

Crystals; Embedding; Millimeter Waves; Resonators; Signal Processing

20070036269 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Materials Development for Auxiliary Components for Large Compact Mo/Au TES Arrays

Finkbeiner, F. m.; Chervenak, J. A.; Bandler, S. R.; Brekosky, R.; Brown, A. D.; Figueroa-Feliciano, E.; Iyomoto, N.; Kelley, R. L.; Kilbourne, C. A.; Porter, F. S.; Saab, T.; Sadleir, J.; Smith, S.; July 21, 2007; 1 pp.; In English; 12th International Workshop on Low Temperature Detectors, 21-27 Jul. 2007, Paris, France; No Copyright; Avail.: Other Sources; Abstract Only

We describe our current fabrication process for arrays of superconducting transition edge sensor microcalorimeters, which incorporates superconducting Mo/Au bilayers and micromachined silicon structures. We focus on materials and integration methods for array heatsinking with our bilayer and micromachining processes. The thin superconducting molybdenum bottom layer strongly influences the superconducting behavior and overall film characteristics of our molybdenum/gold transition-edge sensors (TES). Concurrent with our successful TES microcalorimeter array development, we have started to investigate the thin film properties of molybdenum monolayers within a given phase space of several important process parameters. The monolayers are sputtered or electron-beam deposited exclusively on LPCVD silicon nitride coated silicon wafers. In our current bilayer process, molybdenum is electron-beam deposited at high wafer temperatures in excess of 500 degrees C.

Identifying process parameters that yield high quality bilayers at a significantly lower temperature will increase options for incorporating process-sensitive auxiliary array components (AAC) such as array heat sinking and electrical interconnects into our overall device process. We are currently developing two competing technical approaches for heat sinking large compact TES microcalorimeter arrays. Our efforts to improve array heat sinking and mitigate thermal cross-talk between pixels include copper backside deposition on completed device chips and copper-filled micro-trenches surface-machined into wafers. In addition, we fabricated prototypes of copper through-wafer microvias as a potential way to read out the arrays. We present an overview on the results of our molybdenum monolayer study and its implications concerning our device fabrication. We discuss the design, fabrication process, and recent test results of our AAC development.

Author

Gold; Molybdenum; Superconductivity; Calorimeters; Micromachining; Arrays

20070036391 Illinois Univ. at Urbana-Champaign, Urbana, IL USA

Introducing Defects in 3D Photonic Crystals: State of the Art

Braun, Paul V; Rinne, Stephanie A; Garcia-Santamaria, Florencio; Jan 2006; 15 pp.; In English

Contract(s)/Grant(s): DAAD19-03-1-0227

Report No.(s): AD-A470952; No Copyright; Avail.: Defense Technical Information Center (DTIC)

3D photonic crystals (PhCs) and photonic bandgap (PBG) materials have attracted considerable scientific and technological interest. In order to provide functionality to PhCs, the introduction of controlled defects is necessary; the importance of defects in PhCs is comparable to that of dopants in semiconductors. Over the past few years, significant advances have been achieved through a diverse set of fabrication techniques. While for some routes to 3D PhCs, such as conventional lithography, the incorporation of defects is relatively straightforward; other methods, for example, self-assembly of colloidal crystals (CCs) or holography, require new external methods for defect incorporation. In this review, we will cover the state of the art in the design and fabrication of defects within 3D PhCs. The figure displays a fluorescence laser scanning confocal microscopy image of a y-splitter defect formed through two-photon polymerization within a CC.

DTIC

Colloids; Crystals; Defects; Fabrication

20070036395 State Univ. of New York, Stony Brook, NY USA

Synchrotron White Beam X-Ray Topography Characterization of LGX and SXGS Bulk Single Crystals, Thin Films and Piezoelectric Devices

Dudley, Michael; Apr 27, 2007; 60 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAAD19-01-1-0688

Report No.(s): AD-A470957; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This project comprised a program of research aimed at applying the technique of Synchrotron White Beam X-ray Topography (SWBXT), supplemented by the complementary technique of High Resolution Triple-Axis X-ray Diffraction (HRTXD), to the determination of defect and general distortion distributions in novel LGX piezoelectric crystals with a view to enabling improvement in crystal quality and consequently in piezoelectric device performance. The LGX family of compounds, which includes langanite, LGS ($\text{La}_3\text{Ga}_5\text{SiO}_{14}$), and its isomorphs, langanite or LGN ($\text{La}_3\text{Ga}_5.5\text{Nb}_{0.5}\text{O}_{14}$) and langatate or LGT ($\text{La}_3\text{Ga}_5.5\text{Ta}_{0.5}\text{O}_{14}$), as well as several other variants, are of current interest for application as bulk wave resonators for precision oscillators, with all these materials exhibiting high piezoelectric coupling, low acoustic loss (high Q) and temperature compensation. However, the influence of crystal quality on piezoelectric properties, for example, on mode shapes dictates that high quality crystals are required for this technology to reach full potential. This requires collaboration between crystal growers and characterizers to gain an understanding of the defect content of the crystals and to enable optimization of growth parameters. To this end, detailed SWBXT studies will be carried out on: (1) bulk LGX crystals grown using the Czochralski technique, (2) homo- and heteroepitaxial thin films of LGX, and (3) various LGX resonator structures including Surface Acoustic Wave (SAW) resonators. (4) Selected Quartz Resonators (5) SiC substrates/epilayers.

DTIC

Piezoelectricity; Single Crystals; Synchrotrons; Thin Films; Topography; X Rays

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*.

20070035115 California State Univ., Fullerton, CA, USA; Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
Differential Cross Sections for the Electron Impact Excitation of the $A^{(3)}(\Sigma_u^+)$, $B^{(3)}(\Pi_g)$, $W^{(3)}(\Delta_u)$, $B'^{(3)}(\Sigma_u^-)$, $a'^{(1)}(\Sigma_u^-)$, $a^{(1)}(\Pi_g)$, $w^{(1)}(\Delta_u)$, and $C^{(3)}(\Pi_u)$ States of $N^{(2)}$

Khakoo, M. A.; Johnson, P. V.; Ozkay, I.; Yan, P.; Trajmar, S.; Kanik, I.; Physical Review A; June 2005; Volume 71, pp. 062703-1 - 062703-20; In English; Original contains black and white illustrations

Contract(s)/Grant(s): NSF--PHY-RUI-0096808; Copyright; Avail.: Other Sources

ONLINE: <http://hdl.handle.net/2014/40311>; <http://dx.doi.org/10.1103/PhysRevA.71.062703>

Measurements of differential cross sections for the electron-impact excitation of molecular nitrogen from the ground $X^{(1)}(\Sigma_g^+)(v'=0)$ level to the $A^{(3)}(\Sigma_u^+)(v')$, $B^{(3)}(\Pi_g)(v')$, $W^{(3)}(\Delta_u)(v')$, $B'^{(3)}(\Sigma_u^-)(v')$, $a^{(1)}(\Pi_g)(v')$, $w^{(1)}(\Delta_u)(v')$, and $C^{(3)}(\Pi_u)(v')$ levels are presented. The data are obtained at the incident energies of 10, 12.5, 15, 17.5, 20, 30, 50, and 100 eV over the angular range of 5(deg)-130(deg) in 5(deg) intervals. The individual electronic state excitation differential cross sections are obtained by unfolding electron energy-loss spectra of molecular nitrogen using available semiempirical Frank-Condon factors. The data are compared to previous measurements and to available theory. We also make several important suggestions regarding future work that, like the present, relies on the unfolding of electron energy-loss spectra for obtaining differential cross sections.

Author

Electron Impact; Molecular Gases; Nitrogen; Scattering Cross Sections; Energy Dissipation; Atomic Excitations; Electron Energy

20070035244 Naval Research Lab., Bay Saint Louis, MS USA

Satellite-Based Daily SSTs Over the Global Ocean

Barron, Charlie N; Kara, A B; Aug 3, 2006; 5 pp.; In English; Original contains color illustrations

Report No.(s): AD-A470191; NRL/JA/7320-06-6196; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470191>

Daily 1/8 degrees global fields of sea surface temperature (SST), operationally produced by the Modular Ocean Data Assimilation System (MODAS), are presented. Production using a combination of optimal interpolation and climatologically corrected persistence balances eddy resolving spatial and daily temporal resolution with improved transitions in time and space across cloud obscured regions to eliminate data voids. Hindcast reanalysis has consistently extended complete MODAS SST coverage from 1993 to the present. In validation analysis using 219 yearlong daily SST time series from both coastal and open ocean buoys over the global ocean, MODAS gives a median root mean squared SST difference of 0.41 degrees C. Whether hindcast or real-time, stand-alone or coupled, MODAS SST is applicable for physical or biological studies and operational applications on regional to global scales.

DTIC

Ocean Surface; Oceans; Remote Sensing; Sea Surface Temperature; Surface Temperature

20070035306 Illinois Univ. at Urbana-Champaign, Urbana, IL USA

Scalable Spin-Qubit Circuits with Quantum Dots

Austing, D G; Kouwenhoven, L; Loss, D; Marcus, C M; Tarucha, S; Westervelt, R M; Leburton, J P; Altshuler, B; Dec 31, 2006; 13 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAAD19-01-1-0659

Report No.(s): AD-B329024; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Double and triple coupled quantum dots have been fabricated by planar and vertical technology to contain just a few electrons in each dot. Electron imaging by scanning probe microscopy with the capability of wavefunction mapping in quantum dots has been demonstrated. Gate voltage and magnetic field control of charge and spin states, as well as exchange coupling between electron spins and between electron and nuclear spins have been achieved. Coherent nuclear spin operations and square-root-of-swap operation between two electrons on a time scale inferior at 1 ns have been realized. Meanwhile exchange coupling in various dot configurations has been calculated by realistic simulations in good agreement with

experiment. Spin relaxation and decoherence mechanisms in quantum dots have been identified and their time constants measured (by spin echo) in good agreement with theory. Single-shot read-out of electron spin by charge state correlation has been demonstrated to be very fast and robust to electrostatic noise even at finite temperature exceeding state splitting.

DTIC

Circuits; Quantum Dots

20070035746 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Polarizabilities of the Ps Negative Ion

Bhatia, A. K.; Drachman, Richard J.; [2007]; 1 pp.; In English; No Copyright; Avail.: Other Sources; Abstract Only

We have calculated polarizabilities ($\alpha(\text{sub } 1)$, $\beta(\text{sub } 1)$, $\gamma(\text{sub } 1)$, $\alpha(\text{sub } 2)$, $\beta(\text{sub } 2)$, and $\gamma(\text{sub } 2)$) of $\text{Ps}(\text{sup } -)$ by the pseudostate method. These parameters can be used to calculate Rydberg states of $\text{Ps}(\text{sup } -)$ in the presence of an external electron with high quantum numbers N and L . They are also of importance in a system containing $\text{Ps}(\text{sup } -)$ bound to a proton [PsH], and also Rydberg states of $\text{Ps}(\text{sub } 2)$.

Author

Negative Ions; Polarization Characteristics; Quantum Numbers; Elementary Particles

20070036357 Tufts Univ., Medford, MA USA

Noisy Quantum Communication and Computation

Ruskai, Mary B; Jan 2006; 16 pp.; In English

Contract(s)/Grant(s): DAAD19-03-1-0052

Report No.(s): AD-A470892; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Proposals for adiabatic quantum computation generated renewed interest and questions about the adiabatic approximation. We presented a simple proof of the adiabatic theorem in which we showed that the first order correction has the expected dependence on an energy gap; however, determining the time scale needed to ensure a small error may require consideration of higher order terms. We also give a simple new proof of the key gap estimates needed to show that a quantum circuit can be approximated by adiabatic evolution in time polynomial in the number of gates; our methods also improve one of the estimates. We obtained a number of new results about quantum channels, including several results about the conjugate channels obtained by reversing the roles of the system and environment. We considered several new classes of unital channels, one of which leads to the construction of new bound entangled states. We defined the concept of minimal conditional information of a channel and showed that it gives a measure of the extent to which a channel breaks entanglement. We also proved some mathematical results about norms of channels with implications for channel capacity and error correction.

DTIC

Adiabatic Conditions; Computation; Quantum Communication; Quantum Theory; Theorems

20070036370

Control and Dynamic Approach to Robust Quantum Computing

Mabuchi, Hideo; Jan 2006; 10 pp.; In English

Contract(s)/Grant(s): DAAD19-03-1-0073

Report No.(s): AD-A470909; No Copyright; Avail.: Defense Technical Information Center (DTIC)

During the entire performance period, from 12 May 2003 through 31 December 2006, we have conducted theoretical and computational research on quantum control problems central to quantum computation. In particular we completed a thorough and rigorous analysis of feedback-stabilization of entangled state preparation with atomic hyperfine spins, based on continuous Faraday rotation measurement and feedback via global magnetic fields. We connected three distinct layers of modeling, from Hamiltonian dynamics (quantum field theory) to quantum trajectory models to nonlinear stochastic control theory. We also initiated work on a control-theoretic description of quantum memories based on stabilizer coding and continuous syndrome measurement.

DTIC

Control Theory; Quantum Computation

20070036729 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

Thermal Equilibrium Between Radiation and Matter: A Lead to the Maxwell-Boltzmann and Planck Distributions

Lanyi, Gabor E.; September 5, 2003; 8 pp.; In English; Budapest University of Technology and Economics (BME), Physics Colloquium, 5 Sep. 2003, Budapest, Hungary; Copyright; Avail.: Other Sources

ONLINE: <http://hdl.handle.net/2014/40463>

This viewpoint presentation reviews the 1901 work in Planck's constant and blackbody radiation law and the 1916

Einstein rederivation of the blackbody radiation law. It also reviews Wien's law. It also presents equations that demonstrate the thermal balance between radiation and matter.

CASI

Black Body Radiation; Maxwell-Boltzmann Density Function; Plancks Constant; Radiation Laws; Thermodynamic Equilibrium

80

SOCIAL AND INFORMATION SCIENCES (GENERAL)

Includes general research topics related to sociology; educational programs and curricula. For specific topics in these areas see categories 81 through 85.

20070035862 NASA Johnson Space Center, Houston, TX, USA

Current Psychological Support for US astronauts on the International Space Station

Sipes, Walter; Fiedler, Edna; May 23, 2007; 10 pp.; In English; Air Force Human Performance Functional Area, 23-25 May 2007, San Antonio, TX, USA; Original contains color illustrations; No Copyright; Avail.: CASI: A02, Hardcopy

ONLINE: <http://hdl.handle.net/2060/20070035862>

This viewgraph presentation describes the psychological support services that are offered to the USA astronauts on the International Space Station (ISS). The contents include: 1) Operational Psychology; 2) NASA Extreme Environment Mission Operation (NEEMO); and 3) ISS.

CASI

Astronauts; International Space Station; Psychology; United States

82

DOCUMENTATION AND INFORMATION SCIENCE

Includes information management; information storage and retrieval technology; technical writing; graphic arts; and micrography. For computer program documentation see 61 *Computer Programming and Software*.

20070035055 Library of Congress, Washington, DC USA

Fusion Centers: Issues and Options for Congress

Masse, Todd; O'Neil, Siobhan; Rollins, John; Jul 6, 2007; 101 pp.; In English

Report No.(s): AD-A470027; CRS-RL34070; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470027>

Although elements of the information and intelligence fusion function were conducted prior to 9/11, often at state police criminal intelligence bureaus, the events of 9/11 provided the primary catalyst for the formal establishment of more than 40 state, local, and regional fusion centers across the country. Currently, a number of bills pending before Congress, including S. 4, H.R. 1, S. 1644, and H.R. 2638, have elements that address fusion centers. The value proposition for fusion centers is that by integrating various streams of information and intelligence, including that flowing from the federal government, state, local, and tribal governments, as well as the private sector, a more accurate picture of risks to people, economic infrastructure, and communities can be developed and translated into protective action. The ultimate goal of fusion is to prevent manmade (terrorist) attacks and to respond to natural disasters and manmade threats quickly and efficiently should they occur. As recipients of federal government-provided national intelligence, another goal of fusion centers is to model how events inimical to U.S. interests overseas may be manifested in their communities, and align protective resources accordingly. There are several risks to the fusion center concept including potential privacy and civil liberties violations, and the possible inability of fusion centers to demonstrate utility in the absence of future terrorist attacks, particularly during periods of relative state fiscal austerity.

DTIC

Intelligence; Security

20070035056 Department of Justice, Washington, DC USA

Fusion Center Guidelines: Developing and Sharing Information and Intelligence in a New Era

Jul 6, 2007; 104 pp.; In English; Original contains color illustrations

Report No.(s): AD-A470028; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470028>

The need to develop and share information and intelligence across all levels of government has significantly changed over the last few years. The long-standing information sharing challenges among law enforcement agencies, public safety agencies, and the private sector are slowly disappearing. Yet, the need to identify, prevent, monitor, and respond to terrorist and criminal activities remains a significant need for the law enforcement, intelligence, public safety, and private sector communities. Through the support, expertise, and knowledge of leaders from all entities involved, the fusion center concept can become a reality. Each official has a stake in the development and exchange of information and intelligence and should act as an ambassador to support and further this initiative. It is the responsibility of leadership to implement and adhere to the Fusion Center Guidelines.

DTIC

Intelligence; Security

20070035057 Naval Postgraduate School, Monterey, CA USA

The Impact of Television News Coverage on Al-Qaeda's Operations

Greenbaum, Rebecca L; Jun 2007; 93 pp.; In English; Original contains color illustrations

Report No.(s): AD-A470029; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470029>

Much of what the American public knows about al-Qaeda and its most prominent member, Osama bin Laden, has been delivered through television news. It remains clear that al-Qaeda uses television news as an integral part of achieving their overarching goal, but whether television news has a reciprocal effect on al-Qaeda's future operations remains unclear. An analysis will be conducted to determine if the timing of al-Qaeda's operations coincide with an increase or decrease in public awareness of the terrorist organization based on the volume of television news coverage both the organization and its founder receive. This analysis will be conducted in three distinct parts. First, a timeline of al-Qaeda's terrorist attacks will be created. This timeline will cover the period from the 1998 USA embassy bombings through December 2006. Although Osama bin Laden officially formed al-Qaeda in 1988, they did not appear in CNN transcripts until 1998. Five particular attacks were chosen to study the trends between large-scale events: the 1998 USA embassy bombings, the 2000 attack on the USS Cole, the attacks of 9/11, the 2004 bombings in Madrid, and the 2005 bombings of the London subway. Second, a timeline of the television news coverage by CNN will be created using the searchable news stories database, Nexis.com. This analysis will focus on the CNN television news coverage of both al-Qaeda and Osama bin Laden. A search will be conducted for each term by month and the volume of CNN news transcripts mentioning these search terms will be compiled. The goal of this data collection is to analyze the raw number of times the search terms are mentioned in television news coverage each month. The third part consists of mapping the volume of television news coverage along the timeline of al-Qaeda attacks and analyzing their interaction. The existence of trends may give insight into the timing of future attacks.

DTIC

News; News Media; Television Systems

20070035109 NASA Langley Research Center, Hampton, VA, USA

NASA Patent Abstracts Bibliography: A Continuing Bibliography, Supplement 68

October 2007; 81 pp.; In English

Report No.(s): NASA/SP-2007-7039/SUPPL68; No Copyright; Avail.: CASI: A05, Hardcopy

ONLINE: <http://hdl.handle.net/2060/20070035109>

Several thousand inventions result each year from research supported by the National Aeronautics and Space Administration. NASA seeks patent protection on inventions to which it has title if the invention has important use in government programs or significant commercial potential. These inventions cover a broad range of technologies and include many that have useful and valuable commercial application. NASA inventions best serve the interests of the USA when their benefits are available to the public. In many instances, the granting of nonexclusive or exclusive licenses for the practice of these inventions may assist in the accomplishment of this objective. This bibliography is published as a service to companies, firms, and individuals seeking new, licensable products for the commercial market. The NASA Patent Abstracts Bibliography is an annual NASA publication containing comprehensive abstracts of NASA-owned inventions covered by U.S. patents. The citations included were originally published in NASA's Scientific and Technical Aerospace Reports (STAR). The citations

published in this issue cover the period October 2006 through September 2007. The subjects covered include the NASA Scope and Subject Category Guide's 10 broad subject divisions separated further into 76 specific categories. However, not all categories contain citations during the date range of this issue; therefore, the Table of Contents does not include all divisions and categories. Each citation includes an abstract and, when available, a key illustration taken from the patent or application for patent. Also when available, citations include a link to the full-text document online.

Derived from text

Bibliographies; Abstracts; Technology Utilization; Inventions

20070035142 Library of Congress, Washington, DC USA

Fusion Centers: Issues and Options for Congress

Masse, Todd; O'Neil, Siobhan; Rollins, John; Jul 6, 2007; 101 pp.; In English

Report No.(s): AD-A470027; CRS-RL34070; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470027>

Although elements of the information and intelligence fusion function were conducted prior to 9/11, often at state police criminal intelligence bureaus, the events of 9/11 provided the primary catalyst for the formal establishment of more than 40 state, local, and regional fusion centers across the country. Currently, a number of bills pending before Congress, including S. 4, H.R. 1, S. 1644, and H.R. 2638, have elements that address fusion centers. The value proposition for fusion centers is that by integrating various streams of information and intelligence, including that flowing from the federal government, state, local, and tribal governments, as well as the private sector, a more accurate picture of risks to people, economic infrastructure, and communities can be developed and translated into protective action. The ultimate goal of fusion is to prevent manmade (terrorist) attacks and to respond to natural disasters and manmade threats quickly and efficiently should they occur. As recipients of federal government-provided national intelligence, another goal of fusion centers is to model how events inimical to U.S. interests overseas may be manifested in their communities, and align protective resources accordingly. There are several risks to the fusion center concept including potential privacy and civil liberties violations, and the possible inability of fusion centers to demonstrate utility in the absence of future terrorist attacks, particularly during periods of relative state fiscal austerity.

DTIC

Intelligence; Security

20070035143 Department of Justice, Washington, DC USA

Fusion Center Guidelines: Developing and Sharing Information and Intelligence in a New Era

Jul 6, 2007; 104 pp.; In English; Original contains color illustrations

Report No.(s): AD-A470028; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470028>

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DTIC

Intelligence; Security

20070035144 Naval Postgraduate School, Monterey, CA USA

The Impact of Television News Coverage on Al-Qaeda's Operations

Greenbaum, Rebecca L; Jun 2007; 93 pp.; In English; Original contains color illustrations

Report No.(s): AD-A470029; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470029>

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analysis will be conducted to determine if the timing of al-Qaeda's operations coincide with an increase or decrease in public awareness of the terrorist organization based on the volume of television news coverage both the organization and its founder receive. This analysis will be conducted in three distinct parts. First, a timeline of al-Qaeda's terrorist attacks will be created. This timeline will cover the period from the 1998 USA embassy bombings through December 2006. Although Osama bin Laden officially formed al-Qaeda in 1988, they did not appear in CNN transcripts until 1998. Five particular attacks were chosen to study the trends between large-scale events: the 1998 USA embassy bombings, the 2000 attack on the USS Cole, the attacks of 9/11, the 2004 bombings in Madrid, and the 2005 bombings of the London subway. Second, a timeline of the television news coverage by CNN will be created using the searchable news stories database, Nexis.com. This analysis will focus on the CNN television news coverage of both al-Qaeda and Osama bin Laden. A search will be conducted for each term by month and the volume of CNN news transcripts mentioning these search terms will be compiled. The goal of this data collection is to analyze the raw number of times the search terms are mentioned in television news coverage each month. The third part consists of mapping the volume of television news coverage along the timeline of al-Qaeda attacks and analyzing their interaction. The existence of trends may give insight into the timing of future attacks.

DTIC

News; News Media; Television Systems

20070035169 Defense Technical Information Center, San Diego, CA USA

MATRIS Indexing and Retrieval Thesaurus (MIRT): Hierarchical List of Indexing Terms

Aug 1994; 74 pp.; In English

Report No.(s): AD-A470081; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470081>

Categories covered in this hierarchy: Manpower; Recruitment, Selection/Classification/Assignment; Education and Training; Human Resources Management; Organizations; Human Factors Engineering; Information Processing/Cognition; Human Performance; Data Management; Program Management; Defense/Welfare; Personnel; Skills; Task/System Analysis; Quantification/Analysis Techniques; Safety/Environmental Factors; Systems/Equipment; and Media/Documents

DTIC

Human Resources; Terms; Thesauri

20070035170 Defense Technical Information Center, San Diego, CA USA

MATRIS Indexing and Retrieval Thesaurus (MIRT): Definitions of Indexing Terms

Aug 1994; 196 pp.; In English

Report No.(s): AD-A470082; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470082>

This document gives the definition of terms presented in MIRT - Hierarchical List of Indexing Terms, ADA470081. Categories covered: Manpower; Recruitment; Selection/Classification/Assignment; Education and Training; Human Resources Management; Organizations; Human Factors Engineering; Information Processing/Cognition; Human Performance; Data Management; Program Management; Defense/Welfare; Personnel; Skills; Task/System Analysis; Quantification/Analysis Techniques; Safety/Environmental Factors; Systems/Equipment; and Media/Documents.

DTIC

Human Resources; Terms; Thesauri

20070035171 Defense Technical Information Center, San Diego, CA USA

MATRIS Indexing and Retrieval Thesaurus (MIRT): Keyword Out of Context (KWOC)

Aug 1994; 206 pp.; In English

Report No.(s): AD-A470083; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470083>

Categories covered in this keyword out of context thesaurus: Manpower; Recruitment; Selection/Classification/Assignment; Education and Training; Human Resources Management; Organizations; Human Factors Engineering; Information Processing/Cognition; Human Performance; Data Management; Program Management; Defense/Welfare; Personnel; Skills; Task/System Analysis; Quantification/Analysis Techniques; Safety/Environmental Factors; Systems/Equipment; and Media/Documents.

DTIC

Human Resources; Thesauri

20070035181 Naval Postgraduate School, Monterey, CA USA

Radar Target Recognition Using Bispectrum Correlation

Cole, Zachary K; Jun 2007; 97 pp.; In English; Original contains color illustrations

Report No.(s): AD-A470096; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470096>

Ship commanders and pilots make life or death decisions based on the information they have at their disposal at the instant a decision is made. One component of that information is whether a radar contact is an enemy or a friend. Various systems exist which try to answer that question based on the characteristics of signals emitted or scattered from the contact. The goal is to maximize the accuracy of identification in order to build trust that when the system tells the operator the contact is an incoming friendly, he knows that it is. This thesis examines the technique of using the bispectrum of backscattered radar energy to identify a contact. Bispectra allow the examination of multiple scattering contributions to the return. This technique is compared to one using radar range profiles. A library of sample radar signatures is built using computational radar cross section estimation tools and 3-D model aircraft. This library is the basis of a series of simulations with aircraft at multiple aspects and configurations to determine whether using the bispectrum enhances the performance of identification systems using range profiles. It is determined that a bispectrum method meets or exceeds the identification accuracy of a range profile method especially with high-bandwidth systems.

DTIC

Accuracy; Decision Making; Information Retrieval; Information Systems; Radar Targets; Target Recognition

20070035184 Syracuse Univ., NY USA

Dynamic Hybrid Component Test for Mission-Critical Distributed Systems

Park, Joon; Jun 2007; 28 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): FA8750-06-1-0219; Proj-4519

Report No.(s): AD-A470104; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470104>

The objective of this effort was to provide dynamic and hybrid survivability mechanisms that test a downloaded component in runtime in the current computing environment by considering N-category, N-type, and N-way testing methods. The test results can be used to fix the failures or immunize the component based on our previous research outcomes.

DTIC

Dynamic Tests; Information Systems

20070035191 Southwest Research Inst., San Antonio, TX USA

Continuous Pre-Hospital Data as a Predictor of Outcome Following Major Trauma: A Study Using Improved and Expanded Data

Kinkler, E S; Convertino, Victor A; Gordon, Donald J; Holcomb, John B; Salinas, Jose; Dec 2006; 23 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-04-2-0015

Report No.(s): AD-A470112; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470112>

This study is designed to acquire near continuous physiologic measurements, beginning at the earliest practical time after injury, on large numbers of injured patients with severe trauma. The study will utilize commercially available FDA-certified monitoring equipment, operating in a fleet of front-line ground EMS ambulances currently serving a large metropolitan area with multiple trauma centers, and operating within an existing mobile wireless network. First Responders represent the earliest opportunity to acquire meaningful medical data in injury cases. This data will be correlated with significant clinical outcomes within the first 24 hours of admission and entered into a research database. Analysis of this database may allow development of models that predict outcome and the need for life-saving procedures. During the reporting period, a proof-of-concept process for manually collecting, processing, and reporting pre-hospital physiological data was defined. Research protocols were developed and IRB approvals obtained. Fielding of physical and electronic data collection facilities for this project, and to pave the way for future sustained data collection, was accomplished. Pre-hospital patient data was acquired and processed. Analysis supports the proposed hypothesis that ground EMS systems can provide earlier inception of data recording than helicopter services.

DTIC

Data Acquisition; Emergencies; Hospitals; Injuries; Medical Services; Monitors; Patients; Physiology; Telemedicine

20070035198 Bae Systems Advanced Information Technologies, Inc., Burlington, MA USA

Mediation, Alignment, and Information Services for Semantic interoperability (MAISSI): A Trade Study

Barlos, Fotis; Hunter, Dan; Krikeles, Basil; McDonough, James; Jun 2007; 80 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): FA8750-06-C-0207; Proj-SEMI

Report No.(s): AD-A470119; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470119>

Today's emphasis on joint and combined military operations and the need to maximize the effectiveness of these operations has led to the need to better support interoperability among the various constituent communities. While the emerging net-centric infrastructure allows these communities and their systems to communicate, this dialog is often constrained by the lack of common semantic points of reference. For example, legacy databases often have custom schemas that represent the same information in disparate ways. Semantic Interoperability (SI) encompasses a broad range of technologies such as data mediation and schema matching, ontology alignment, and context representation that attempt to enable systems to understand each others semantics with minimal modification of the legacy systems.

DTIC

Alignment; Data Processing; Information Management; Information Systems; Interoperability; Semantics

20070035227 City Univ. of New York, NY USA

Information Fusion for Command and Control: From Data to Actionable Knowledge and Decision

Eskicioglu, Ahmet; May 5, 2007; 20 pp.; In English

Contract(s)/Grant(s): F49620-01-1-0542; FA9550-05-1-0400

Report No.(s): AD-A470162; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470162>

Information must be sorted out and fused not only to allow commanders to make situation assessments, but also to support the generation of hypotheses about enemy force disposition and enemy intent. Current information fusion technology has two notable limitations. First, current approaches do not consider the battlefield context as a first class entity and therefore have great difficulty in making sense out of entities once they have been identified. Second, there are no integrated and implemented models of this high level fusion process. Our research has focused on the problems of developing integrated techniques for high level (levels 2, 3, and 4) information fusion and the tools and methods needed to evaluate them. Our work can roughly be divided into techniques for integrating diverse sensors and recognizing aggregated forces (level 2 fusion), methods for analyzing context in order to infer intent (level 3 fusion), methods for tasking assets or assisting humans to acquire new information (level 4 fusion), and efforts to develop simulation tools and environments needed to conduct the research. In this report we present a very brief summary of our work in each of these areas accompanied by reprints of papers presenting the research in detail.

DTIC

Command and Control; Decision Support Systems; Multisensor Fusion

20070035232 Illinois Natural History Survey, Havana, IL USA

Development of a Life History Database for Upper Mississippi River Fishes

O'Hara, Matt; Ickes, Brian S; Gittinger, Eric; DeLain, Steve; Dukerschein, Terry; Pegg, Mark; Kalas, John; May 2007; 28 pp.; In English; Original contains color illustrations

Report No.(s): AD-A470170; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470170>

This report summarizes the development of a life history database for Upper Mississippi River System fishes. It provides the rationale for its development within the Long Term Resource Monitoring Program, describes it, outlines standards for its development. and demonstrates how it can be linked to the LTRMP fisheries database and used to address a host of new questions relevant to management and science in the basin.

DTIC

Data Bases; Fishes; Mississippi River (US)

20070035255 Library of Congress, Washington, DC USA

Access to Government Information in the USA

Relyea, Harold C; Kolakowski, Michael W; Jun 13, 2007; 7 pp.; In English

Report No.(s): AD-A470219; CRS-97-71-GOV; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470219>

The Constitution of the USA makes no specific allowance for any one of the co-equal branches to have access to information held by the others and contains no provision expressly establishing a procedure for, or a right of, public access to government information. Nonetheless, Congress has legislated various public access laws. These include two records access statutes -- the Freedom of Information Act (FOI Act or FOIA; 5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a) -- and two meetings access statutes -- the Federal Advisory Committee Act (FACA; 5 U.S.C. App.) and the Government in the Sunshine Act (5 U.S.C. 552b). Moreover, due to the American separation of powers model of government, interbranch conflicts over the accessibility of information are neither unexpected nor necessarily destructive. The federal courts, historically, have been reluctant to review and resolve 'political questions' involving information disputes between Congress and the executive branch. Although there is considerable interbranch cooperation, such conflicts probably will continue to occur on occasion.

DTIC

Law (Jurisprudence); Public Law; United States

20070035260 Library of Congress, Washington, DC USA

Restructuring EPA's Libraries: Background and Issues for Congress

Bearden, David M; Esworthy, Robert; Jun 15, 2007; 7 pp.; In English

Report No.(s): AD-A470225; CRS-RS22533; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470225>

Near the end of the 109th Congress, some Members raised questions about the closing of several libraries administered by the Environmental Protection Agency (EPA), expressing concerns about the continued availability of the agency's collections. Library professional associations and public interest groups raised similar questions about access to this information. EPA reported that the closings were part of its efforts to restructure its libraries in response to the agency's transition from walk-in services to electronic dissemination of information, as a result of the increasing use of the Internet to access its collections. In response to the concerns about the library closings, EPA announced a temporary moratorium in January 2007, prohibiting further changes to its library services while the agency continued digitizing its collections. Interest in the library closings has continued into the 110th Congress. Although Members and Committees of Congress have addressed the closings in letters to EPA and in hearings, Congress has not addressed the matter so far in appropriations bills or other legislation. This report summarizes EPA's plan to restructure its libraries, examines relevant issues, and discusses congressional action in response to the agency's plan.

DTIC

Environment Protection; Libraries; United States

20070035262 Library of Congress, Washington, DC USA

Journalists' Privilege to Withhold Information in Judicial and Other Proceedings: State Shield Statutes

Cohen, Henry; Jun 27, 2007; 51 pp.; In English

Report No.(s): AD-A470227; CRS-RL32806; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470227>

Absent a statutory or constitutional recognition of journalistic privilege, a reporter may be compelled to testify in legal, administrative, or other governmental proceedings. To date, 33 states and the District of Columbia have recognized a journalists' privilege through the enactment of press 'shield laws,' which protect the relationship between reporters, their source, and sometimes, the information that may be communicated in that relationship. Another 16 states have adopted a journalists' privilege through court decisions; Wyoming is the only state without a legislatively or judicially adopted journalists' privilege. The journalists' privilege is distinct from other recognized privileges, in that the privilege vests only with the journalist, not with the source of the information. This report provides a brief overview of the state shield statutes and then sets forth the full text of each.

DTIC

Law (Jurisprudence); Laws; Protection

20070035457 Louisiana State Univ., Baton Rouge, LA USA

Military Health Behaviors: Promotion of Healthy Weight and Fitness in Career Personnel

Williamson, Donald A; Stewart, Tiffany M; Ryan, Donna H; Allen, H R; Bathalon, Gaston P; Sigrist, Lori; Burrell, Lolita M; May 1, 2007; 55 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-03-2-0030

Report No.(s): AD-A470274; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The specific aims of this research project are: 1) development of the Military Soldier Fitness Database a computer-based data collection system that can be used to record and track the results of the Army Physical Fitness tests and measurements of body weight/fatness across time 2) development of an environmental/Internet-based intervention to promote healthy weight through proper nutrition and physical fitness 3) test of the efficacy of and consumer satisfaction with the environmental/Internet-based intervention in a single population i.e. Soldiers at Fort Bragg NC. These aims fit into a three phase project completion plan. The research team from Pennington Biomedical Research Center (PBRC) has completed phases 1 and 2 of this three phase project. In Phase 1 the PBRC team studied the unique needs of the military as they pertain to the primary aims. Guided by the Executive Committee a prototype for the computerized database was established and the architectural design of the Internet-based intervention was developed. In Phase 2 PBRC personnel developed refined and pilot-tested the MSFD and the Internet-based program. Phase 3 which includes a controlled evaluation of the environmental/Internet-based intervention is currently in progress. The environmental/Internet-based program was implemented in July 2006 and data are being collected via the Internet-based program. The primary endpoints of the Intervention will be to determine consumer satisfaction with the program and the amount of Internet activity on the website.

DTIC

Body Weight; Data Acquisition; Health; Nutrition; Occupation; Personnel; Physical Fitness

20070035492 Library of Congress, Washington, DC USA

Intelligence and Information-Sharing Elements of S.4 and H.R. 1

Masse, Todd; Jun 26, 2007; 16 pp.; In English

Report No.(s): AD-A470325; CRS-RL34061; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Title I of S.4 and Title VII of H.R. 1 include corresponding measures related to enhancing information and intelligence sharing, both horizontally within the Federal Government and vertically between the Federal Government and state and local law enforcement and homeland security authorities. The companion bills have two common subtitles (one each for the Homeland Security Information Sharing Enhancement and Homeland Security Information Sharing Partnerships) and a number of unique subtitles. Each of the common subtitles does not necessarily contain identical language. Three subtitles unique to H.R. 1 are as follows: (1) the Fusion and Law Enforcement Education and Teaming (FLEET) Grant Program, (2) the Border Intelligence Fusion Center Program, and (3) the Homeland Security Intelligence Offices Reorganization. One subtitle, the Interagency Threat Assessment Coordination Group (ITACG), is unique to S.4. With respect to Homeland Security Information Sharing Enhancement, the bills would require the Secretary of Department of Homeland Security (DHS) to integrate and standardize the information of DHS intelligence components into a Department information-sharing environment. Among other measures, the bills would require the Secretary of DHS to implement a Homeland Security Advisory System, which shall provide '...in each warning or alert specific information and advice on...appropriate protective measures and countermeasures that may be taken in response to the threat or risk.' Furthermore, the responsible DHS official shall, '...whenever possible, limit the scope' of each advisory or warning 'to a specific region, locality, or economic sector believed to be at risk.' Unique to H.R. 1 is a proposal that DHS not use color designations as the exclusive means of specifying homeland security threat conditions. DHS would be required to develop mechanisms to provide feedback to state, local, tribal, and private sector officials on the utility of information they gathered.

DTIC

Intelligence; Law (Jurisprudence); Security; United States

20070035493 Library of Congress, Washington, DC USA

Presidential Claims of Executive Privilege: History, Law, Practice and Recent Developments

Rosenberg, Morton; Jul 5, 2007; 34 pp.; In English

Report No.(s): AD-A470326; CRS-RL30319; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Presidential claims of a right to preserve the confidentiality of information and documents in the face of legislative demands have figured prominently, though intermittently, in executive-congressional relations since at least 1792. Few such interbranch disputes over access to information have reached the courts for substantive resolution, the vast majority achieving resolution through political negotiation and accommodation. It was not until the Watergate-related lawsuits in the 1970s

seeking access to President Nixon's tapes that the existence of a presidential confidentiality privilege was judicially established as a necessary derivative of the President's status in our constitutional scheme of separated powers. Of the eight court decisions involving interbranch or private information access disputes, three have involved Congress and the Executive, but only one of these resulted in a decision on the merits. The Nixon and post-Watergate cases established the broad contours of the presidential communications privilege. Under those precedents, the privilege, which is constitutionally rooted, could be invoked by the President when asked to produce documents or other materials or information that reflect presidential decision making and deliberations that he/she believes should remain confidential. If the President does so, the materials become presumptively privileged. The privilege, however, is qualified, not absolute, and can be overcome by an adequate showing of need. Finally, while reviewing courts have expressed reluctance to balance executive privilege claims against a congressional demand for information, they have acknowledged they will do so if the political branches have tried in good faith but failed to reach an accommodation. The appendix includes Presidential Claims of Executive Privilege from the Kennedy Administration through the Bush II Administration.

DTIC

Claiming; Information Transfer; Presidential Reports

20070035494 Library of Congress, Washington, DC USA

Freedom of Information Act (FOIA) Amendments: 110th Congress

Relyea, Harold C; Jul 10, 2007; 16 pp.; In English

Report No.(s): AD-A470327; CRS-RL32780; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Enacted in 1966 after 11 years of investigation, legislative development, and deliberation in the House and half as many years of such consideration in the Senate, the Freedom of Information Act (FOIA) displaced the ineffective public information section of the Administrative Procedure Act. The FOIA was designed to enable any person -- individual or corporate, regardless of citizenship -- to request, without explanation or justification, presumptive access to existing, identifiable, unpublished, executive branch agency records on any topic. The statute specified nine categories of information that may be permissibly exempted from the rule of disclosure. Disputes over the accessibility of requested records could be ultimately settled in court. Not supported as legislation or enthusiastically received as law by the executive branch, the FOIA was subsequently refined with direct amendments in 1974, 1976, 1986, and 1996. The statute has become a somewhat popular tool of inquiry and information gathering for various quarters of American society -- the press, business, scholars, attorneys, consumers, and environmentalists, among others -- as well as some foreign interests. The response to a request may involve a few sheets of paper, several linear feet of records, or perhaps information in an electronic format. Such responses require staff time, search and duplication efforts, and other resource commitments. Agency information management professionals must efficiently and economically service FOIA requests, doing so, of late, in the sensitized homeland security milieu. Requesters must be satisfied through timely supply, brokerage, or explanation. Simultaneously, agency FOIA costs must be kept reasonable. The perception that these conditions are not operative can result in proposed new corrective amendments to the statute. Several bills were offered in this regard in the 109th Congress. This report will be updated as events warrant.

DTIC

Law (Jurisprudence); United States

20070035513 Commerce Dept., Washington, DC USA

Suspicious Indicators and Security Countermeasures for Foreign Collection Activities Directed Against the USA

Jun 19, 2006; 9 pp.; In English

Report No.(s): AD-A470350; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Foreign requests for U.S. industry Science and Technology (S&T) program information and technology are the most frequently reported method of operation (MO) associated with foreign targeting activity. Requests frequently involve faxing, mailing, e-mailing, or telephoning to individual U.S. persons rather than corporate marketing departments. The requests may involve surveys or questionnaires and are frequently sent over the Internet.

DTIC

Countermeasures; Information Retrieval; Intelligence; Security; United States

20070035537 Office of Force Transformation, Washington, DC USA

Network Centric Operations 'NCO' Case Study. The British Approach to Low-Intensity Operations: Part I

Feb 12, 2007; 137 pp.; In English

Report No.(s): AD-A470401; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The purpose of this section is to provide a brief summary of the Research Design that served as an overall framework

for conducting the LIO case study. As such, this section recaps essential elements of the Research Design Plan. The complete Research Design Plan is included in Appendix B.

DTIC

Human Relations; Networks; Research Management; United Kingdom

20070035539 Florida Univ., Gainesville, FL USA

Storing and Predicting Dynamic Attributes in a World Model Knowledge Store

Kent, Daniel A; Jan 2007; 190 pp.; In English

Report No.(s): AD-A470407; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The world is an ever-changing, dynamic environment. If robots and other intelligent systems are to find ways to cope with and reason about the world adequately, they must be capable of understanding these dynamic features. This dissertation examines the need for a centralized knowledge store capable of storing information that is both spatial and temporal in nature. The interface of a new and unique architecture to handle the exchange of dynamic information and questions about the future state of that information is presented. A novel algorithm, called the Statistics-Based Nth Order Polynomial Predictor 'SNOPP', is also developed which allows state prediction of almost any time-variant data. Each of these contributions is demonstrated through the use of a reference implementation. The author's reference implementation is done using the Joint Architecture for Unmanned Systems 'JAUS', a widely accepted, open robotics architecture developed for use in defense programs. The architecture and predictor are tested using a real-world sensor algorithm deployed on an autonomous vehicle at the University of Florida's Center for Intelligent Machines and Robotics 'CIMAR'. Findings and results of these tests are given which examine the behavior of the architecture and novel prediction algorithm in a variety of scenarios involving different time-variant data types. The Dynamic World Model architecture and the SNOPP algorithm provide significant contributions to the future of robotics. Many robotic problems, including decision making, health monitoring and path planning, stand to benefit from better understanding of the dynamic nature of both the robot and its environment. This dissertation provides a framework in which many of these and other problems may be addressed and summarily solved by future robotic engineers.

DTIC

Computer Storage Devices; Data Storage; Information Management; Predictions; Robotics

20070035554 Northwestern Univ., Evanston, IL USA

Plenty of Blame to Go Around: A Qualitative Approach to Attribution of Moral Responsibility

Tomai, Emmett; Forbus, Ken; Jan 2007; 8 pp.; In English

Report No.(s): AD-A470434; No Copyright; Avail.: Defense Technical Information Center (DTIC)

We present a computational model of blame attribution. Recently Mao and Gratch, following Attribution theory, created a computational model that assigned blame to an agent for a negative occurrence. Their model made categorical judgments, and could only assign blame to a single agent. Our model extends this work, using QP theory to provide a continuous model for the parameters involved in attribution and directly capturing the constraints postulated by Attribution theory. This allows our model to infer relative amounts of blame in a situation in a manner that is consistently overall with relative amounts of blame attributed in a psychological experiment.

DTIC

Mathematical Models; Social Factors

20070035600 Department of Defense, Fort Meade, MD USA

Text Retrieval via Semantic Forests

Schone, Patrick; Townsend, Jeffrey L; Crystal, Thomas H; Olano, Calvin; Nov 1997; 14 pp.; In English

Report No.(s): AD-A470518; No Copyright; Avail.: Defense Technical Information Center (DTIC)

We approached our first participation in TREC with an interest in performing retrieval on the output of automatic speech-to-text (speech recognition) systems and a background in performing topic-labeling on such output. Our primary thrust, therefore, was to participate in the SDR track. In conformance with the rules, we also participated in the Ad Hoc text-retrieval task, to create a baseline for comparing our converted topic-labeling system with other approaches to IR and to assess the effect of speech-transcription errors. A second thrust was to explore rapid prototyping of an IR system, given the existing topic-labeling software. Our IR system makes use of software called Semantic Forests which is based on an algorithm originally developed for labeling topics in text and transcribed speech (Schone & Nelson, ICASSP 96). Topic-labelling is not an IR task, so Semantic Forests was adapted for use in TREC over an eight-week period for the Ad Hoc task, with an additional

two weeks for SDR. In what follows, we describe our system as well as experiments, timings, results, and future directions with these techniques.

DTIC

Forests; Information Retrieval; Semantics; Texts

20070035609 New York Univ., New York, NY USA

Natural Language Information Retrieval: TREC-3 Report

Strzalkowski, Tomek; Carballo, Jose P; Marinescu, Mihnea; Nov 1994; 16 pp.; In English

Contract(s)/Grant(s): N00014-90-J-1851; 94-F157900-000

Report No.(s): AD-A470537; No Copyright; Avail.: Defense Technical Information Center (DTIC)

In this paper we report on the recent developments in NYU's natural language information retrieval system, especially as related to the 3rd Text Retrieval Conference 'TREC-3'. The main characteristic of this system is the use of advanced natural language processing to enhance the effectiveness of term-based document retrieval. The system is designed around a traditional statistical backbone consisting of the indexer module, which builds inverted index files from pre-processed documents, and a retrieval engine which searches and ranks the documents in response to user queries. Natural language processing is used to (1) preprocess the documents in order to extract content-carrying terms, (2) discover inter-term dependencies and build a conceptual hierarchy specific to the database domain, and (3) process user's natural language requests into effective search queries. For the present TREC-3 effort, the total of 3.3 GBytes of text articles have been processed 'Tipster disks 1 through 3', including material from the Wall Street Journal, the Associated Press newswire, the Federal Register, Ziff Communications's Computer Library, Department of Energy abstracts, U.S. Patents and the San Jose Mercury News, totaling more than 500 million words of English. Since the TREC-2 conference, many components of the system have been redesigned to facilitate its scalability to deal with ever increasing amounts of data. In particular, a randomized index-splitting mechanism has been installed which allows the system to create a number of smaller indexes that can be independently and efficiently searched.

DTIC

Data Processing; Information Retrieval; Natural Language (Computers)

20070035610 General Electric Co., Schenectady, NY USA

Natural Language Information Retrieval: TREC-4 Report

Strzalkowski, Tomek; Carballo, Jose P; Nov 1995; 16 pp.; In English

Contract(s)/Grant(s): N00014-90-J-1851; 94-F157900-000

Report No.(s): AD-A470538; No Copyright; Avail.: Defense Technical Information Center (DTIC)

In this paper we report on the joint GE/NYU natural language information retrieval project as related to the 4th Text Retrieval Conference 'TREC-4'. The main thrust of this project is to use natural language processing techniques to enhance the effectiveness of full-text document retrieval. During the course of the four TREC conferences, we have built a prototype IR system designed around a statistical full-text indexing and search backbone provided by the NIST's *Prise* engine. The original *Prise* has been modified to allow handling of multi-word phrases, differential term weighting schemes, automatic query expansion, index partitioning and rank merging, as well as dealing with complex documents. Natural language processing is used to '1' preprocess the documents in order to extract content-carrying terms, '2' discover inter-term dependencies and build a conceptual hierarchy specific to the database domain, and '3' process user's natural language requests into effective search queries. The overall architecture of the system is essentially the same as in TREC-3, as our efforts this year were directed at optimizing the performance of all components. A notable exception is the new massive query expansion module used in routing experiments, which replaces prototype extension used in the TREC-3 system. On the other hand, it has to be noted that the character and the level of difficulty of TREC queries has changed quite significantly since the last year evaluation. TREC-4 new ad-hoc queries are far shorter, less focused, and they have a flavor of information requests 'What is the prognosis of ...' rather than search directives typical for earlier TRECs 'The relevant document will contain ...'. This makes building of good search queries a more sensitive task than before. We thus decided to introduce only minimum number of changes to our indexing and search processes,

DTIC

Data Processing; Information Retrieval; Natural Language (Computers); Texts

20070035614 Carnegie-Mellon Univ., Pittsburgh, PA USA

Word Level Predicate Abstraction and Refinement for Verifying RTL Verilog

Jain, Himanshu; Sharygina, Natasha; Kroening, Daniel; Clarke, Edmund; Jun 2005; 7 pp.; In English

Contract(s)/Grant(s): N00014-01-1-0796; DAAD19-01-1-0485

Report No.(s): AD-A470547; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Model checking techniques applied to large industrial circuits suffer from the state space explosion problem. A major technique to address this problem is abstraction. The most commonly used abstraction technique for hardware verification is localization reduction, which removes latches that are not relevant to the property. However, localization reduction fails to reduce the size of the model if the property actually depends on most of the latches. This paper proposes to use predicate abstraction for verifying RTL Verilog, a technique successfully used for software verification. The main challenge when using predicate abstraction is the discovery of suitable predicates. We propose to use weakest pre-conditions of Verilog statements in order to obtain new predicates during abstraction refinement. This technique has not been applied to circuits before. On benchmarks taken from an industrial microprocessor, we successfully verified safety properties with more than 32,000 latches in the cone of influence. We compare the performance of our technique with a modern model checker that implements localization reduction.

DTIC

Algorithms; Circuits; Words (Language)

20070035783 Mitre Corp., Bedford, MA USA

Adaptive Web-page Content Identification

Gibson, John; Wellner, Ben; Lubar, Susan; Jul 2007; 9 pp.; In English

Contract(s)/Grant(s): W15P7T-07-C-F600

Report No.(s): AD-A470494; MITRE-07-0958; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Identifying which parts of a Web-page contain target content (e.g., the portion of an online news page that contains the actual article) is a significant problem that must be addressed for many Web-based applications. Most approaches to this problem involve crafting hand-tailored rules or scripts to extract the content, customized separately for particular Web sites. Besides requiring considerable time and effort to implement, hand-built extraction routines are brittle: they fail to properly extract content in some cases and break when the structure of a site's Web-pages changes. In this work we treat the problem of identifying content as a sequence labeling problem, a common problem structure in machine learning and natural language processing. Using a Conditional Random Field sequence labeling model, we correctly identify the content portion of web-pages anywhere from 80-97% of the time depending on experimental factors such as ensuring the absence of duplicate documents and application of the model against unseen sources.

DTIC

Data Processing; Machine Learning; Texts

20070035845 Massachusetts Univ., Amherst, MA USA

Recent Experiments with INQUERY

Allan, James; Ballesteros, Lisa; Callan, James P; Croft, W B; Lu, Zhihong; Nov 1995; 16 pp.; In English

Contract(s)/Grant(s): N66001-94-D-6054

Report No.(s): AD-A470554; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Past TREC experiments by the University of Massachusetts have focused primarily on ad hoc query creation. Substantial effort was directed towards automatically translating TREC topics into queries using a set of simple heuristics and query expansion. Less emphasis was placed on the routing task although results were generally good. The Spanish experiments in TREC-3 concentrated on simple indexing sophisticated stemming and simple methods of creating queries. The TREC-4 experiments were a departure from the past. The ad hoc experiments involved 'fine tuning' existing approaches and modifications to the INQUERY term weighting algorithm. However, much of the research focus in TREC-4 was on the routing, Spanish, and collection merging experiments. These tracks more closely match our broader research interests in document routing document filtering distributed IR, and multilingual retrieval. The University of Massachusetts experiments were conducted with version 3.0 of the INQUERY information retrieval system. INQUERY is based on the Bayesian inference network retrieval model. It is described elsewhere [7, 5, 12, 11], so this paper focuses on relevant differences to the previously published algorithms.

DTIC

Information Retrieval; Bayes Theorem

20070035865 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

Content Integration Networks: Turning Search Upside Down

Dutra, Jayne E.; November 1, 2006; 54 pp.; In English; KM World/Inranets 2006, 31 Oct. - 2 Nov. 2006, San Jose, CA, USA; Original contains color illustrations; Copyright; Avail.: Other Sources

ONLINE: <http://hdl.handle.net/2014/40254>

The slide presentation examines information management and retrieval among NASA centers and with outside sources. It provides an overview and problem statement, vision and high level technologies, strategies, knowledge management benefits, and a summary and challenge.

CASI

Information Management; Knowledge Based Systems; Information Retrieval; Data Management; Service Oriented Architecture

20070035988 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

Charting the Course: Life Cycle Management of Mars Mission Digital Information

Reiz, Julie M.; August 22, 2003; 26 pp.; In English; Society of American Archivists Annual Meeting, 22 Aug. 2003, Los Angeles, CA, USA; Original contains black and white illustrations; Copyright; Avail.: Other Sources

ONLINE: <http://hdl.handle.net/2014/40420>

This viewgraph presentation reviews the life cycle management of MER Project information. This process was an essential key to the successful launch of the MER Project rovers. Incorporating digital information archive requirements early in the project life cycle resulted in: Design of an information system that included archive metadata, Reduced the risk of information loss through in-process appraisal, Easier transfer of project information to institutional online archive and Project appreciation for preserving information for reuse by future projects

CASI

Information Management; Information Systems; Mars Missions

20070036072 Naval Postgraduate School, Monterey, CA USA

Fatigue in Military Operational Environments: An Annotated Bibliography

Miller, Nita L; Shattuck, Lawrence G; Matsangas, Panagiotis; Jul 2007; 76 pp.; In English

Report No.(s): AD-A470586; NPS-OR-07-0001; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470586>

Research involving sleep and fatigue in military operations has been conducted for many years. Indeed, following nearly every major military engagement or conflict, reports are published which detail the effects of sleep deprivation on human performance. Unfortunately, many of these reports never make it to the scientific literature, and are published instead as technical reports. Following an extensive search of all available data sources including open scientific journals and electronic resources (e.g., military, psychological, medical, pharmacological, and biomedical journals or electronic resources), the Defense Technical Information Center (DTIC), and other government information sources, this annotated bibliography represents an effort to put together a comprehensive, although not exhaustive, description of all such studies that were conducted between the years 1983 and 2006. The bibliography covers research involving military personnel in operational environments including combat, observations during military exercises, findings on fatigue in laboratory settings, including with simulated military tasks, findings on fatigue in simulations, and findings on sustained (SUSOPS) and continuous operations (CONOPS). When available and deemed appropriate, the original abstracts from the citations were used. If no abstract was available from the original work, the authors developed one.

DTIC

Annotations; Bibliographies; Circadian Rhythms; Military Operations; Sleep Deprivation

20070036091 Walter Reed Army Inst. of Research, Silver Spring, MD USA

AMSARA: Accession Medical Standards Analysis and Research Activity. 2005 Annual Report

Scott, Christine T; Powers, Timothy E; Li, Yuanzhang; Han, Weiwei; Weber, Natalya S; Gary, Janice K; Niebuhr, David W; Jul 23, 2007; 81 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAMD17-02-F-0139

Report No.(s): AD-A470613; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470613>

The Accession Medical Standards and Research Activity (AMSARA) has completed its ninth year of providing the DoD

with evidence-based evaluations of accession medical standards. Preliminary findings of the ongoing prospective multi-site field study, the Assessment of Recruit Motivation and Strength (ARMS), are presented along with descriptive statistics that AMSARA compiles annually and publishes for historical and reference value. The descriptive statistics are for applicants who enlisted in 2004. Data are collected while the recruits remain on active duty for their first year (during 2005 for this report). The data are then collated, cleaned, and analyzed during the first half of the subsequent year (2006 for this report). By convention, the annual report is dated for the last year of data on which the analyses were performed.

DTIC

Medical Science; Motivation; Physical Fitness; Statistical Analysis

20070036100 Army Research Lab., White Sands Missile Range, NM USA

Ontology for the Gridded Met Database

Measure, Edward M; Jul 2007; 50 pp.; In English; Original contains color illustrations

Report No.(s): AD-A470625; ARL-TR-4172; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470625>

The concept of net-centricity requires not only interconnection of individual soldiers, but of their machines. Processing the vast ocean of information from sensors and the Internet will require sophisticated machine-to-machine communication and interoperability. By attaching semantic markup or meaning to information, the Semantic Web takes a large step in advancing human-machine and machine-machine communication. In this report, we describe the development of an ontology designed to capture much of the semantic information in the Gridded Meteorological Database (GMDB). In part, the ontology developed is based on the GMDB metadata descriptions; however, the ontology developed goes beyond the metadata description in that it contains information about the semantic relationships between the metadata entities and attributes that the metadata descriptions do not capture. The ontology developed and described here is essentially a prototype. An operational version should incorporate both an expanded set of meteorological and meteorological effects entities and have a more detailed semantic structure.

DTIC

Data Bases; Internets; Interoperability; Metadata; Semantics

20070036107 General Electric Co., Schenectady, NY USA

NLP Track at TREC-5

Strzalkowski, Tomek; Jones, Karen S; Nov 1996; 5 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): 94-FI59900-000; 97-FI56800-000

Report No.(s): AD-A470634; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470634>

The Natural Language Processing (NLP) track was organized for the first time at TREC-5 to provide a more focused look at how NLP techniques can improve performance in information retrieval (IR). The intent was to see if the NLP techniques available today are mature enough to have an impact on IR, and whether they offer an advantage over purely quantitative methods. TREC-5 also was the place to try more expensive and more risky solutions than those used in main TREC evaluations. This NLP track demonstrated that NLP techniques have a solid but limited impact on the quality of text retrieval, particularly precision. Techniques aimed at producing higher quality queries, (e.g., query expansion, constraints) appear to be more effective than those aimed primarily at obtaining improved indexing of database documents. More work is needed before substantial gains can be seen, including the use of more advanced and expensive semantic analysis techniques. Figure 2 summarizes the NLP techniques that have been tried in information retrieval, and what their potential might be for improving retrieval precision. This chart was discussed at the NLP track workshop on the last day of TREC-5. The consensus was that NLP techniques that show particular promise in relatively small-scale track evaluations should be transferred to main evaluations as soon as practical.

DTIC

Indexes (Documentation); Information Retrieval; Natural Language (Computers); Precision; Quality; Subjects

20070036125 Army Medical Dept. Center and School, Fort Sam Houston, TX USA

US Army Medical Department Journal, April - June 2007

Aldridge, Don; Jun 2007; 73 pp.; In English; Original contains color illustrations

Report No.(s): AD-A470683; PB 8-07-4/5/6; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470683>

Clinical and nonclinical professional information designed to keep U.S. Army Medical Department personnel informed

of health care, research, and combat and doctrine development information.

DTIC

Medical Services; Military Operations; Periodicals

20070036131 Colorado Univ., Boulder, CO USA

Japan's Potential Role in a Military-Technical Revolution

Alexander, Arthur J; Udis, Bernard; Nov 30, 1994; 50 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): MDA903-93-C-0123

Report No.(s): AD-A470693; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470693>

By the 1930s, Japan had achieved the objectives of its 1868 Meiji Restoration. It had created a heavy industrial system of world rank supporting a modern military establishment to defend itself against western colonialism. This singular achievement led to the one thing the strategy was intended to prevent - defeat and domination by foreigners. Industrial growth ended centuries of autarky; a modernized Japan depended on imports for its technology, energy, raw materials, and strategic industrial supplies. To ensure itself of these inputs, it embarked on its own colonial ventures in Asia and built a naval fleet to protect its lines of supply. These actions eventually led Japan into conflict with the USA. Japanese dependence on overseas supplies made its merchant shipping a cornerstone of its industrial might. Yet, during the Second World War, Japan did not protect this fleet against attack by the use of anti-submarine warfare or protected convoys. Rather, the Imperial Japanese Navy saw its job as one of defeating the main American naval fleet. With its commerce unprotected, Japan suffered unsustainable losses to its economy and its ability to wage war. However, at the tactical-technical level, especially in naval aviation, Japanese industry and military planners were quite innovative. Despite its acceptance of the idea of total war, Japan's decision to make war on the USA was a profound error of historic proportions as the nation's strategic objectives vastly outran its military and industrial means. Although Japan's economic growth was remarkable, its economy was still considerably smaller than that of the USA; its technology - even its military technology - seriously lagged American levels.

DTIC

Defense Industry; International Relations; International Trade; Japan

20070036133 Army Command and General Staff Coll., Fort Leavenworth, KS USA

Media: A Line of Operation for Urban Combat on the Operational Level

Krivda, Erik; May 9, 2007; 47 pp.; In English; Original contains color illustrations

Report No.(s): AD-A470699; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470699>

Understanding and leveraging the news media has become critical for operational-level commanders conducting urban combat operations. The insatiable public appetite for information has created conditions in which tactical actions can have severe strategic repercussions because of media reporting. In the 21st century, the operational-level commander conducting urban combat operations must clearly understand the influence that the news media has on operational success. Media influences on world public opinion can now change the traditional model of warfare described by Clausewitz's trinity. World public opinion, influenced by the media, is now a fourth factor in influencing war, modifying the trinity into a diamond. Therefore, operational-level commanders must address the media in their planning and operations. Adding the media as a line of operation for planning and establishing media crisis teams will allow the commander to consider media coverage, or the media battle space, throughout an operation. This ensures that planners will develop the media battle space as an integral part of the urban kinetic fight. The author examines the battles of Hue during the Vietnam War and Fallujah during the Iraqi insurgency through the lenses of the reporting cycle, public perception, and military doctrine to demonstrate the new significance of the media in 21st century urban combat.

DTIC

Combat; News Media; Vietnam; Warfare

20070036302 Organisatie voor Toegepast Natuurwetenschappelijk Onderzoek, The Hague, Netherlands

Algorithms for the Fusion of Two Sets of (Sonar) Data

Theije, P A de; Moll, C A van; Dec 2006; 54 pp.; In English; Original contains color illustrations

Report No.(s): AD-A470758; TNO-DV-2006-A518; No Copyright; Avail.: Defense Technical Information Center (DTIC)

In this report we study different methods to combine sonar contacts as observed by two sonars. The sonar contacts are given realistic position errors, which makes their association non-trivial. First, for a single pair of contacts the most-likely

position of the true underlying target position is derived. Based on this, the probability that two observed contacts originate from a single object is calculated. Based on these theoretical derivations, different association methods are evaluated using simulations, in which both targets-of-interest and false alarms are inserted. It is concluded that an 'OR'-fusion of the two sets of sonar contacts gives a much better performance than an 'AND'-fusion; the latter induces severe losses. The results are insensitive to the number of targets inserted, to the exact magnitude of the position errors, and to the amplitude distribution of the targets-of-interest.

DTIC

Algorithms; Multisensor Fusion; Sonar

20070036327 Naval War Coll., Newport, RI USA

Live From the Front: Operational Ramifications of Military Web Logs in Combat Zones

Keyes, Paul R; May 10, 2007; 31 pp.; In English

Report No.(s): AD-A470844; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Military web logs (online journals written by service members serving in combat zones) began appearing on the Internet shortly after the start of OPERATION ENDURING FREEDOM. Their firsthand accounts of action on the front lines provide the public with a perspective that cannot be gained from the mainstream media. Their instantaneous nature and widespread reach create unique operational concerns not experienced with other forms of communication. This paper examines these operational concerns, with a particular focus on operational security, while also examining the positive aspects of military web logs. Legal implications and the military's efforts to manage risks associated with military web logs also are discussed. Using parallels found in civilian web logs, business sector web log management techniques are discussed as they relate to military web logs. Finally, the paper concludes that military leaders must allow a permissive military web log environment, framed with sound operational security guidance and training, if they are to leverage the benefits that military web logs can provide to the operational commander.

DTIC

Combat; Internets; Military Personnel; Personnel Management; Security

20070036329 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

Developing Integrated Taxonomies for a Tiered Information Architecture

Dutra, Jayne E.; November 30, 2006; 36 pp.; In English; Online Information 2006 Conference, 30 Nov. 2006, London, UK;

Original contains color illustrations; Copyright; Avail.: Other Sources

ONLINE: <http://hdl.handle.net/2014/40335>

This viewgraph presentation reviews the concept of developing taxonomies for an information architecture. In order to assist people in accessing information required to access information and retrieval, including cross repository searching, a system of nested taxonomies is being developed. Another facet of this developmental project is collecting and documenting attributes about people, to allow for several uses: access management, i.e., who are you and what can you see?; targeted content delivery i.e., what content helps you get your work done?; work force planning i.e., what skill sets do you have that we can apply to work?; and IT Services i.e., How can we provision you with the proper IT services?

CASI

Information Retrieval; Information Analysis; Taxonomy; Classifications

20070036371 Army Command and General Staff Coll., Fort Leavenworth, KS USA

Confounding our Enemies and Astounding our Friends, Honesty in Twenty-First Century Warfare

Oliver Jr, John A; May 10, 2007; 52 pp.; In English; Original contains color illustrations

Report No.(s): AD-A470910; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Propaganda and disinformation characterized indispensable components of 19th and 20th century warfare. Examples such as Leni Riefenstahl's 'Triumph of the Will' or Frank Capra's 'Why We Fight' series made no attempt to honestly display differences between nations, but instead cast all arguments in black and white. In an age where audiences had no readily available resources to question the accuracy of such works, propaganda and disinformation represented effective methods to target the will of large groups of people. The information revolution and the 'flattening' of the world has forever altered the use of information and disinformation in warfare. The evolution of warfare in concert with the information revolution, as well as current political, demographic, and religious trends, also contribute to the downfall of propaganda and disinformation. Twenty-first century warfare, or Fourth Generation warfare, does not emphasize the destruction of enemy forces, but instead targets the minds and will of political decision makers. The primary ordinance on this battleground of ideas is not artillery

shells, tank rounds, or bullets. It is legitimacy. This legitimacy, the key to victory in the battle of ideas, can only be won by honesty. This study concludes with a synthesis of this deeper understanding of truth and honesty with a thorough awareness of the nature of 21st century conflict to clarify the relationship between the two. In the 21st century, Soldiers will fight violent extremists more often than they will face the armies of other nation states. In such confusing warfare, the temptation to use any means will be ever present. As American Soldiers, we must be courageous in the face of such temptation and heed the words of that uniquely American philosopher, Samuel Clemens, who wrote 'When in doubt, tell the truth. It will confound your enemies and astound your friends.'

DTIC

Ethics; Warfare

20070036380 Cranfield Univ., Cranfield, UK

General Interoperability Concepts

Searle, Jonathan; Brennan, John; Sep 1, 2006; 32 pp.; In English; Original contains color illustrations

Report No.(s): AD-A470923; No Copyright; Avail.: Defense Technical Information Center (DTIC)

No abstract available

Information Systems; Interoperability; Military Operations

20070036383 Army Command and General Staff Coll., Fort Leavenworth, KS USA

CCIR for Complex and Uncertain Environments

Spinuzzi, Marc A; May 1, 2007; 122 pp.; In English; Original contains color illustrations

Report No.(s): AD-A470928; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This monograph examines the concept of Commander's Critical Information Requirements (CCIR) and determines if the doctrine is suitable for particularly complex operations, like counterinsurgency (COIN). CCIR was developed to accomplish three distinct purposes: (1) maintain situational understanding, (2) support decision points, and (3) manage information. A fourth purpose -- to support assessment -- is a relatively new addition. These purposes were all developed with conventional warfare in mind. Lessons learned from unconventional wars against insurgents or guerrillas were rarely applied to the concept of CCIR, and were systematically removed from doctrine when they did appear. However, Commanders involved in COIN have developed new tactics, techniques, and procedures (TTPs) for creating and using CCIR. These TTPs often directly contradict existing doctrine and result in information requirements that fail to meet the criteria established for conventional warfare. These TTPs result from a doctrine that is ambiguous, confusing, and overly complex. CCIR can be considered to be part of an intuitive decision maker's response to uncertainty, and are highly suitable for use in a complex environment. However, their use is contingent on a clear and simple description of CCIR purposes, and an understanding of the difference between execution and adjustment decisions. Chapter 1 summarizes the Army's doctrine for CCIR, introduces key terms and concepts, and discusses relevant issues. Chapter 2 is a literature review that traces the historical development of CCIR in Army doctrine. Beginning shortly after World War I and going through doctrinal manuals published as recently as 2006, it examines the development of CCIR in three distinct periods. Chapter 3 addresses the use of CCIR in complex environments, particularly counterinsurgency operations. It also examines complexity theory and its implications for C2, intuitive decision making, and information overload.

DTIC

Command and Control; Decision Making; Information; User Requirements

20070036749 Northwestern Univ., Evanston, IL USA

From Whiteboard to Model: A Preliminary Analysis (Preprint)

Paritosh, Praveen; Bridewell, Will; Jan 2007; 9 pp.; In English

Report No.(s): AD-A470563; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470563>

Building models of a complex system such as an ecosystem or a chemical plant is an arduous task that can take several person months to complete. One rarely knows the scope of the model, its assumptions and claims, at the outset of the task, let alone how to state those in a formal language. To make this task manageable, modelers start at the whiteboard - by making free-form drawings that capture their current understanding of the studied system. These drawings need not conform to any particular ontology and may lack internal coherency or consistency. Nevertheless, such drawings can help organize one's thoughts and can capture key participants and relationships in the dynamic system. We argue that these free-form drawings facilitate the modeling process, based on evidence from modeling in practice. We analyze the relationship between free-form

drawings and formally encoded models. We then suggest how to exploit these relationships to develop a modeling environment that supports a tighter integration between conceptual and detailed modeling.

DTIC

Models; Complex Systems

84

LAW, POLITICAL SCIENCE AND SPACE POLICY

Includes aviation law; space law and policy; international law; international cooperation; and patent policy.

20070036004 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

A Review of the Approach of NASA Projects to Planetary Protection Compliance

Barengoltz, Jack B.; March 5, 2005; 11 pp.; In English; IEEE Aerospace Conference, 5-12 Mar. 2005, Big Sky, MT, USA;

Original contains black and white illustrations; Copyright; Avail.: Other Sources

ONLINE: <http://hdl.handle.net/2014/40515>

NASA planetary protection, formerly planetary quarantine, is a set of regulations for extraterrestrial space missions which addresses applicable COSPAR resolutions, and ultimately derives from a 1967 United Nations treaty (the 'Moon treaty'). The purpose of the NASA regulations is set forth in a basic policy, NPD 8020.7E (Ref. 1). The purposes are: to protect extraterrestrial objects from terrestrial biological contamination that may interfere with the search for extant life or its remnants or its precursors; and to protect the Earth from the possible hazards of an extraterrestrial sample return.

Author

Planetary Protection; Planetary Quarantine; Space Missions; Biological Effects; Contamination; NASA Programs; Policies; Regulations

85

TECHNOLOGY UTILIZATION AND SURFACE TRANSPORTATION

Includes aerospace technology transfer; urban technology; surface and mass transportation. For related information see also *03 Air Transportation and Safety*, *16 Space Transportation and Safety*, and *44 Energy Production and Conversion*. For specific technology transfer applications see also the category where the subject is treated.

20070036018 NASA Langley Research Center, Hampton, VA, USA

The Three Tsunamis

Antcliff, Richard R.; [2007]; 2 pp.; In English

Contract(s)/Grant(s): WBS 292487.08.07.01; No Copyright; Avail.: CASI: A01, Hardcopy

ONLINE: <http://hdl.handle.net/2060/20070036018>

We often talk about how different our world is from our parent's world. We then extrapolate this thinking to our children and try to imagine the world they will face. This is hard enough. However, change is changing! The rate at which change is occurring is accelerating. These new ideas, technologies and ecologies appear to be coming at us like tsunamis. Our approach to responding to these oncoming tsunamis will frame the future our children will live in. There are many of these tsunamis; I am just going to focus on three really big ones heading our way.

Derived from text

Technologies; Ecology

20070036627 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

NASA New Millennium Program Overview

Stevens, Christopher M.; January 11, 2001; 7 pp.; In English; New Millennium Program (NMP) First Earth Observing Mission (EO-1) Technology Workshop, 11 Jan. 2001, Reston, VA, USA; Original contains color and black and white illustrations; Copyright; Avail.: Other Sources

ONLINE: <http://hdl.handle.net/2014/40390>

This viewgraph presentation reviews the New Millennium Program (NMP) which was established in 1994 to revolutionize NASA's Space and Earth science programs to achieve more capable, less costly missions in the 21st Century by:

1. Developing and flight-validating revolutionary technologies;
2. Reducing development times and life cycle mission cost;

3. Enabling highly autonomous spacecraft and 4. Promoting nationwide teaming and coordination

Author

Technology Assessment; Technology Utilization; Feasibility Analysis; NASA Programs; Space Flight

20070036628 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Cooling Technology for Large Space Telescopes

DiPirro, Michael; Cleveland, Paul; Durand, Dale; Klavins, Andy; Muheim, Daniella; Paine, Christopher; Petach, Mike; Tenerelli, Domenick; Tolomeo, Jason; Walyus, Keith; [2007]; 10 pp.; In English; NSTC 2007/NASA-HQ Science Mission Directorate, 19-21 Jun. 2007, College Park, MD, USA; Original contains color illustrations; Copyright; Avail.: CASI:

A02, Hardcopy

NASA's New Millennium Program funded an effort to develop a system cooling technology, which is applicable to all future infrared, sub-millimeter and millimeter cryogenic space telescopes. In particular, this technology is necessary for the proposed large space telescope Single Aperture Far-Infrared Telescope (SAFIR) mission. This technology will also enhance the performance and lower the risk and cost for other cryogenic missions. The new paradigm for cooling to low temperatures will involve passive cooling using lightweight deployable membranes that serve both as sunshields and V-groove radiators, in combination with active cooling using mechanical coolers operating down to 4 K. The Cooling Technology for Large Space Telescopes (LST) mission planned to develop and demonstrate a multi-layered sunshield, which is actively cooled by a multi-stage mechanical cryocooler, and further the models and analyses critical to scaling to future missions. The outer four layers of the sunshield cool passively by radiation, while the innermost layer is actively cooled to enable the sunshield to decrease the incident solar irradiance by a factor of more than one million. The cryocooler cools the inner layer of the sunshield to 20 K, and provides cooling to 6 K at a telescope mounting plate. The technology readiness level (TRL) of 7 will be achieved by the active cooling technology following the technology validation flight in Low Earth Orbit. In accordance with the New Millennium charter, tests and modeling are tightly integrated to advance the technology and the flight design for 'ST-class' missions. Commercial off-the-shelf engineering analysis products are used to develop validated modeling capabilities to allow the techniques and results from LST to apply to a wide variety of future missions. The LST mission plans to 'rewrite the book' on cryo-thermal testing and modeling techniques, and validate modeling techniques to scale to future space telescopes such as SAFIR.

Author

Spaceborne Telescopes; Technology Assessment; Cryogenic Cooling; Space Missions

88

SPACE SCIENCES (GENERAL)

Includes general research topics related to the natural space sciences. For specific topics in space sciences see *categories 89 through 93*.

20070035528 Naval Observatory, Washington, DC USA

The Theory of Canonical Perturbations Applied to Attitude Dynamics and to the Earth Rotation. Osculating and Nonosculating Andoyer Variables

Efroimsky, Michael; Escapa, Alberto; Jun 21, 2007; 34 pp.; In English

Report No.(s): AD-A470382; No Copyright; Avail.: Defense Technical Information Center (DTIC)

In the method of variation of parameters we express the Cartesian coordinates or the Euler angles as functions of the time and six constants. If, under disturbance, we endow the 'constants' with time dependence, the perturbed orbital angular velocity will consist of a partial time derivative and convective term that includes time derivatives of the 'constants'. The Lagrange constraint, often imposed for convenience, nullifies the convective term and thereby guarantees that the functional dependence of the velocity on the time and 'constants' stays unaltered under disturbance. 'Constants' satisfying this constraint are called osculating elements. Otherwise, they are simply termed orbital or rotational elements. When the equations for the elements are required to be canonical, it is normally the Delaunay variables that are chosen to be the orbital elements, and it is the Andoyer variables that are typically chosen to play the role of rotational elements. (Since some of the Andoyer elements are time-dependent even in the unperturbed setting, the role of 'constants' is actually played by their initial values.) The Delaunay and Andoyer sets of variables share a subtle peculiarity: under certain circumstances the standard equations render the elements nonosculating. In the theory of orbits, the planetary equations yield nonosculating elements when perturbations depend on velocities. To keep the elements osculating, the equations must be amended with extra terms that are not parts of the disturbing function [Efroimsky, M., Godreich, P.J. *Math. Phys.*, 44, 5958-5977 (2003); *Astron. Astrophys.* 415, 1187-1199

(2004); Efroimsky, M.; *Celest. Mech. Dyn. Astron.* 91, 75-108 (2005); *Ann. New York Acad. Acad. Sci.* 1065, 346-374 (2006)].

DTIC

Attitude (Inclination); Cartesian Coordinates; Earth Orbits; Earth Rotation; Perturbation; Perturbation Theory

20070035873 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

Miniaturized Mercury Ion Clock for Ultrastable Deep Space Applications

Prestage, John D.; Chung, Sang; Lim, Lawrence; Le, Thanh; December 5, 2006; 8 pp.; In English; 38th Annual Precise Time and Time Interval (PTTI) Meeting, 5-7 Dec. 2006, Reston, VA, USA; Original contains color and black and white illustrations; Copyright; Avail.: Other Sources

ONLINE: <http://hdl.handle.net/2014/40340>

We have recently completed a prototype ion-clock physics package based on Hg ions shuttled between a quadrupole and a 16-pole rf trap. With this architecture we have demonstrated short-term stability $\sim 2\text{-}3 \times 10^{-13}$ at 1 second, averaging to 10-15 at 1 day. This development shows that H-maser quality stabilities can be produced in a small clock package, comparable in size to an ultra-stable quartz oscillator required for holding $1\text{-}2 \times 10^{-13}$ at 1 second. This performance was obtained in a sealed vacuum configuration where only a getter pump was used to maintain vacuum. The vacuum tube containing the traps has now been under sealed vacuum conditions for nearly 1.5 years with no measurable degradation of ion trapping lifetimes or clock short-term performance. Because the tube is sealed, the Hg source and Neon buffer gas are held indefinitely, for the life of the tube. There is no consumption of Hg in this system unlike in a Cs beam tube where lifetime is often limited by Cs depletion.

Author

Deep Space; Clocks; Mercury (Metal); Ions; Quartz; Miniaturization

20070035917 Government Accountability Office, Washington, DC, USA

NASA: Agency Has Taken Steps Toward Making Sound Investment Decisions for Ares I but Still Faces Challenging Knowledge Gaps

October 2007; 33 pp.; In English

Report No.(s): GAO-08-51; No Copyright; Avail.: CASI: [A03](#), Hardcopy

One of the first steps in the National Aeronautics and Space Administration's (NASA) efforts to implement the President's plan to return humans to the moon and prepare for eventual human space flight to Mars is the development of the Ares I Crew Launch Vehicle. In 2005, NASA outlined a framework for implementing the President's plan and has awarded contracts for Ares I and the Orion Crew Exploration Vehicle it is designed to send into space. It plans to conduct the first human space flight in 2015. However, the agency is seeking to speed development efforts in order to reduce the gap in our nation's ability to provide human access to space caused by the Space Shuttle's retirement in 2010. GAO was asked to assess NASA's progress in developing the knowledge needed to make sound investment decisions for the Ares I project. GAO's work included analyzing Ares I plans, contracts, schedules, and risk assessments.

Derived from text

Ares I Launch Vehicle; NASA Space Programs; Space Shuttles; Decision Making

20070035999 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

Single Event Effects in Highly Scaled Devices for Space Applications

Johnston, Allan. H.; October 6, 2004; 6 pp.; In English; 6th International Workshop on Radiation Effects on Semiconductor Devices for Space Applications, 6 Oct. 2004, Tsukuba, Japan; Original contains black and white illustrations; Copyright; Avail.: Other Sources

ONLINE: <http://hdl.handle.net/2014/40535>

This paper discusses single-event upset (SEU) in memories and microprocessors that are the 'drivers' of highly scaled commercial integrated circuits. Despite the decrease in critical charge that occurs for highly scaled CMOS devices, recent test data has shown that SEU rates are actually somewhat lower for scaled devices compared to older devices with larger feature size. Hard errors, which are increasingly important for memories, are discussed along with conventional soft errors. Functional errors in memories and microprocessors are particularly significant, and tend to dominate the response of highly scaled devices from an application standpoint. Predictions for future devices are made using the Semiconductor Industry Roadmap along with recent modeling and radiation test results.

Author

Single Event Upsets; Semiconductors (Materials); Integrated Circuits; Microprocessors; Errors

20070036020 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

Operation's Concept for Array-Based Deep Space Network

Bagri, Durgadas S.; Statman, Joseph I.; Gatti, Mark S.; [2005]; 10 pp.; In English; IEEE Aerospace Conference, 5-12 Mar. 2005, Big Sky, MT, USA; Copyright; Avail.: Other Sources

ONLINE: <http://hdl.handle.net/2014/40545>

The Array-based Deep Space Network (DSNArray) will be a part of more than 10(exp 3) times increase in the downlink/telemetry capability of the Deep space Network (DSN). The key function of the DSN-Array is to provide cost-effective, robust Telemetry, Tracking and Command (TT&C) services to the space missions of NASA and its international partners. It provides an expanded approach to the use of an array-based system. Instead of using the array as an element in the existing DSN, relying to a large extent on the DSN infrastructure, we explore a broader departure from the current DSN, using fewer elements of the existing DSN, and establishing a more modern Concept of Operations. This paper gives architecture of DSN-Array and its operation's philosophy. It also describes customer's view of operations, operations management and logistics - including maintenance philosophy, anomaly analysis and reporting.

Author

Space Missions; Deep Space Network; Telemetry; Logistics; Cost Effectiveness

20070036023 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

Link Design and Planning for Mars Reconnaissance Orbiter (MRO) Ka-band (32 GHz) Telecom Demonstration

Shambayati, Shervin; Davarian, Faramaz; Morabito, David; March 6, 2004; 10 pp.; In English; IEEE Aerospace Conference, 6-13 Mar. 2004, Big Sky, MT, USA; Original contains black and white illustrations; Copyright; Avail.: Other Sources

ONLINE: <http://hdl.handle.net/2014/40524>

NASA is planning an engineering telemetry demonstration with Mars Reconnaissance Orbiter (MRO). Capabilities of Ka-band (32 GHz) for use with deep space mission are demonstrated using the link optimization algorithms and weather forecasting. Furthermore, based on the performance of previous deep space missions with Ka-band downlink capabilities, experiment plans are developed for telemetry operations during superior solar conjunction. A general overview of the demonstration is given followed by a description of the mission planning during cruise, the primary science mission and superior conjunction. As part of the primary science mission planning the expected data return for various data optimization methods is calculated. These results indicate that, given MRO's data rates, a link optimized to use of at most two data rates, subject to a minimum availability of 90%, performs almost as well as a link with no limits on the number of data rates subject to the same minimum availability.

Author

Mars Reconnaissance Orbiter; Extremely High Frequencies; Deep Space; Space Missions; Mission Planning

20070036050 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

Wind-Driven Montgolfiere Balloons for Mars

Jones, Jack A.; Fairbrother, Debora; Lemieux, Aimee; Lachenmeier, Tim; Zubrin, Robert; January 2005; 10 pp.; In English; American Institute of Aeronautics and Astronautics (AIAA), 44th Aerospace Sciences Meeting, 9-12 Jan. 2004, Reno, NV, USA; Original contains black and white illustrations; Copyright; Avail.: Other Sources

ONLINE: <http://hdl.handle.net/2014/40539>

Solar Montgolfiere balloons, or solar-heated hot air balloons have been evaluated by use on Mars for about 5 years. In the past, JPL has developed thermal models that have been confirmed, as well as developed altitude control systems to allow the balloons to float over the landscape or carry ground sampling instrumentation. Pioneer Astronautics has developed and tested a landing system for Montgolfieres. JPL, together with GSSL, have successfully deployed small Montgolfieres (<15-m diameter) in the earth's stratosphere, where conditions are similar to a Mars deployment. Two larger Montgolfieres failed, however, and a series of larger scale Montgolfieres is now planned using stronger, more uniform polyethylene bilaminate, combined with stress-reducing ripstitch and reduced parachute deceleration velocities. This program, which is presently under way, is a joint effort between JPL, WFF, and GSSL, and is planned for completion in three years.

Author

Balloons; Altitude Control; High Temperature Air; Temperature Distribution; Deployment

20070036051 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

Laser Metrology in the Micro-Arcsecond Metrology Testbed

An, Xin; Marx, D.; Goullioud, Renaud; Zhao, Feng; November 8, 2004; In English; SPIE Photonics Asia, 8-12 Nov. 2004, Beijing, China; Original contains black and white illustrations; Copyright; Avail.: Other Sources

ONLINE: <http://hdl.handle.net/2014/40540>

The Space Interferometer Mission (ESA), scheduled for launch in 2009, is a space-born visible light stellar interferometer capable of micro-arcsecond-level astrometry. The Micro-Arcsecond Metrology testbed (MAM) is the ground-based testbed that incorporates all the functionalities of ESA minus the telescope, for mission-enabling technology development and verification. MAM employs a laser heterodyne metrology system using the Sub-Aperture Vertex-to-Vertex (SAVV) concept. In this paper, we describe the development and modification of the SAVV metrology launchers and the metrology instrument electronics, precision alignments and pointing control, locating cyclic error sources in the MAM testbed and methods to mitigate the cyclic errors, as well as the performance under the MAM performance metrics.

Author

Interferometers; Space Missions; Mission Planning; Metrology; Laser Applications; Astrometry

20070036652 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

An Ultra Reliability for Project for NASA

Shapiro, Andrew A.; March 5, 2005; 12 pp.; In English; IEEE Aerospace Conference, 5-12 Mar. 2005, Big Sky, MT, USA; Original contains black and white illustrations

Report No.(s): IEEEAC Paper-1001, Version 0; Copyright; Avail.: Other Sources

ONLINE: <http://hdl.handle.net/2014/40505>

NASA has embarked on a new program designed to improve the reliability of NASA systems. In this context, the goal for ultra reliability is to ultimately improve the systems by an order of magnitude. The approach outlined in this presentation involves five steps: 1. Divide NASA systems into seven sectors; 2. Establish sector champions and representatives from each NASA center; 3. Develop a challenge list for each sector using a team of NASA experts in each area with the sector champion facilitating the effort; 4. Develop mitigation strategies for each of the sectors' challenge lists and rank their importance by holding a workshop with area experts from government (NASA and non-NASA), universities and industry; 5. Develop a set of tasks for each sector in order of importance for improving the reliability of NASA systems. Several NASA-wide workshops have been held, identifying issues for reliability improvement and providing mitigation strategies for these issues.

Author

NASA Programs; Reliability; Identifying

20070036654 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

An Integrated Approach to Risk Assessment for Concurrent Design

Meshkat, Leila; Voss, Luke; Feather, Martin; Cornford, Steve; March 5, 2005; 9 pp.; In English; IEEE Aerospace Conference, 5-12 Mar. 2005, Big Sky, MT, USA; Original contains black and white illustrations; Copyright; Avail.: Other Sources

ONLINE: <http://hdl.handle.net/2014/40506>

This paper describes an approach to risk assessment and analysis suited to the early phase, concurrent design of a space mission. The approach integrates an agile, multi-user risk collection tool, a more in-depth risk analysis tool, and repositories of risk information. A JPL developed tool, named RAP, is used for collecting expert opinions about risk from designers involved in the concurrent design of a space mission. Another in-house developed risk assessment tool, named DDP, is used for the analysis.

Author

Space Missions; Risk; Assessments

20070036655 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

A Rapid, Flexible Approach to Conceptual Space Mission Tradespace Definition and Exploration

Girerd, Andre R.; March 5, 2005; 15 pp.; In English; IEEE Aerospace Conference, 5-12 Mar. 2005, Big Sky, MT, USA; Original contains black and white illustrations; Copyright; Avail.: Other Sources

ONLINE: <http://hdl.handle.net/2014/40512>

This paper provides an overview of the Mission Tradespace Tool (MTT), a methodology and software framework developed to improve JPL's early design process by offering a rapid, structured, and inexpensive way to identify feasible design architectures from a wide array of candidate architectures. There has been a growing consensus at JPL that to improve

the quality of service offered to design customers it is desirable to explore a wide tradespace of candidate architectures prior to forming a conceptual design baseline. This paper describes the rationale behind the MTT's approach to meet this need. Notable features of the framework are introduced and explained.

Author

Architecture; Space Missions; Space Exploration

20070036667 NASA Marshall Space Flight Center, Huntsville, AL, USA

Developments in Radiation-Hardened Electronics Applicable to the Vision for Space Exploration

Keys, Andrew S.; Frazier, Donald O.; Patrick, Marshall C.; Watson, Michael D.; Johnson, Michael A.; Cressler, John D.; Kolawa, Elizabeth A.; September 18, 2007; 10 pp.; In English; AIAA Space 2007, 18-20 Sep. 2007, Long Beach, CA, USA; Original contains black and white illustrations; Copyright; Avail.: CASI: A02, Hardcopy

The Radiation Hardened Electronics for Space Exploration (RHESE) project develops the advanced technologies required to produce radiation hardened electronics, processors, and devices in support of the anticipated requirements of NASA's Constellation program. Methods of protecting and hardening electronics against the encountered space environment are discussed. Critical stages of a spaceflight mission that are vulnerable to radiation-induced interruptions or failures are identified. Solutions to mitigating the risk of radiation events are proposed through the infusion of RHESE technology products and deliverables into the Constellation program's spacecraft designs.

Author

Aerospace Environments; Space Exploration; Radiation Hardening; Electronic Equipment; Constellation Program

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ASTRONOMY

Includes observations of celestial bodies; astronomical instruments and techniques; radio, gamma-ray, x-ray, ultraviolet, and infrared astronomy; and astrometry.

20070035114 NASA Goddard Space Flight Center, Greenbelt, MD, USA

The Remarkable X-ray Spectrum of the Broad-Line Radio Galaxy 3C 445

Sambruna, R. M.; Reeves, J. N.; Braito, V.; [2007]; 29 pp.; In English; Original contains black and white illustrations; No Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: <http://hdl.handle.net/2060/20070035114>

The nearby ($z=0.057$) radio-loud source 3C 445, optically classified as a Broad-Line Radio Galaxy, exhibits an X-ray spectrum strongly reminiscent of an obscured AGN, suggesting we are seeing this source at a relatively large angle from the radio jet. Here we present an archival 15 ks XMM-Newton observation of 3C 445 which confirms the remarkable complexity of its X-ray emission. The X-ray emission is described by a power law continuum with GAMMA approximately equal to 1.4, absorbed by several layers of cold gas, plus strong cold reflection. A narrow, unresolved Fe K α emission line is detected, confirming previous findings, with EW approximately equal to 400 eV. A soft excess is present below 2 keV over the extrapolation of the hard X-ray power law, which we model with a power law with the same photon index and absorbed by a column density $N(\text{H})$ approximately equal to 10^{20} cm $^{-2}$ in excess to Galactic. Remarkably, a host of emission lines are present below 2 keV, confirming previous indications from ASCA, due to H- and He-like O, Mg, and Si. The detection of two features at 0.74 and 0.87 keV, identified with OVII and OVIII Radiative Recombination Continuum features, suggest an origin of the lines from a photoionized gas, with properties very similar to radio-quiet obscured AGN. Two different ionized media, or a single stratified medium, are required to fit the soft X-ray data satisfactorily. The similarity of the X-ray spectrum of 3C 445 to Seyferts underscores that the central engines of radio-loud and radio-quiet AGN similarly host both cold and warm gas.

Author

X Ray Spectra; Radio Galaxies; X Ray Astronomy; Emission Spectra

20070035130 NASA Goddard Space Flight Center, Greenbelt, MD, USA

The Hottest Horizontal-Branch Stars in Omega Centauri: Late Hot Flasher vs. Helium Enrichment

Moehler, S.; Dreizler, S.; Lanz, T.; Bono, G.; Sweigart, A V.; Calamida, A.; Monelli, M.; Nonino, M.; [2007]; 4 pp.; In English; Original contains black and white illustrations; Copyright; Avail.: Other Sources

UV observations of some massive globular clusters uncovered a significant population of very hot stars below the hot end of the horizontal branch (HB), the so-called blue hook stars. This feature might be explained either by the late hot flasher

scenario here stars experience the helium flash while on the white dwarf cooling curve or by the helium-rich sub-population recently postulated to exist in some clusters. Spectroscopic analyses of blue hook stars in omega Cen and NGC 2808 support the late hot flasher scenario, but the stars contain much less helium than expected and the predicted C, N enrichment could not be verified from existing data. We want to determine effective temperatures, surface gravities and abundances of He, C, N in blue hook and canonical extreme horizontal branch (EHB) star candidates. Moderately high resolution spectra of stars at the hot end of the blue horizontal branch in the globular cluster omega Cen were analysed for atmospheric parameters ($T_{\text{sub eff}}$), $\log g$) and abundances using LTE and Non-LTE model atmospheres. In the temperature range 30,000 K to 50,000 K we find that 37% of our stars are helium-poor ($\log n_{\text{He}}/n_{\text{H}}$ less than -2), 49% have solar helium abundance within a factor of 3 (-1.5 less than or equal to $\log n_{\text{He}}/n_{\text{H}}$ less than or equal to -0.5) and 14% are helium rich ($\log n_{\text{He}}/n_{\text{H}}$ greater than -0.4). We also find carbon enrichment in step with helium enrichment, with a maximum carbon enrichment of 3% by mass. At least 30% of the hottest HB stars in omega Centauri show helium abundances well above the predictions from the helium enrichment scenario ($Y = 0.42$ corresponding to $\log n_{\text{He}}/n_{\text{H}}$ approximately equal to -0.74). In addition the most helium-rich stars show strong carbon enrichment as predicted by the late hot flasher scenario. We conclude that the helium-rich HB stars in omega Cen cannot be explained solely by the helium-enrichment scenario invoked to explain the blue main sequence.

Author

Centaurus Constellation; Enrichment; Globular Clusters; Helium; Horizontal Branch Stars; Hot Stars

20070035140 NASA Goddard Space Flight Center, Greenbelt, MD, USA

A Search for Short-Lived Transient Phenomenon in LSI+61 303

Shrader, Chris; Sturmer, S.; [2007]; 2 pp.; In English; Original contains black and white illustrations; No Copyright;

Avail.: CASI: [A01](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20070035140>

Motivated by reports of transient behavior on the circumstellar disk of the gamma-ray bright, X-ray binary system LSI +61 303 we have undertaken a search for possible ionizing events. We have utilized the bard-X-ray monitoring database provided by the INTEGRAL Galactic Plane survey program.

Author

X Ray Binaries; Gamma Rays; Large Scale Integration; Stellar Envelopes; X Rays

20070035512 Naval Observatory, Washington, DC USA

Toward a Common Language: The Washington Multiplicity Catalog

Hartkopf, William I; Jan 2006; 6 pp.; In English

Report No.(s): AD-A470349; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Due to improvements in technology (interferometers, precision radial-velocity techniques, etc.), the traditional separation/period regimes of 'wide' and 'close' binaries are witnessing increasing overlap. This is expected to lead to increasing confusion in component identification, since different observing techniques adopted their own rules for designation of these components. A quick overview will be given of the Washington Multiplicity Catalog, an effort to create a common nomenclature scheme for all types of stellar and sub-stellar companions.

DTIC

Binary Stars; Catalogs (Publications)

20070035530 NASA Goddard Space Flight Center, Greenbelt, MD, USA

HST/ACS Coronagraphic Observations of the HD 163296 Circumstellar Disk: Evidence of Time-Variable Self-Shadowing?

Wisniewski, J.; Dowling, Lorraine; Clampin, Mark; Grady, C.; Ardila, D.; Golimowski, D.; Illingworth, G.; Krist, J.; June 08, 2007; 2 pp.; In English; The Spirit of Lyot: Direct Detection of Exoplanets and Circumstellar Disks, 4-8 Jun. 2007, Berkeley, CA, USA; Original contains black and white illustrations

Contract(s)/Grant(s): NNH06CC03B; Copyright; Avail.: Other Sources; Abstract Only

We present Hubble Space Telescope Advanced Camera for Surveys (HST/ACS) coronagraphic observations of the Herbig Ae star HD 163296. HD 163296's scattered light disk was resolved in the F606W and F814W filters in observations obtained in 2003 and in the F435W filter in observations obtained in 2004. Analysis of single-epoch data indicates that the disk (V-I) color is redder than the observed stellar (V-I) color. This spatially uniform red disk color might be indicative of either an evolution in the grain size distribution (i.e. grain growth) and/or composition. Both of these processes would be consistent with the observed flat geometry of the outer disk, as diagnosed by the observed r_{exp}^{-3} power law behavior of its median

azimuthally averaged disk surface brightness, which suggest that grain evolution is occurring. Comparison of ACS and STIS epoch scattered light data reveals differences in the observed disk surface brightnesses, of order 1 mag arcsec⁻², in both V and white-light filter bandpasses. Along with the observed variability in the visibility and surface brightness of the ansa(e) in the disk, and spectropolarimetric variability of the system, these results suggest that the resolved scattered light disk is variable, a phenomenon not previously observed in any other Herbig protoplanetary system We speculate that the observed behavior might be attributable to the variable inflation of the scale height of the inner disk wall, which results in variable self-shadowing of the outer disk.

Author

Coronagraphs; Stellar Envelopes; Hubble Space Telescope; Cameras; Stellar Color; Size Distribution; Polarimetry; Grain Size; A Stars

20070035532 Naval Research Lab., Washington, DC USA

High-Resolution Infrared Spectroscopy of Protoplanetary Disks

Carr, John S; Jan 2005; 12 pp.; In English

Report No.(s): AD-A470393; No Copyright; Avail.: Defense Technical Information Center (DTIC)

High-resolution spectroscopy at near and mid-infrared wavelengths can provide important and unique information about protoplanetary disks around young stars. In particular infrared molecular spectroscopy is a good diagnostic of gas in the planet-forming regions of disks within tilde 10 AU of the star. Data on the physical conditions gas content structure and chemistry of inner disks can be obtained through the analysis of velocity-resolved line profiles.

DTIC

High Resolution; Infrared Spectroscopy; Planets; Protoplanetary Disks

20070035533 Villanova Univ., PA USA

Introduction & Overview to Symposium 240: Binary Stars as Critical Tools and Tests in Contemporary Astrophysics

Guinan, Edward F; Harmanec, Petr; Hartkopf, William; Jan 2006; 13 pp.; In English

Contract(s)/Grant(s): N00014-06-1-1054

Report No.(s): AD-A470396; No Copyright; Avail.: Defense Technical Information Center (DTIC)

An overview is presented of the many new and exciting developments in binary and multiple star studies that were discussed at IAU Symposium 240. Impacts on binary and multiple star studies from new technologies, techniques, instruments, missions and theory are highlighted. It is crucial to study binary and multiple stars because the vast majority of stars (>60%) in our Galaxy and in other galaxies consist, not of single stars, but of double and multiple star systems. To understand galaxies we need to understand stars, but since most are members of binary and multiple star systems, we need to study and understand binary stars. The major advances in technology, instrumentation, computers, and theory have revolutionized what we know (and also don't know) about binary and multiple star systems. Data now available from interferometry (with milliarcsecond [mas] and sub-mas precisions), high-precision radial velocities (<1-2 m/s) and high precision photometry (<1 2 milli-mag) as well as the wealth of new data that are pouring in from panoramic optical and infrared surveys (e.g., >10,000 new binaries found since 1995), have led to a renaissance in binary star and multiple star studies. For example, advances have lead to the discovery of new classes of binary systems with planet and brown dwarf components (over 200 systems). Also, extremely valuable data about binary stars are available across the entire electromagnetic spectrum from gamma-ray to IR space missions and from the ground using increasingly more powerful and plentiful optical and radio telescopes as well as robotic telescopes. In the immediate future, spectral coverage could even be extended beyond the radio to the first detection of gravity waves from interacting close binaries.

DTIC

Astrophysics; Binary Stars; Conferences

20070035545 Naval Postgraduate School, Monterey, CA USA

Optimal Trajectory Generation for Multiple Asteroid Rendezvous

Koeppel, David M; Jun 2007; 117 pp.; In English; Original contains color illustrations

Report No.(s): AD-A470418; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This thesis is focused on solving one component of the proposed problem in the Global Trajectory Optimization Competition released by the Jet Propulsion Laboratory in late 2006. The goal is to find an optimal spacecraft trajectory to rendezvous with an asteroid in a group of asteroids. The analysis is conducted using a MATLAB application package for dynamic optimization called DIDO. In order to verify the selection results one-to-one transfers between Earth and several

asteroids are conducted. The selection process is applied to this group of asteroids. When the initial results do not meet the expectations based on the one-to-one transfers a more thorough search for a global minimum is necessary. The gradual cost-constrained technique is used to progress from local minima toward the global minimum. The results are checked to satisfy the constraints as well as the necessary conditions for optimality. When the results are analyzed feasible one-to-one rendezvous trajectories are found however a sufficient selection process is lacking. There is a great deal of work remaining on this project including the continued development of an asteroid selection procedure.

DTIC

Asteroid Missions; Asteroids; Trajectories

20070035549 Naval Research Lab., Washington, DC USA

ISO FAR-IR Spectroscopy of IR-Bright Galaxies and ULIRGs

Fischer, J; Luhman, M L; Satyapal, S; Greenhouse, M A; Stacey, G J; Bradford, C M; Lord, S D; Brauher, J R; Unger, S J; Clegg, P E; Jan 1999; 9 pp.; In English

Report No.(s): AD-A470426; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Based on far-infrared spectroscopy of a small sample of nearby infraredbright and ultraluminous infrared galaxies 'ULIRGs' with the ISO Long Wavelength Spectrometer 1 we find a dramatic progression in ionic/atomic fine-structure emission line and molecular/atomic absorption line characteristics in these galaxies extending from strong [O III]52,88 um and [N III]57 um line emission to detection of only faint [C II]158 um line emission from gas in photodissociation regions in the ULIRGs. The molecular absorption spectra show varying excitation as well, extending from galaxies in which the molecular population mainly occupies the ground state to galaxies in which there is significant population in higher levels. In the case of the prototypical ULIRG, the merger galaxy Arp 220, the spectrum is dominated by absorption lines of OH, H₂O, CH, and [O I]. Low [O III]88 um line flux relative to the integrated far-infrared flux correlates with low excitation and does not appear to be due to far-infrared extinction or to density effects. A progression toward soft radiation fields or very dusty H II regions may explain these effects.

DTIC

Far Infrared Radiation; Galaxies; Spectroscopy

20070035603 Naval Research Lab., Washington, DC USA

On the Generation of the Hubble Sequence Through an Internal Secular Dynamical Process

Zhang, Xiaolei; Jan 2004; 11 pp.; In English

Report No.(s): AD-A470522; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The secular evolution process, which slowly transforms the morphology of a galaxy over its lifetime, could naturally account for observed properties of the great majority of physical galaxies if both stellar and gaseous accretion processes are taken into account. As an emerging paradigm for galaxy evolution, its dynamical foundation had been established in the past few years, and its observational consequences are yet to be fully explored. The secular evolution picture provides a coherent framework for understanding the extraordinary regularity and the systematic variation of galaxy properties along the Hubble sequence.

DTIC

Galaxies; Morphology

20070035612 Naval Research Lab., Washington, DC USA

Secular Evolution of Spiral Galaxies

Zhang, Xiaolei; Jan 2003; 18 pp.; In English

Report No.(s): AD-A470541; No Copyright; Avail.: Defense Technical Information Center (DTIC)

It is now a well established fact that galaxies undergo significant morphological transformation during their lifetimes, manifesting as an evolution along the Hubble sequence from the late to the early Hubble types. The physical processes commonly believed to be responsible for this observed evolution trend, i.e. the major and minor mergers, as well as gas accretion under a barred potential, though demonstrated applicability to selected types of galaxies, on the whole have failed to reproduce the most important static and internal properties of galaxies. The secular evolution mechanism reviewed in this paper has the potential to overcome most of the known difficulties of the existing theories to provide a natural and coherent explanation of the properties of present day as well as high-redshift galaxies.

DTIC

Galactic Evolution; Galaxies; Spiral Galaxies

20070035618 Naval Observatory, Washington, DC USA

Proceedings of the Nautical Almanac Office Sesquicentennial Symposium Held in Washington, The District of Columbia on March 3-4, 1999

Fiala, Alan D; Dick, Steven J; Mar 1999; 417 pp.; In English; Original contains color illustrations
Report No.(s): AD-A470556; No Copyright; Avail.: Defense Technical Information Center (DTIC)

On the occasion of the 150th anniversary of the founding of the USA Nautical Almanac Office, the U. S. Naval Observatory hosted a three-day Symposium and associated activities beginning March 3, 1999. The choice of date was in itself an historical exercise, and March 3, marking the passage of legislation appropriating funds for an American almanac, was the first of several dates that might have been chosen. The Nautical Almanac Office actually came into existence when the funds became available July 1, 1849, and the first Superintendent of the office was appointed July 11. Work commenced still later that year, and the first volume was published in 1852. Still, March 3, when the Congressional appropriation set all these events in motion, it's traditionally observed as our anniversary date. The details of this history can be found within this volume of Proceedings. The Nautical Almanac Office was established as an independent entity, and became part of the older Naval Observatory only a half century later. Part of the rationale for establishing an American office was to remove dependence upon foreign almanacs, especially the British Almanac, and to join the ranks of the few major powers producing almanacs at the time: Britain, France, Germany, and Spain. Somewhat over a century later, the almanac offices of the UK and the USA became equal partners co-producing these major publications. Thus, it was symbolically appropriate that the Symposium and a banquet were held at the British Embassy, next door to the Naval Observatory. Attending the event were representatives from the almanac offices of the UK, France, Spain, and Japan, and greetings were sent from Russia.

DTIC

Astronomy; Conferences; District of Columbia

20070035739 NASA Goddard Space Flight Center, Greenbelt, MD, USA

X-ray Emission from UVLGs and ULXs

Cardiff, Ann Hornschemeier; [2007]; 1 pp.; In English; A Population Explosion: The Nature and Evolution of X-ray Binaries in Diverse Environments, 28 Oct. - 2 Nov. 2007, Saint Petersburg, FL, USA; No Copyright; Avail.: Other Sources; Abstract Only

The first topic covered in this talk will be the study of GALEX-selected Ultraviolet-Luminous Galaxies (UVLGs) which appear to include an interesting subset of galaxies that are analogs to the distant ($3 < z < 4$) Lyman Break Galaxies (LBGs). The 2-10 keV X-ray emission of LBGs appear to be broadly similar to that of galaxies in the local Universe, possibly indicating similarity in the production of accreting binaries over large evolutionary timescales in the Universe. Given the very large distances to the LBGs, we have elected to use the UVLGs as possible local-Universe LBG analogs. This technique is showing promise; we have detected luminous X-ray emission from one UVLG that permits basic X-ray spectroscopic analysis, and have direct X-ray constraints on a total of 6 UVLGs. The second topic for the talk is MIR diagnostics of accretion activity in Ultraluminous X-ray (ULX) sources. We have determined that the Spitzer IRS mid-infrared emission-line flux ratios for ULX sources bear similarity to those for AGN. We discuss strategies for future development of this technique using archival data and/or future observations.

Author

X Ray Sources; Galaxies; X Ray Analysis; Spectroscopic Analysis; Emission; Luminosity; X Rays

20070035741 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Gamma-Ray Emission from X-Ray Binaries

Shrader, Chris R.; [2007]; 2 pp.; In English

Contract(s)/Grant(s): NNG06EO90A; No Copyright; Avail.: CASI: A01, Hardcopy

ONLINE: <http://hdl.handle.net/2060/20070035741>

We summarize the current observational picture regarding high-energy emission from Galactic X-ray binaries, reviewing the results of the Compton Gamma Ray Observatory mission. We speculate on the prospects for the GLAST era.

Author

Gamma Ray Observatory; X Ray Binaries; Gamma Rays; Neutron Stars

20070035742 NASA Goddard Space Flight Center, Greenbelt, MD, USA

The Living with a Star Radiation Belt Storm Probes

Sibeck, D. G.; Mauk, B. H.; Grebowsky, J. M.; Fox, N. J.; March 09, 2007; 3 pp.; In English; LW Geostrom CDAW and Conference, 5-9 Mar. 2007, Melbourne, FL, USA; Copyright; Avail.: Other Sources; Abstract Only

The goal of NASA's Living With a Star Radiation Belt Storm Probe mission is to understand, ideally to the point of

predictability, how populations of relativistic electrons and ions in space form or change in response to the variable inputs of energy from the Sun. The investigations selected for this 2-spacecraft mission scheduled for launch in early 2012 address this task by making extensive observations of the plasma waves, thermal, ring current, and relativistic particle populations, and DC electric and magnetic fields within the Earth's inner and outer radiation belts. We first describe the current mission concept within the scope of NASA's strategic plan and the Vision for Exploration, and then consider how its observations will be used to define and quantify the processes that accelerate, transport, and remove particles in the Earth's radiation belts.

Author

Radiation Belts; Relativistic Particles; High Energy Electrons; Magnetic Fields; Storms; Plasma Waves; Electric Fields; Mission Planning

20070035745 NASA Goddard Space Flight Center, Greenbelt, MD, USA

INTEGRAL Observations of the Pulsar PSR J1846-0258

Sturner, Steve J.; Shrader, C. R.; [2007]; 2 pp.; In English

Contract(s)/Grant(s): NNG06EO90A; Copyright; Avail.: CASI: [A01](#), Hardcopy

We present the results of a study of the high-energy properties of PSR J1846-0258 using INTEGRAL data PSR J1846-0258 has a period of 325 ms and is embedded within a PWN that is associated with the SNR KES 75. This pulsar is unusual for two reasons. First, like Geminga, no radio pulsations have yet been detected from this pulsar. It has thus far been detected exclusively in the X-ray and gamma-ray bands. Second, it has a large inferred magnetic field, approx. 5×10^{13} G. The 20-200 keV spectra derived from 2.35 Msec of INTEGRAL IBIS/ISGRI observations are consistent with an extension of the previous spectral results at energies below 10 keV from Chandra. The possibility of detecting PSR J1846-0258 with GLAST is discussed as well as the implications a GLAST detection would have on pulsar theory, specifically photon splitting in the magnetospheres of high-field pulsars.

Author

Pulsars; Gamma Rays; Magnetic Fields; X Rays; Detection; Unsteady Flow

20070035749 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Alternative Optimizations of X-ray TES Arrays: Soft X-rays, High Count Rates, and Mixed-Pixel Arrays

Kilbourne, C. A.; Bandler, S. R.; Brown, A.-D.; Chervenak, J. A.; Figueroa-Feliciano, E.; Finkbeiner, F. M.; Iyomoto, N.; Kelley, R. L.; Porter, F. S.; Smith, S. J.; [2007]; 1 pp.; In English; 12th International Workshop on Low Temperature Detectors, 22-27 Jul. 2007, Paris, France; No Copyright; Avail.: Other Sources; Abstract Only

We are developing arrays of superconducting transition-edge sensors (TES) for imaging spectroscopy telescopes such as the XMS on Constellation-X. While our primary focus has been on arrays that meet the XMS requirements (of which, foremost, is an energy resolution of 2.5 eV at 6 keV and a bandpass from approx. 0.3 keV to 12 keV), we have also investigated other optimizations that might be used to extend the XMS capabilities. In one of these optimizations, improved resolution below 1 keV is achieved by reducing the heat capacity. Such pixels can be based on our XMS-style TES's with the separate absorbers omitted. These pixels can be added to an array with broadband response either as a separate array or interspersed, depending on other factors that include telescope design and science requirements. In one version of this approach, we have designed and fabricated a composite array of low-energy and broad-band pixels to provide high spectral resolving power over a broader energy bandpass than could be obtained with a single TES design. The array consists of alternating pixels with and without overhanging absorbers. To explore optimizations for higher count rates, we are also optimizing the design and operating temperature of pixels that are coupled to a solid substrate. We will present the performance of these variations and discuss other optimizations that could be used to enhance the XMS or enable other astrophysics experiments.

Author

Optimization; X Ray Astronomy; Sensors; Arrays; Superconductors (Materials); Fabrication; Pixels

20070035850 Commerce Dept., Washington, DC USA

Sundials, Circular of the Bureau of Standards, No. 402

Gould, R E; Mar 27, 1933; 9 pp.; In English; Original contains color illustrations

Report No.(s): AD-A470375; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This circular gives instructions for the construction of a horizontal sundial, with drawings showing the method of laying out the dial. It also gives a table showing the equation of time, some mottos that have been used on sundials, and a

bibliography of books on the subject of sundials. It also provides a short introduction on sundials.

DTIC

Sunlight; Astronomy

20070035864 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

The Cosmological Evolution of Radio Sources with CENSORS

Brookes, Mairi; Best, Philip; Peacock, John; Dunlop, James; Rottgering, Huub; July 31, 2006; 12 pp.; In English; Cosmic Frontiers, 31 Jul. - 4 Aug. 2006, Durham, UK; Original contains color and black and white illustrations; Copyright;

Avail.: Other Sources

ONLINE: <http://hdl.handle.net/2014/40241>

The CENSORS survey, selected from the NVSS, has been followed up using EIS, K-band imaging and spectroscopic observations to produce a radio sample capable of probing the source density in the regime: z greater than 2.5. With a current spectroscopic completeness of 62%, CENSORS has been used in direct modeling of RLF evolution and in V/V(sub max) tests. There is evidence for a shallow decline in number density of source in the luminosity range $10(\text{sup } 26) - 10(\text{sup } 27)\text{WHz}(\text{sup } -1)$ at 1.4GHz.

CASI

Cosmology; Radio Sources (Astronomy); European Southern Observatory; Imaging Techniques; Sky Surveys (Astronomy)

20070035866 Lowell Observatory, Flagstaff, AZ USA

H II Regions in Spiral Galaxies: Size Distribution, Luminosity Function, and New Isochrone Diagnostics of Density-Wave Kinematics

Oey, M S; Parker, Jeffrey S; Mikles, Valerie J; Zhang, Xiaolei; Nov 2003; 14 pp.; In English

Report No.(s): AD-A470548; No Copyright; Avail.: Defense Technical Information Center (DTIC)

We investigate the relationship of the H ii region luminosity function (H ii LF) to the H ii region size distribution and density-wave triggering in grand-design spiral galaxies. We suggest that the differential nebular size distribution is described by a power law approximately of slope 4, with flattening at radii below 130 pc. This contrasts with the conventional exponential description, but it is physically and quantitatively consistent with the typical observed value of 2 for the H ii LF slope. To study H ii LF evolution, we have developed an interactive code that computes spatial isochrones for the evolving loci of spiral density waves in disk galaxies. This allows comparison of the nebular spatial distribution with the spatial isochrones for simple rotation curve parameters. Our comparisons for four grand-design galaxies suggest that the corotation radius r_{co} coincides with the outer ends of the star-forming arms. This value for r_{co} yields the best spatial correspondence between the H ii regions and the isochrones and also appears to yield a coincidence between the inner Lindblad resonance with the radial onset of star formation in the arms. Thus, we suggest that isochrones offer a new, simple, and effective technique for determining r_{co} and thus the spiral pattern speed. However, application of the isochrones also demonstrates that the evolution of the nebular population is difficult to spatially isolate in these galaxies.

DTIC

Diagnosis; Distribution Functions; Galaxies; H II Regions; Kinematics; Luminosity; Size Distribution; Spatial Distribution

20070035890 NASA Dryden Flight Research Center, Edwards, CA, USA

SOFIA - Stratospheric Observatory for Infrared Astronomy

Kunz, Nans; Bowers, Al; September 20, 2007; 57 pp.; In English; AV NCMA Meeting, 20 Sep. 2007, Lancaster, CA, USA; Original contains color and black and white illustrations; No Copyright; Avail.: CASI: A04, Hardcopy

ONLINE: <http://hdl.handle.net/2060/20070035890>

This viewgraph presentation reviews the Stratospheric Observatory for Infrared Astronomy (SOFIA). The contents include: 1) Heritage & History; 2) Level 1 Requirements; 3) Top Level Overview of the Observatory; 4) Development Challenges; and 5) Highlight Photos.

CASI

SOFIA (Airborne Observatory); Histories; General Overviews; Wind Tunnel Tests

20070035896 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Determination of the Far-Infrared Cosmic Background Using COBE/DIRBE and WHAM Data

Odegard, N.; Arendt, R. G.; Dwek, E.; Haffner, L. M.; Hauser, M. G.; Reynolds, R. J.; May 19, 2007; 38 pp.; In English; Original contains black and white illustrations

Contract(s)/Grant(s): NRA-99-01-ADP-137; Copyright; Avail.: CASI: A03, Hardcopy

Determination of the cosmic infrared background (CIB) at far infrared wavelengths using COBE/DIRBE data is limited

by the accuracy to which foreground interplanetary and Galactic dust emission can be modeled and subtracted. Previous determinations of the far infrared CIB (e.g., Hauser et al. 1998) were based on the detection of residual isotropic emission in sky maps from which the emission from interplanetary dust and the neutral interstellar medium were removed. In this paper we use the Wisconsin H(alpha) Mapper (WHAM) Northern Sky Survey as a tracer of the ionized medium to examine the effect of this foreground component on determination of the CIB. We decompose the DIRBE far infrared data for five high Galactic latitude regions into HI- and H(alpha)- correlated components and a residual component. Eased on FUSE H2 absorption line observations, the contribution of a11 H2-correlated component is expected to be negligible. We find the H(alpha)-correlated component to be consistent with zero for each region, and we find that addition of an H(alpha)-correlated component in modeling the foreground emission has negligible effect on derived CIB results. Our CIB detections and 2(sigma) upper limits are essentially the same as those derived by Hauser et al. and are given by $(\nu)I(\text{sub } \nu)(\text{nW/sq m/sr}) < 75, < 32, 25\pm 8, \text{ and } 13\pm 3$ at $\gamma = 60, 100, 140, \text{ and } 240$ microns, respectively. Our residuals have not been subjected to a detailed anisotropy test, so our CIB results do not supersede those of Hauser et al. Mie derive upper limits on the 100 micron emissivity of the ionized medium that are typically about 40% of the 100 micron emissivity of the neutral atomic medium. This low value may be caused in part by a lower dust-to-gas mass ratio in the ionized medium than in the neutral medium, and in part by a shortcoming of using H(alpha) intensity as a tracer of far infrared emission. If H(alpha) is not a reliable tracer, our analysis would underestimate the emissivity of the ionized medium, and both our analysis and the Hauser et al. analysis may slightly overestimate the CIB. We estimate the possible effect for the CIB to be only about 5%, which is much smaller than the quoted uncertainties. From a comparison of the Hauser et al. CIB results with the integrated galaxy brightness from Spitzer source counts, we obtain 2(sigma) upper limits on a possible diffuse CIB component that are 26 nW/sq m/sr at 140 microns and 8.5 nW/sq m/sr at 240 microns.

Author

Background Radiation; Cosmic Background Explorer Satellite; Far Infrared Radiation; Interplanetary Dust; Infrared Radiation; Emissivity; Brightness

20070035936 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Gamma-Ray Pulsar Studies with GLAST

Thompson, David J.; August 12, 2007; 23 pp.; In English; 40 Years of Pulsars, 12-17 Aug. 2007, Montreal, Canada; Original contains color illustrations; No Copyright; Avail.: CASI: [A03](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20070035936>

This viewgraph presentation reviews the prospects of extending the understanding of gamma ray pulsars, and answering the open questions left from the limited observations that are available from current observatories. There are 2 new gamma ray observatories that are either on orbit or will be shortly launched: (1) Astro-rivelatore Gamma a Immagini LEggero (AGILE), and Gamma-ray Large Area Space Telescope (GLAST). On board GLAST there will be two instruments Large Area Telescope (LAT), and GLAST Burst Monitor (GBM).

Author

Gamma Ray Telescopes; Pulsars; Gamma Ray Sources (Astronomy); Gamma Ray Astronomy

20070035958 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Erratum: 'Discovery of a Second Millisecond Accreting Pulsar: XTE J1751-305'

Markwardt, Craig; Swank, J. H.; Strohmayer, T. E.; in 'tZand, J. J. M.; Marshall, F. E.; [2007]; 2 pp.; In English

Contract(s)/Grant(s): NNG06EO90A; Copyright; Avail.: CASI: [A01](#), Hardcopy

The original Table 1 ('Timing Parameters of XTE J1751-305') contains one error. The epoch of pulsar mean longitude 90deg is incorrect due to a numerical conversion error in the preparation of the original table text. A corrected version of Table 1 is shown. For reference, the epoch of the ascending node is also included. The correct value was used in all of the analysis leading up to the paper. As T(sub 90) is a purely fiducial reference time, the scientific conclusions of the paper are unchanged.

Author

Errors; Longitude; Pulsars; Tables (Data); Deposition

20070035963 NASA Dryden Flight Research Center, Edwards, CA, USA

SOFIA: Stratospheric Observatory for Infrared Astronomy

Becker, Eric; Kunz, Nans; Bowers, Al; September 20, 2007; 44 pp.; In English; Original contains color and black and white illustrations; No Copyright; Avail.: CASI: [A03](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20070035963>

This viewgraph presentation reviews the Stratospheric Observatory for Infrared Astronomy (SOFIA). The contents

include: 1) Heritage & History; 2) Level 1 Requirements; 3) Top Level Overview of the Observatory; 4) Development Challenges; and 5) Highlight Photos.

CASI

SOFIA (Airborne Observatory); Histories; General Overviews; Flight Tests; Wind Tunnel Tests

20070035979 Johns Hopkins Univ., Baltimore, MD, USA

An Analysis of Dust Halo and Extinction Toward X Persei

Valencic, Lynne A.; Smith, Randall K.; [2007]; 31 pp.; In English

Contract(s)/Grant(s): NNG04GB78A; No Copyright; Avail.: CASI: [A03](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20070035979>

Interstellar dust grain models are not sufficiently constrained by UV extinction curves to be able to distinguish between them. By testing grain models in the X-ray regime and applying elemental abundance constraints, we show to what extent the models can reproduce the observables in these regimes, and if they are capable of doing so while respecting the abundance limits. We tested the MRN and WD grain models. The fits to the X-ray data do not allow us to distinguish between MRN and WD; both models provide reasonable fits, but cannot do so while respecting the elemental abundance constraints. The situation in the UV regime is similar. Both MRN and WD underestimate the hydrogen column density NH. The model of ZDA provides promising results, as it finds NH much closer to the UV-measured value; further testing of this model is called for.

Author

Cosmic Dust; X Rays; Extinction; O Stars; Halos

20070035985 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

Astrometry at 24 and 43 GHz

Lanyi, Gabor E.; Boboltz, D.; Charlot, P.; Fey, A.; Fomalont, E.; Gordon, D.; Jacobs, C. S.; Ma, C. - C.; Naudet, C. J.; Sovers, O. J.; Zhang, L. D.; August 28, 2003; 10 pp.; In English; Radio Astronomy at 70: from Karl Jansky to Microjansky, Joint European and National Astronomical Meeting (JENAM) Symposium, 27-30 Aug. 2003, Budapest, Hungary; Original contains black and white illustrations; Copyright; Avail.: Other Sources

ONLINE: <http://hdl.handle.net/2014/40461>

We describe the goals and initial results of a collaboration formed to survey extragalactic objects at radio frequencies of 24 and 43 GHz. This survey is for extending the International Celestial Reference Frame (ICRF) that is the current coordinate system for astrometry and which is the angular inertial frame of deep space navigation. In principle, the extension should lead to a more stable reference frame. We report upon our initial three 24-hour observing sessions involving about 100 radio sources at the VLBA.

Author

Astrometry; Sky Surveys (Astronomy); Celestial Reference Systems; Radio Astronomy

20070036001 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

The Lunar L1 Gateway: Portal to the Stars and Beyond

Lo, Martin; Ross, Shane; August 28, 2001; 9 pp.; In English; AIAA Space 2001 Conference and Exposition, 28-30 Aug. 2001, Albuquerque, NM, USA; Original contains color illustrations; Copyright; Avail.: Other Sources

ONLINE: <http://hdl.handle.net/2014/40516>

Our Solar System is interconnected by a vast system of winding tunnels generated by the Lagrange Points of all the planets and their moons. These passageways are identified by portals around L1 and L2, the halo orbits. By passing through a halo orbit portal, one enters the ancient and colossal labyrinth of the Sun. This natural Interplanetary Superhighway System (IPS) provides ultra-low energy transport throughout the Earth's Neighborhood, the region between Earth's L1 and L2. This is enabled by an accident: the current energy levels of the Earth L1 and L2 Lagrange points differ from that of the Earth-Moon by only about 50 m/s (as measured by AV). The significance of this happy coincidence to the development of space cannot be overstated. For example, this implies that Lunar L1 halo orbits are connected to halo orbits around Earth's L1 or L2 via low energy pathways...

Author

Solar System; Energy Levels; Passageways; Halos; Labyrinth; Energy Transfer

20070036309 NASA Goddard Space Flight Center, Greenbelt, MD, USA

X-Ray, UV, and Optical Observations of Supernova 2006bp with Swift: Detection of Early X-Ray Emission

Immler, S.; Brown, P. J.; Milne, P.; Dessart, L.; Mazzali, P. A.; Landsman, W.; Gehrels, N.; Petre, R.; Burrows, D. N.; Nousek, J. A.; Chevalier, R. A.; Williams, C. L.; Koss, M.; Stockdale, C. J.; Kelley, M. T.; Weiler, K. W.; Holland, S. T.; Pian, E.; Roming, P. W. A.; Pooley, D.; Nomoto, K.; Greiner, J.; Campana, S.; Soderberg, A. M.; [2007]; 22 pp.; In English; Original contains black and white illustrations

Contract(s)/Grant(s): NAS5-00136; HST-GO-10182.75-A; PF4-50035; NSF AST-03-07366; DE-FC02-01ER41184; NSF AST-05-04947; Copyright; Avail.: CASI: [A03](#), Hardcopy

We present results on the X-ray and optical/UV emission from the Type IIP supernova (SN) 2006bp and the interaction of the SW shock with its environment, obtained with the X-Ray Telescope (XRT) and UV/Optical Telescope (UVOT) on-board the Swift observatory. SN 2006bp is detected in X-rays at a 4.5 sigma level of significance in the merged XRT data from days 1 to 12 after the explosion. If the (0.2-10 keV band) X-ray luminosity of $L_{(0.2-10)} = (1.8 \pm 0.4) \times 10^{39}$ ergs s⁻¹ is caused by interaction of the SN shock with circumstellar material (CSM), deposited by a stellar wind from the progenitor's companion star, a mass-loss rate of \dot{M} is approximately 2×10^{-6} solar mass yr⁻¹ ($v_{\text{sw}}/10 \text{ km s}^{-1}$) is inferred. The mass-loss rate is one of the lowest ever recorded for a core-collapse SN and consistent with the non-detection in the radio with the VLA on days 2, 9, and 11 after the explosion. The Swift data further show a fading of the X-ray emission starting around day 12 after the explosion. In combination with a follow-up XMM-Newton observation obtained on day 21 after the explosion, an X-ray rate of decline L_x , varies as t^{-n} with index $n = 1.2 \pm 0.6$ is inferred. Since no other SN has been detected in X-rays prior to the optical peak and since Type IIP SNe have an extended 'plateau' phase in the optical, we discuss the scenario that the X-rays might be due to inverse Compton scattering of photospheric optical photons off relativistic electrons produced in circumstellar shocks. However, due to the high required value of the Lorentz factor (approximately 10-100), inconsistent with the ejecta velocity inferred from optical line widths, we conclude that Inverse Compton scattering is an unlikely explanation for the observed X-ray emission. The fast evolution of the optical/ultraviolet (1900-5500Å) spectral energy distribution and the spectral changes observed with Swift reveal the onset of metal line-blanketing and cooling of the expanding photosphere during the first few weeks after the outburst.

Author

Supernovae; X Rays; Ultraviolet Radiation; Ultraviolet Telescopes; X Ray Telescopes; Electron Scattering

20070036460 Naval Observatory, Washington, DC USA

A Survey of Stellar Families: Multiplicity Among Solar-Type Stars

Raghavan, Deepak; McAlister, H A; Henry, T J; Mason, B D; Jan 2006; 5 pp.; In English

Report No.(s): AD-A471049; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Stellar multiplicity is a fundamental astrophysical property. In addition to being the only physical basis for accurate mass determination, this parameter is believed to influence important aspects such as planet formation and stability. Contrary to earlier expectations, recent studies have shown that even against selection biases, as many as 23% of the planetary systems reside in multiple star systems (Raghavan et al. 2006). Leveraging recent efforts in identifying stellar and substellar companions to solar-type stars, and augmenting them with targeted observations, we are conducting a comprehensive survey, aimed at providing a modern update to the seminal work of Duquennoy & Mayor (1991). The details of our sample, survey methods, and some preliminary results are presented here.

DTIC

Astronomical Observatories; Binary Stars; G Stars; Main Sequence Stars; Stars; Surveys

20070036462 Naval Observatory, Washington, DC USA

The Serret-Andoyer Formalism in Rigid-Body Dynamics: 1. Symmetries and Perturbations

Gurfil, P; Elipe, A; Tangren, W; Efroimsky, M; Jan 2007; 38 pp.; In English

Report No.(s): AD-A471055; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This paper reviews the Serret-Andoyer (SA) canonical formalism in rigid-body dynamics, and presents some new results. As is well known, the problem of unsupported and unperturbed rigid rotator can be reduced. The availability of this reduction is offered by the underlying symmetry, that stems from conservation of the angular momentum and rotational kinetic energy. When a perturbation is turned on, these quantities are no longer preserved. Nonetheless, the language of reduced description remains extremely instrumental even in the perturbed case. We describe the canonical reduction performed by the Serret-Andoyer (SA) method, and discuss its applications to attitude dynamics and to the theory of planetary rotation. Specifically, we consider the case of angular-velocity-dependent torques, and discuss the variation-of-parameters-inherent antinomy

between canonicity and osculation. Finally, we address the transformation of the Andoyer variables into action-angle ones, using the method of Sadov.

DTIC

Formalism; Perturbation; Rigid Structures; Symmetry

20070036629 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Two Suzaku Observations of the Cyclotron Line Source 4U 1907+09

Pottschmidt, Katja; [2008]; 1 pp.; In English; AAS 211th Meeting, 11 Jan. 2008, Austin, TX, USA; Copyright; Avail.: Other Sources; Abstract Only

Suzaku observed the accreting pulsar 4U 1907+09 in May 2006 and in April 2007. We present and compare the light curves and broad band spectra of both observations. The approximately 10 mCrab source is strongly variable and shows a rich phenomenology. While the 2006 observation is dominated by typical, non-absorption-related dipping behavior, the 2007 observation shows equally typical flaring behavior in both the XIS and PIN light curves. Above 2 keV the average combined XIS and PIN broad band spectrum can be well described by standard pulsar continuum models, modified by the fundamental cyclotron resonant scattering feature at approximately 19 keV. We model the cyclotron line using the standard phenomenological Gaussian model as well as a new physically motivated Green's functions based approach (Schoenherr et al., 2007, A&A 472, 353). Below 2 keV the XIS spectra allow for the first detection of a soft excess in this source, in addition to providing the best determination of the parameters of the weak iron line at 6.4 keV (EW approximately 70 eV) to date.

Author

Cyclotrons; Pulsars; Phenomenology; Light Curve; Stellar Models

20070036659 NASA Goddard Space Flight Center, Greenbelt, MD, USA

The Suzaku Observation of NGC 3516: Complex Absorption and the Broad and Narrow Fe K Lines

Markowitz, Alex; Reeves, James N.; Miniutti, Giovanni; Serlemitsos, Peter; Kunieda, Hideyo; Taqoob, Tahir; Fabian, Andrew C.; Fukazawa, Yasushi; Mushotzky, Richard; Okajima, Takashi; Gallo, Luigi; Awaki, Hisamitsu; Griffiths, Richard E.; [2007]; 29 pp.; In English; Original contains black and white illustrations; Copyright; Avail.: CASI: [A03](#), Hardcopy

We present results from a 150 ksec Suzaku observation of the Seyfert 1 NGC 3516 in October 2005. The source was in a relatively highly absorbed state. Our best-fit model is consistent with partial covering by a lowly-ionized absorber with a column density near $5 \times 10^{22} \text{ cm}^{-2}$ and with a covering fraction 96-100 percent. Narrow K-shell absorption features due to He- and H-like Fe confirm the presence of a high-ionization absorbing component as well. A broad Fe K(alpha) diskline is required in all fits, even after the complex absorption is taken into account; an additional partial-covering component is an inadequate substitute for the continuum curvature associated with the broad line. The narrow Fe Ka line at 6.4 keV is resolved, yielding a velocity width commensurate with the optical Broad Line Region. The strength of the Compton reflection hump suggests a contribution mainly from the broad Fe line origin. We include in our model soft band emission lines from He- and H-like ions and radiative recombination lines, consistent with photo-ionization, though a small contribution from collisional ionization is possible.

Author

Seyfert Galaxies; Emission Spectra; K Lines; Astronomical Observatories

20070036664 NASA Marshall Space Flight Center, Huntsville, AL, USA

The Chandra X-Ray Observatory: An Overview of Its Success

Weisskopf, Martin C.; September 18, 2007; 50 pp.; In English; AIAA Conference 'Space 2007', 17-19 Sep. 2007, Long Beach, CA, USA; Original contains color and black and white illustrations; No Copyright; Avail.: CASI: [A03](#), Hardcopy
ONLINE: <http://hdl.handle.net/2060/20070036664>

The Chandra X-Ray Observatory was designed for three years of operation with a goal of five. Launched on July 23, 1999 this Great Observatory is now beginning its 8th year of operation, The Observatory is an outstanding example of one of NASA's technical and scientific success stories. The reasons for that success will be reviewed and some of the outstanding scientific discoveries will be presented.

Author

X Ray Astrophysics Facility; X Rays; Observatories

20070036668 NASA Marshall Space Flight Center, Huntsville, AL, USA

Science Enabled by the Ares V: A Large Monolithic Telescope Placed at the Second Sun-Earth Lagrange Point

Hopkins, Randall C.; Stahl, H. Philip; September 18, 2007; 6 pp.; In English; 2007 Space Conference and Exhibit, 18-20 Sep. 2007, Long Beach, CA, USA; Original contains color and black and white illustrations; No Copyright; Avail.: CASI: [A02](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20070036668>

The payload mass and volume capabilities of the planned Ares V launch vehicle provide the science community with unprecedented opportunities to place large science payloads into low earth orbit and beyond. One example, the outcome of a recent study conducted at the NASA Marshall Space Flight Center, is a large, monolithic telescope with a primary mirror diameter of 6.2 meters placed into a halo orbit about the second Sun-Earth Lagrange point, or L2, approximately 1.5 million km beyond Earth's orbit. Operating in the visible and ultraviolet regions of the electromagnetic spectrum, such a large telescope would allow astronomers to detect bio-signatures and characterize the atmospheres of transiting exoplanets, provide high resolution imaging three or more times better than the Hubble Space Telescope and the James Webb Space Telescope, and observe the ultraviolet light from warm baryonic matter.

Author

Ares 5 Cargo Launch Vehicle; Payloads; Low Earth Orbits; Telescopes; Imaging Techniques

20070036730 Liege Univ., Belgium; NASA Goddard Space Flight Center, Greenbelt, MD, USA

First Detection of Phase-dependent Colliding Wind X-ray Emission outside the Milky Way

Naze, Yael; Koenigsberger, Gloria; Moffat, Anthony F. J.; [2007]; 7 pp.; In English

Contract(s)/Grant(s): DGAPA/PAPIIT IN 119205; NNG06EO90A; Copyright; Avail.: CASI: [A02](#), Hardcopy

After having reported the detection of X-rays emitted by the peculiar system HD 5980, we assess here the origin of this high-energy emission from additional X-ray observations obtained with XMM-Newton. This research provides the first detection of apparently periodic X-ray emission from hot gas produced by the collision of winds in an evolved massive binary outside the Milky Way. It also provides the first X-ray monitoring of a Luminous Blue Variable only years after its eruption and shows that the source of the X-rays is not associated with the ejecta.

Author

Milky Way Galaxy; Detection; Emission; X Ray Binaries

20070036732 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Absorber Materials for Transition-Edge Sensor X-ray Microcalorimeters

Brown, Ari-David; Bandler, Simon; Brekosky, Regis; Chervenak, James; Figueroa-Feliciano, Enectali; Finkbeiner, Fred; Sadleir, Jack; Iyomoto, Naoko; Kelley, Richard; Kilbourne, Caroline; Porter, F. Scott; Smith, Stephen; Saab, Tarek; Sadleir, Jac.; [2007]; 2 pp.; In English; 12th International Workshop on Low Temperature Detectors, 22-27 Jul. 2007, Paris, France; Original contains black and white illustrations; No Copyright; Avail.: CASI: [A01](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20070036732>

Arrays of superconducting transition-edge sensors (TES) can provide high spatial and energy resolution necessary for x-ray astronomy. High quantum efficiency and uniformity of response can be achieved with a suitable absorber material, in which absorber x-ray stopping power, heat capacity, and thermal conductivity are relevant parameters. Here we compare these parameters for bismuth and gold. We have fabricated electroplated gold, electroplated gold/electroplated bismuth, and evaporated gold/evaporated bismuth 8x8 absorber arrays and find that a correlation exists between the residual resistance ratio (RRR) and thin film microstructure. This finding indicates that we can tailor absorber material conductivity via microstructure alteration, so as to permit absorber thermalization on timescales suitable for high energy resolution x-ray microcalorimetry. We show that by incorporating absorbers possessing large grain size, including electroplated gold and electroplated gold/electroplated bismuth, into our current Mo/Au TES, devices with tunable heat capacity and energy resolution of 2.3 eV (gold) and 2.1 eV (gold/bismuth) FWHM at 6 keV have been fabricated.

Author

Absorbers (Materials); Calorimeters; Sensors; Fabrication; X Ray Astronomy

20070036791 American Inst. of Aeronautics and Astronautics, Reston, VA, USA

Searching Out Cosmic Disaster and Opportunity

Jones, Thomas D.; Aerospace American; August 2007; ISSN 0740-722X; Volume 45, No. 8, pp. 18-20; In English; Original contains black and white illustrations; Copyright; Avail.: Other Sources

This article calls for enhancing NASA's search for Near Earth Objects that could possibly impact Earth. While most

objects break up when they enter the Earth's atmosphere, the powerful explosion, even from those that explode in the atmosphere, can cause massive damage. The article reviews some of the asteroids and other objects that have or will come into close proximity of Earth and have the potential to cause massive damage on impact. The NASA supported, Spaceguard survey has found roughly 4,680 NEAs. Of that number, 715 were larger than 1 km in diameter. Adding short-period comets in Earth-approaching orbits brings the total of known NEOs to 4,744. The total rises each month as discoveries continue.

CASI

Near Earth Objects; Surveys; Micrometeorites; Impact Damage

90

ASTROPHYSICS

Includes cosmology; celestial mechanics; space plasmas; and interstellar and interplanetary gases and dust.

20070035102 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Swift and GLAST Cooperative Efforts

Thompson, D. J.; April 30, 2007; 1 pp.; In English; No Copyright; Avail.: Other Sources; Abstract Only

Because gamma-ray astrophysics depends in many ways on multiwavelength studies, the Gamma-ray Large Area Space Telescope (GLAST) instrument teams are eagerly anticipating coordinated observations with the Swift observatory. Swift and GLAST combined cover most of twelve orders of magnitude in the electromagnetic spectrum, offering numerous opportunities for cooperation. Three of the high-priority interests are: (1) gamma-ray burst studies; (2) broad-spectrum studies of blazars in both quiescent and flaring states; and (3) identification and detailed study of unidentified gamma-ray sources.

Author

Gamma Ray Bursts; Electromagnetic Spectra; Swift Observatory; Blazars; Astrophysics; Gamma Rays

20070035106 NASA Goddard Space Flight Center, Greenbelt, MD, USA

X-Raying the MOJAVE Sample of Compact Extragalactic Radio Jets

Kadler, M.; Sato, G.; Tueller, J.; Sambruna, R. M.; Markwardt, C. B.; Giommi, P.; Gehrels, N.; [2007]; 3 pp.; In English; The First GLAST Symposium, 2-5 Feb. 2007, Stanford, CA, USA; Copyright; Avail.: CASI: [A01](#), Hardcopy

The MOJAVE sample is the first large radio-selected, VLBI-monitored AGN sample for which complete X-ray spectral information is being gathered. We report on the status of Swift survey observations which complement the available archival X-ray data at 0.3-10 keV and in the UV with its XRT and UVOT instruments. Many of these 133 radio-brightest AGN in the northern sky are now being observed for the first time at these energies. These and complementary other multiwavelength observations provide a large statistical sample of radio-selected AGN whose spectral energy distributions we measured from radio to gamma-ray wavelengths, available at the beginning of GLAST operations in 2008. Here, we report the X-ray spectral characteristics of 36 of these previously unobserved MOJAVE sources. In addition, the number of MOJAVE sources detected by the BAT instrument in the hard X-ray band is growing; we report the detection of five new blazars with BAT.

Author

Radio Jets (Astronomy); Very Long Base Interferometry; Spectral Energy Distribution; Gamma Rays; Blazars; X Rays

20070035129 NASA Goddard Space Flight Center, Greenbelt, MD, USA

The EPIC-MOS Particle-Induced Background Spectra

Kuntz, K. D.; Sowden, S. L.; Astronomy and Astrophysics; April 19, 2007; 24 pp.; In English; Original contains black and white illustrations; Copyright; Avail.: Other Sources

In order to analyse diffuse emission that fills the field of view, one must accurately characterize the instrumental backgrounds. For the XMM-Newton EPIC instrument these backgrounds include a temporally variable 'quiescent' component, as well as the strongly variable soft proton contamination. We have characterized the spectral and spatial response of the EPIC detectors to these background components and have developed tools to remove these backgrounds from observations. The 'quiescent' component was characterized using a combination of the filter-wheel-closed data and a database of unexposed-region data. The soft proton contamination was characterized by differencing images and spectra taken during flared and flare-free intervals. After application of our modeled backgrounds, the differences between independent observations of the same region of 'blank sky' are consistent with the statistical uncertainties except when there is clear spectral evidence of solar wind charge exchange emission. Using a large sample of blank sky data, we show that strong magnetospheric SWCX emission requires elevated solar wind fluxes; observations through the densest part of the

magnetosheath are not necessarily strongly contaminated with SWCX emission.

Author

Spectral Sensitivity; Field of View; Contamination; Exposure; Magnetosheath; Protons; Charge Exchange

20070035738 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Eta Carinae: At the Crossroads of becoming a Supernova

Gull, Theodore; September 14, 2007; 1 pp.; In English; No Copyright; Avail.: Other Sources; Abstract Only

Since the 1840's, when Eta Carinae's visual magnitude rivaled Sirius, the brightest star in the night sky, astronomers have wondered what major event took place. Today with the Hubble Space Telescope Imaging Spectrograph, with CHANDRA X-ray spectroscopy and the Very Large Telescope spectrographs and interferometers, we have learned that over 12 solar masses of material was ejected at 500 to 700 km/s into interstellar space. This ejecta is quite different from the normal interstellar medium. It is rich in nitrogen, poor in oxygen and carbon. The dust properties are quite peculiar and many metals such as vanadium, strontium, cadmium are seen in both absorption against the central source, plus a number of molecules. The chemical and dust formation is likely dominated by nitrogen as we see H₂, CH, CH⁺, OH, NH, HCl and NH₃, but no CO. Other metals and molecules are being searched out in the FUSE, HST/STIS, VLT/UVES and VLT/CRIRES spectra. I will describe what we know about the massive binary stellar system, how it changes every 5.54 year in UV and X-ray output and how the massive ejecta responds in this astrophysical laboratory.

Author

X Ray Spectroscopy; Supernovae; Stellar Systems; Interstellar Space; Interstellar Matter; Astrophysics; Imaging Techniques; Molecules

20070035780 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Gravitational Waves: Elusive Cosmic Messengers

Centrella, Joan; [2007]; 1 pp.; In English; No Copyright; Avail.: Other Sources; Abstract Only

The final merger of two black holes is expected to be the strongest gravitational wave source for ground-based interferometers such as LIGO, VIRGO, and GEO600, as well as the space-based interferometer LISA. Observing these sources with gravitational wave detectors requires that we know the radiation waveforms they emit. Since these mergers take place in regions of extreme gravity, we need to solve Einstein's equations of general relativity on a computer in order to calculate these waveforms. For more than 30 years, scientists have tried to compute black hole mergers using the methods of numerical relativity. The resulting computer codes have been plagued by instabilities, causing them to crash well before the black holes in the binary could complete even a single orbit. Within the past few years, however, this situation has changed dramatically, with a series of remarkable breakthroughs. This talk will focus on new simulations that are revealing the dynamics and waveforms of binary black hole mergers, and their applications in gravitational wave detection, data analysis, and astrophysics.

Author

Astrophysics; Black Holes (Astronomy); Gravitational Waves; Waveforms; Binary Stars; Gravity Waves; Spaceborne Astronomy; Relativistic Effects

20070035785 Naval Research Lab., Washington, DC USA

The Potential-Density Phase-Shift Method for Determining the Corotation Radii in Spiral and Barred Galaxies

Zhang, Xiaolei; Buta, Ronald J; Jun 2007; 25 pp.; In English

Contract(s)/Grant(s): NSF AST-05-07140; NSF AST-92-17716; NSF AST-96-17006

Report No.(s): AD-A470395; No Copyright; Avail.: Defense Technical Information Center (DTIC)

We have developed a new method for determining the corotation radii of density waves in disk galaxies, which makes use of the calculated radial distribution of an azimuthal phase shift between the potential and density wave patterns. The approach originated from improved theoretical understanding of the relation between the morphology and kinematics of galaxies and of the dynamical interaction between density waves and the basic-state disk stars, which results in the secular evolution of disk galaxies. We present the rationales behind the method and the 1st application of it to several representative barred and grand-design spiral galaxies, using near-infrared images to trace the mass distributions and to calculate the potential distributions used in the phase-shift calculations. We compare our results with those from other existing methods and show that the new method both confirms the previously established trends of bar-length dependence on galaxy morphological types and provides new insights into the possible extent of bars in disk galaxies. The method also facilitates the estimation of mass accretion /excretion rates due to bar and spiral density waves, providing an alternative way of quantifying the importance of

these features in disk galaxies. A preliminary analysis of a larger sample shows that the phase-shift method is likely to be a generally applicable, accurate, and essentially model-independent method for determining the pattern speeds and corotation radii of single or nested density wave patterns in galaxies. Other implications of the results of this work include that most of the nearby bright disk galaxies appear to possess quasi-stationary spiral modes; that these density wave modes, as well as the associated basic states of the galactic disks, slowly transform over the time span of a Hubble time due to a collective dissipation process directly related to the presence of the phase shift between the potential and density patterns.

DTIC

Barred Galaxies; Corotation; Galaxies; Phase Shift; Radii; Spiral Galaxies

20070035920 NASA Goddard Space Flight Center, Greenbelt, MD, USA

The UDF05 Follow-up of the HUDF: I. The Faint-End Slope of the Lyman-Break Galaxy Population at zeta approx. 5

Oesch, P. A.; Stiavelli, M.; Carollo, C. M.; Bergeron, L. E.; Koekemoer, A.; Lucas, R. A.; Pavlovsky, C. M.; Trenti, M.; Lilly, S. J.; Beckwith, S. V. W.; Dahlen, T.; Ferguson, H. C.; Gardner, J. P.; Lacey, C.; Mobasher, B.; Panagia, N.; Rix, H.-W.; [2007]; 44 pp.; In English

Contract(s)/Grant(s): NAS5-26555; Copyright; Avail.: CASI: **A03**, Hardcopy

We present the UDF05 project, a HST Large Program of deep ACS (F606W, F775W, F850LP, and NICMOS (F110W, F160W) imaging of three fields, two of which coincide with the NICP1-4 NICMOS parallel observations of the Hubble Ultra Deep Field (HUDF). In this first paper we use the ACS data for the NICP12 field, as well as the original HUDF ACS data, to measure the UV Luminosity Function (LF) of z approximately 5 Lyman Break Galaxies (LBGs) down to very faint levels. Specifically, based on a V - i, i - z selection criterion, we identify a sample of 101 and 133 candidate z approximately 5 galaxies down to z(sub 850) = 28.5 and 29.25 magnitudes in the NICP12 field and in the HUDF, respectively. Using an extensive set of Monte Carlo simulations we derive corrections for observational biases and selection effects, and construct the rest-frame 1400 Angstroms LBG LF over the range M(sub 1400) = [-22.2, -17.1], i.e. down to approximately 0.04 L(sub *) at z = 5. We show that: (i) Different assumptions for the SED distribution of the LBG population, dust properties and intergalactic absorption result in a 25% variation in the number density of LBGs at z = 5 (ii) Under consistent assumptions for dust properties and intergalactic absorption, the HUDF is about 30% under-dense in z = 5 LBGs relative to the NICP12 field, a variation which is well explained by cosmic variance; (iii) The faint-end slope of the LF is independent of the specific assumptions for the input physical parameters, and has a value of alpha approximately -1.6, similar to the faint-end slope of the LF that has been measured for LBGs at z = 3 and z = 6. Our study therefore supports no variation in the faint-end of the LBG LF over the whole redshift range z = 3 to z = 6. The comparison with theoretical predictions suggests that (a,) the majority of the stars in the z = 5 LBG population are produced with a Top-Heavy IMF in merger-driven starbursts, and that (b) possibly, either the fraction of stellar mass produced in starburst, or the fraction of high mass stars in the bursts is increased towards the bright end of the LF.

Author

Galactic Evolution; Hubble Space Telescope; Lyman Spectra; Populations; Red Shift; Starburst Galaxies

20070036123 Naval Research Lab., Washington, DC USA

Atmospheric Effects of the Total Solar Eclipse of 4 December 2002 Simulated with a High-Altitude Global Model

Eckermann, S D; Broutman, D; Stollberg, M T; Ma, J; McCormack, J P; Hogan, T F; Jul 25, 2007; 23 pp.; In English

Contract(s)/Grant(s): ATM-0435789; ATM-0448888

Report No.(s): AD-A470678; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA470678>

The atmosphere's response to the total solar eclipse of 4 December 2002 is studied using a prototype high-altitude global numerical weather prediction model (NOGAPS-ALPHA). Local reductions in solar ultraviolet (UV) radiation during the eclipse are estimated using astronomical calculations of umbral and penumbral surface trajectories and observed solar limb darkening at ~ 200-300 nm. In NOGAPS-ALPHA these UV eclipse shadows yield stratospheric radiative cooling rate footprints peaking near 27 K day⁻¹, a value 2-3 times larger than assumed in previous modeling. Difference fields between NOGAPS-ALPHA runs with and without this eclipse forcing reveal vertically deep middle atmospheric responses, with three-dimensional horizontal structures very similar to the large-scale bow-wave response first proposed by Chimonas (1970). Such structure appears clearly only at later times when total eclipses have abated and gravity waves generated in the stratosphere have had time to propagate vertically. Bow-wave amplitudes and direct thermal cooling responses are both small (1 K for temperature and 2-3 m s⁻¹ for horizontal winds), contradicting some rocketsonde measurements that suggest much larger responses near 50-60 km altitude. We also find clear evidence of a bow-wave-like response in the model's surface

pressure fields, with an amplitude 0.1 0.5 hPa, while surface air temperatures in NOGAPS-ALPHA show 4 K cooling over Africa during the eclipse. Both findings are consistent with surface atmospheric data acquired during previous eclipse passages.

DTIC

Atmospheric Effects; Atmospheric Temperature; High Altitude; Solar Eclipses; Solar Radiation; Stratosphere; Ultraviolet Radiation

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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*.

20070035070 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.; November 2007; 26 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

Report No.(s): NASA/TM-2007-214426; AIAA Paper 2006-4036; E-15703; 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

Lunar Environment; Radioisotope Heat Sources; Stirling Cycle; Lunar Surface

20070035079 NASA Glenn Research Center, Cleveland, OH, USA

Propulsion Health Management System Development for Affordable and Reliable Operation of Space Exploration Systems

Melcher, Kevin J.; Maul, William A.; Garg, Sanjay; October 2007; 19 pp.; In English; AIAA SPACE 2007 Conference and Exhibit, 18-20 Sep. 2007, Long Beach, CA, USA; Original contains color illustrations

Contract(s)/Grant(s): WBS 136905.08.05.07.01.03

Report No.(s): NASA/TM-2007-215034; AIAA Paper 2007-6237; E-16214; Copyright; Avail.: CASI: [A03](#), Hardcopy

The constraints of future Exploration Missions will require unique integrated system health management capabilities throughout the mission. An ambitious launch schedule, human-rating requirements, long quiescent periods, limited human access for repair or replacement, and long communication delays, all require an integrated approach to health management that can span distinct, yet interdependent vehicle subsystems, anticipate failure states, provide autonomous remediation and support the Exploration Mission from beginning to end. Propulsion is a critical part of any space exploration mission, and monitoring the health of the propulsion system is an integral part of assuring mission safety and success. Health management is a somewhat ubiquitous technology that encompasses a large spectrum of physical components and logical processes. For this reason, it is essential to develop a systematic plan for propulsion health management system development. This paper provides a high-level perspective of propulsion health management systems, and describes a logical approach for the future planning and early development that are crucial to planned space exploration programs. It also presents an overall approach,

or roadmap, for propulsion health management system development and a discussion of the associated roadblocks and challenges.

Author

Space Exploration; Systems Health Monitoring; Reliability Analysis; Propulsion System Performance; Systems Engineering

20070035094 American Inst. of Aeronautics and Astronautics, Reston, VA, USA

Homesteading the Moon

Jones, Thomas D.; Aerospace America; April 2007; Volume 45, no. 4, pp. 12-15; In English; Original contains color illustrations; Copyright; Avail.: Other Sources

This article examines the challenges and the planning to fulfilling the goal of building a settlement on the Moon. It outlines NASA's proposal to establish a lunar outpost, that is believed to be preferable to a series of short term visits.

CASI

Lunar Bases; Moon; Lunar Environment; Lunar Landing Sites; Lunar Exploration; In Situ Resource Utilization; Lunar Resources

20070035110 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

On Target to Mars

Cheng, Yang; February 7, 2007; 58 pp.; In English; Research Seminar to University of Washington Bothell, 7 Feb. 2007, Bothell, WA, USA; Original contains color and black and white illustrations; Copyright; Avail.: Other Sources

ONLINE: <http://hdl.handle.net/2014/40331>

This viewgraph presentation reviews the use of Descent Image Motion Estimation System (DIMES) for the descent of a spacecraft onto the surface of Mars. In the past this system was used to assist in the landing of the MER spacecraft. The overall algorithm is reviewed, and views of the hardware, and views from Spirit's descent are shown. On Spirit, had DIMES not been used, the impact velocity would have been at the limit of the airbag capability and Spirit may have bounced into Endurance Crater. By using DIMES, the velocity was reduced to well within the bounds of the airbag performance and Spirit arrived safely at Mars. Views from Opportunity's descent are also shown. The system to avoid and detect hazards is reviewed next. Landmark Based Spacecraft Pinpoint Landing is also reviewed. A cartoon version of a pinpoint landing and the various points is shown. Mars's surface has a large amount of craters, which are ideal landmarks. According to literatures on Martian cratering, 60 % of Martian surface is heavily cratered. The ideal (craters) landmarks for pinpoint landing will be between 1000 to 50 meters in diameter. The ideal altitude for position estimation should be greater than 2 km above the ground. The algorithms used to detect and match craters are reviewed.

CASI

Algorithms; Descent; Landmarks; Mars Surface; Mars Landing; Mars Landing Sites

20070035112 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

Mars Exploration Program and Mars Technology Program

Whetsel, Charles W.; May 5, 2002; 25 pp.; In English; The First Agenzia Spaziale Italiana (ASI) International Workshop on Futuristic Space Technologies, 5-7 Oct. 2002, Trieste, Italy; Original contains color illustrations; Copyright; Avail.: Other Sources

ONLINE: <http://hdl.handle.net/2014/40400>

The Mars Exploration Program and constituent Mars Technology Program are described. Current, ongoing and future NASA-led missions are presented, including discussions of scientific accomplishments and objectives as well as technology validations accomplished and technological enablers for future missions. The missions summarized include (in order of actual or planned launch): Mars Global Surveyor, Mars Pathfinder, 2001 Mars Odyssey, Mars Reconnaissance Orbiter, Mars 'Smart' Lander, Mars Scouts, Mars Sample Return. Key technology areas discussed include: Navigation, Entry, Descent and Landing, Science and Surface Operations, Orbital Transport and Sample Return Technologies.

Author

Mars Exploration; Mars Sample Return Missions; NASA Programs; 2001 Mars Odyssey; Mars Reconnaissance Orbiter; Mars Pathfinder; Mars Global Surveyor

20070035736 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Stationkeeping for the Lunar Reconnaissance Orbiter (LRO)

Beckman, Mark; Lamb, Rivers; January 2007; 15 pp.; In English; 20th International Symposium on Space Flight Dynamics, 24-28 Sep. 2007, Annapolis, MD, USA; Original contains black and white illustrations; No Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: <http://hdl.handle.net/2060/20070035736>

The Lunar Reconnaissance Orbiter (LRO) is scheduled to launch in 2008 as the first mission under NASA's Vision for Space Exploration. Following several weeks in a quasi-frozen commissioning orbit, LRO will fly in a 50 km mean altitude lunar polar orbit. During the one year mission duration, the orbital dynamics of a low lunar orbit force LRO to perform periodic sets of stationkeeping maneuvers. This paper explores the characteristics of low lunar orbits and explains how the LRO stationkeeping plan is designed to accommodate the dynamics in such an orbit. The stationkeeping algorithm used for LRO must meet five mission constraints. These five constraints are to maintain ground station contact during maneuvers, to control the altitude variation of the orbit, to distribute periselene equally between northern and southern hemispheres, to match eccentricity at the beginning and the end of the sidereal period, and to minimize stationkeeping (ΔV). This paper addresses how the maneuver plan for LRO is designed to meet all of the above constraints.

Author

Space Exploration; Reconnaissance; Polar Orbits; Mission Planning; Stationkeeping; Lunar Orbiter

20070035965 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

Lessons Learned from Coordinating Relay Activities at Mars

Gladden, Roy E.; Hwang, Pauline; Waggoner, Bruce; McLaughlin, Bruce; Fieseler, Paul; Thomas, Reid; Bigwood, Maria; Herrera, Paul; March 5, 2005; 14 pp.; In English; IEEE Aerospace Conference, 5-12 Mar. 2005, Big Sky, MT, USA; Original contains black and white illustrations; Copyright; Avail.: Other Sources

ONLINE: <http://hdl.handle.net/2014/40534>

The Mission Management Office at the Jet Propulsion Laboratory was tasked with coordinating the relay of data between multiple spacecraft at Mars in support of the Mars Exploration Rover Missions in early 2004. The confluence of three orbiters (Mars Global Surveyor, Mars Odyssey, and Mars Express), two rovers (Spirit and Opportunity), and one lander (Beagle 2) has provided a challenging operational scenario that required careful coordination between missions to provide the necessary support and to avoid potential interference during simultaneous relay sessions. As these coordination efforts progressed, several important lessons were learned that should be applied to future Mars relay activities.

Author

Mars Missions; Mars Sample Return Missions; Space Missions; 2001 Mars Odyssey; Mars Express

20070035969 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

Planetary Protection Technology for Mars Sample Return

Gershman, Robert; March 5, 2005; 12 pp.; In English; IEEE Aerospace Conference, 5-12 Mar. 2005, Big Sky, MT, USA; Original contains black and white illustrations; Copyright; Avail.: Other Sources

ONLINE: <http://hdl.handle.net/2014/40530>

The NASA Mars Exploration Program has recently adopted a plan that includes a first Mars sample return (MSR) mission proposed for launch in 2013. Such a mission would deal with two new categories of planetary protection requirements: (1) assuring a very low probability of inadvertent release of the sample in order to provide extra protection against the extremely unlikely possibility of biological hazards in the returned material and (2) keeping the samples free of round-trip Earth organisms to facilitate confirmation of safety after return to Earth. This paper describes the planetary-protection-related technical challenges awaiting any MSR mission and describes work in progress on technology needed to meet these challenges. New technology is needed for several functions. Containment assurance requires breaking the chain of contact with Mars: the exterior of the sample container must not be contaminated with Mars material either during the loading process or during launch from the Mars surface.

Author

Planetary Protection; Mars Sample Return Missions; Biological Hazards; Contamination; Mars Exploration

20070035970 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

Model-Based Trade Space Exploration for Near-Earth Space Missions

Cohen, Ronald H.; Boncyk, Wayne; Brutocao, James; Beveridge, Iain; March 5, 2005; 11 pp.; In English; IEEE Aerospace Conference, 5-12 mar. 2005, Big Sky, MT, USA; Original contains color and black and white illustrations
Report No.(s): IEEEACC Paper-1196, Version 3; Copyright; Avail.: Other Sources

ONLINE: <http://hdl.handle.net/2014/40563>

We developed a capability for model-based trade space exploration to be used in the conceptual design of Earth-orbiting space missions. We have created a set of reusable software components to model various subsystems and aspects of space missions. Several example mission models were created to test the tools and process. This technique and toolset has demonstrated itself to be valuable for space mission architectural design.

Author

Space Missions; Space Exploration; Mission Planning

20070035983 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

JPL Missions Overview

Sengupta, Anita; September 8, 2006; 21 pp.; In English; 23rd American Society of Engineers of Indian Origin National Convention, 8-10 Sep. 2006, Cerritos, CA, USA; Original contains color and black and white illustrations; Copyright; Avail.: Other Sources

ONLINE: <http://hdl.handle.net/2014/40337>

This viewgraph reviews the current missions that JPL is managing for NASA. Specifically it reviews JPL's capabilities end-to-end to implement missions, development of research and technology. It includes information on JPL's vision for space exploration and JPL's current missions. It reviews the recent scientific findings. Lastly, the presentation gives an overview of the Mars Science Laboratory Mission.

CASI

Space Exploration; NASA Space Programs; Project Planning; Project Management; Laboratories; Research Facilities

20070036003 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

Preparing for the Dawn Mission to Vesta and Ceres

Rayman, Marc D.; Frascchetti, Thomas C.; Raymond, Carol A.; Russell, Christopher T.; October 17, 2005; 11 pp.; In English; 56th International Astronautical Congress, Space Exploration Symposium, Small Bodies Mission and Technologies Session, 17-21 Oct. 2005, Fukuoka, Japan; Original contains black and white illustrations; Copyright; Avail.: Other Sources

ONLINE: <http://hdl.handle.net/2014/40514>

The Dawn project is progressing toward its 2006 launch on a mission to orbit main belt asteroids (4) Vesta and (1) Ceres. Designed to provide insights into important questions about the evolution of the solar system, Dawn will spend more than 0.5 years in orbit about each of these bodies. This challenging mission is enabled by an ion propulsion system. In contrast to missions that use conventional chemical propulsion, the use of this system couples flight system mass and power, thereby requiring different methods of managing these and other technical resources. Now that the project is nearing launch, the refinement of resource estimates allows the identification of excess margin, which is being applied in novel ways to increase the scientific potential of the mission. The unusual relationship of the margins is described, and progress in preparing for the mission is presented.

Author

Ion Propulsion; Vesta Asteroid; Chemical Propulsion; Launching

20070036047 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA; European Space Agency, France; Italian Space Agency, Italy

The Cassini-Huygens Mission to Saturn and Titan

Maize, Earl H.; February 13, 2005; 8 pp.; In English; Space Technology and Applications International Forum, 13-17 Feb. 2005, Albuquerque, NM, USA; Original contains black and white illustrations; Copyright; Avail.: Other Sources

ONLINE: <http://hdl.handle.net/2014/40541>

The Cassini-Huygens mission is an international collaboration whose goal is an intense and detailed study of Saturn and its system. This paper provides a brief overview of the mission.

Author

Cassini Mission; Saturn (Planet); Titan; Spacecraft Orbits; NASA Programs; Saturn Rings; Huygens Probe

20070036049 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

A Systems Study to Determine the Attractiveness of Solar System Bodies and Sites for Eventual Human Exploration

Andringa, Jason M.; Gray, Andrew A.; March 5, 2005; 7 pp.; In English; IEEE Aerospace Conference, 5-12 Mar. 2005, Big Sky, MT, USA; Copyright; Avail.: Other Sources

ONLINE: <http://hdl.handle.net/2014/40537>

A pre-phase A idea-generation team at the Jet Propulsion Laboratory (JPL), has conducted a study to rank all locations in the solar system based on attractiveness for human exploration. The process used to perform the study was composed of the following primary steps: determination of criteria (including value, cost, and risk criteria) upon which to rate sites in the solar system; weighting of the criteria based upon importance to eventual human exploration; selection of sites to consider and assignment of team members to the task of advocating the benefits of particular sites; rating the sites in both the short- and longterm based on team member presentations and team discussions; compilation of a score based on criteria weights and individual ratings. Finally a comparison of the total scores of different sites was completed to determine a ranking of all the bodies and sites in the solar system. Sensitivity analysis was also performed to determine how weightings affect the rankings.

Author

Sensitivity Analysis; Position (Location); Risk; Solar System

20070036625 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Energetic Neutral Atom Emissions From Venus: VEX Observations and Theoretical Modeling

Fok, M.-C.; Galli, A.; Tanaka, T.; Moore, T. E.; Wurz, P.; Holmstrom, M.; [2007]; 1 pp.; In English; 2007 American Geophysical Union (AGU) Fall Meeting, 10-14 Dec. 2007, San Francisco, CA, USA; Copyright; Avail.: Other Sources;

Abstract Only

Venus has almost no intrinsic magnetic field to shield itself from its surrounding environment. The solar wind thus directly interacts with the planetary ionosphere and atmosphere. One of the by-products of this close encounter is the production of energetic neutral atom (ENA) emissions. Theoretical studies have shown that significant amount of ENAs are emanated from the planet. The launch of the Venus Express (VEX) in 2005 provided the first light ever of the Venus ENA emissions. The observed ENA flux level and structure are in pretty good agreement with the theoretical studies. In this paper, we present VEX ENA data and the comparison with numerical simulations. We seek to understand the solar wind interaction with the planet and the impacts on its atmospheres.

Author

Mathematical Models; Neutral Atoms; Emission; Venus (Planet)

20070036651 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

Planetary Protection Technologies: Technical Challenges for Mars Exploration

Buxbaum, Karen L.; March 5, 2005; 6 pp.; In English; IEEE Aerospace Conference, 5-12 Mar. 2005, Big Sky, MT, USA Report No.(s): IEEEAC Paper-1554; Copyright; Avail.: Other Sources

ONLINE: <http://hdl.handle.net/2014/40509>

The search for life in the solar system, using either in situ analysis or sample return, brings with it special technical challenges in the area of planetary protection. Planetary protection (PP) requires planetary explorers to preserve biological and organic conditions for future exploration and to protect the Earth from potential extraterrestrial contamination that could occur as a result of sample return to the Earth-Moon system. In view of the exploration plans before us, the NASA Solar System Exploration Program Roadmap published in May 2003 identified planetary protection as one of 13 technologies for 'high priority technology investments.' Recent discoveries at Mars and Jupiter, coupled with new policies, have made this planning for planetary protection technology particularly challenging and relevant. New missions to Mars have been formulated, which present significantly greater forward contamination potential. New policies, including the introduction by COSPAR of a Category IVc for planetary protection, have been adopted by COSPAR in response. Some missions may not be feasible without the introduction of new planetary protection technologies. Other missions may be technically possible but planetary protection requirements may be so costly to implement with current technology that they are not affordable. A strategic investment strategy will be needed to focus on technology investments designed to enable future missions and reduce the costs of future missions. This presentation will describe some of the potential technological pathways that may be most protective.

Author

Space Exploration; Mars Exploration; Planetary Protection; Mars Missions; Sample Return Missions

20070036653 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

The NASA Exploration Design Team; Blueprint for a New Design Paradigm

Oberto, Robert E.; Nilsen, Erik; Cohen, Ron; Wheeler, Rebecca; DeFlorio, Paul; March 5, 2005; 11 pp.; In English; IEEE Aerospace Conference, 6-12 Mar. 2005, Big Sky, MT, USA; Original contains black and white illustrations; Copyright; Avail.: Other Sources

ONLINE: <http://hdl.handle.net/2014/40507>

NASA has chosen JPL to deliver a NASA-wide rapid-response real-time collaborative design team to perform rapid execution of program, system, mission, and technology trade studies. This team will draw on the expertise of all NASA centers and external partners necessary. The NASA Exploration Design Team (NEDT) will be led by NASA Headquarters, with field centers and partners added according to the needs of each study. Through real-time distributed collaboration we will effectively bring all NASA field centers directly inside Headquarters. JPL's Team X pioneered the technique of real time collaborative design 8 years ago. Since its inception, Team X has performed over 600 mission studies and has reduced per-study cost by a factor of 5 and per-study duration by a factor of 10 compared to conventional design processes. The Team X concept has spread to other NASA centers, industry, academia, and international partners. In this paper, we discuss the extension of the JPL Team X process to the NASA-wide collaborative design team. We discuss the architecture for such a process and elaborate on the implementation challenges of this process. We further discuss our current ideas on how to address these challenges.

Author

Space Exploration; Real Time Operation; Design Analysis

20070036666 NASA Marshall Space Flight Center, Huntsville, AL, USA

Space Exploration

McGrath, Melissa A.; September 09, 2007; 1 pp.; In English; Space Forum 2007, 9-14 Sep. 207, Kiruna, Sweden; No Copyright; Avail.: Other Sources; Abstract Only

Space exploration is an endeavor that has universal appeal, is far reaching in its consequences, crossing borders and spanning intellectual disciplines from art to literature to mathematics, with a purpose and reach that can potentially unite. To enhance awareness and strengthen cooperation within the space community, and provide inspiration for new activities, Dr. McGrath will provide a brief glimpse into a few of the exciting space exploration activities currently being undertaken by NASA.

Author

Space Exploration; NASA Programs; Manned Space Flight

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SOLAR PHYSICS

Includes solar activity, solar flares, solar radiation and sunspots. For related information see *93 Space Radiation*.

20070035127 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Short- and Medium-term Atmospheric Effects of Very Large Solar Proton Events

Jackman, Charles H.; Marsh, Daniel R.; Vitt, Francis M.; Garcia, Rolando R.; Fleming, Eric L.; Labow, Gordon J.; Randall, Cora E.; Lopez-Puertas, Manuel; Funke, Bernd; [2007]; 22 pp.; In English; Original contains black and white illustrations; Copyright; Avail.: CASI: [A03](#), Hardcopy

Long-term variations in ozone have been caused by both natural and humankind related processes. In particular, the humankind or anthropogenic influence on ozone from chlorofluorocarbons and halons (chlorine and bromine) has led to international regulations greatly limiting the release of these substances. These anthropogenic effects on ozone are most important in polar regions and have been significant since the 1970s. Certain natural ozone influences are also important in polar regions and are caused by the impact of solar charged particles on the atmosphere. Such natural variations have been studied in order to better quantify the human influence on polar ozone. Large-scale explosions on the Sun near solar maximum lead to emissions of charged particles (mainly protons and electrons), some of which enter the Earth's magnetosphere and rain down on the polar regions. 'Solar proton events' have been used to describe these phenomena since the protons associated with these solar events sometimes create a significant atmospheric disturbance. We have used the National Center for Atmospheric Research (NCAR) Whole Atmosphere Community Climate Model (WACCM) to study the short- and medium-term (days to a few months) influences of solar proton events between 1963 and 2005 on stratospheric ozone. The four largest events in the past 45 years (August 1972; October 1989; July 2000; and October-November 2003) caused very distinctive polar changes in layers of the Earth's atmosphere known as the stratosphere (12-50 km; -7-30 miles) and mesosphere (50-90 km; 30-55

miles). The solar protons connected with these events created hydrogen- and nitrogen- containing compounds, which led to the polar ozone destruction. The hydrogen-containing compounds have very short lifetimes and lasted for only a few days (typically the duration of the solar proton event). On the other hand, the nitrogen-containing compounds lasted much longer, especially in the Winter. The nitrogen oxides were predicted to increase substantially due to these solar events and led to mid- to upper polar stratospheric ozone decreases of over 20%. These WACCM results generally agreed with satellite measurements. Both WACCM and measurements showed enhancements of nitric acid, dinitrogen pentoxide, and chlorine nitrate, which were indirectly caused by these solar events. Solar proton events were shown to cause a significant change in the polar stratosphere and need to be considered in understanding variations during years of strong solar activity.

Author

Solar Activity Effects; Solar Protons; Atmospheric Effects; Ozone; Nitrogen Compounds; Polar Regions; Charged Particles; Climate Models

20070035138 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Observation of Low Level Heating in an Erupting Prominence

Kucera, Theresa; Landi, E.; [2007]; 2 pp.; In English; Copyright; Avail.: Other Sources; Abstract Only

We present multi-wavelength observations of low level heating in an erupting prominence observed in the UV and EUV over a wide range of temperatures and wavelengths by SOHO's SUMER instrument, TRACE and also in H-alpha by the Yunnan Astronomical Observatory. The eruption occurred on 2004 April 30. The heating is relatively mild, leading only to the ionization of neutral hydrogen and probably helium. It is also localized, occurring along the bottom edge of the erupting prominence and in a kink-like feature in the prominence. The heating is revealed as a decrease in the Lyman absorption. This decrease results in an apparent increase in emission in all the lines observed by SUMER, especially those formed at temperatures approx. $10^{(exp 5)}$. However, this is due to the disappearance of cooler absorbing material in the prominence rather than an increase in these higher temperature species.

Author

Extreme Ultraviolet Radiation; H Alpha Line; Gas Ionization; Helium; Hydrogen; Emission Spectra

20070035743 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Solar Modulation of Low-Energy Antiproton and Proton Spectra Measured by BESS

Mitchell, John W.; Abe, Ko; Fuke, Hideyuki; Haino, Sadakazu; Hams, Thomas; Horikoshi, Atsushi; Kim, Ki-Chun; Lee, MooHyun; Makida, Yashuhiro; Matsuda, Shinya; Moiseev, Alexander; Nishimura, Jun; Nozaki, Mitsuaki, et al.; July 09, 2007; 2 pp.; In English; International Cosmic Ray Conference, 3-11 Jul. 2007, Merida, Mexico; Copyright; Avail.: Other Sources; Abstract Only

The spectra of low-energy cosmic-ray protons and antiprotons have been measured by BESS in nine high-latitude balloon flights between 1993 and 2004. These measurements span a range of solar activity from the previous solar minimum through solar maximum and the onset of the present solar minimum, as well as a solar magnetic field reversal from positive to negative in 2000. Because protons and antiprotons differ only in charge sign, these simultaneous measurements provide a sensitive probe of charge dependent solar modulation. The antiproton to proton ratio measured by BESS is consistent with simple spherically symmetric models of solar modulation during the Sun's positive polarity phase, but favor charge-sign-dependent drift models during the negative phase. The BESS measurements will be presented and compared to various models of solar modulation.

Author

Solar Activity Effects; Antiprotons; Protons; Cosmic Rays; Balloon Flight; Solar Magnetic Field; Modulation

20070035893 Science Applications International Corp., San Diego, CA, USA

Generalized Squashing Factors for Covariant Description of Magnetic Connectivity in the Solar Corona

Titov, V. S.; The Astrophysical Journal; May 2007; Volume 660, pp. 863-873; In English; Original contains black and white illustrations

Contract(s)/Grant(s): NNG05EE09C; Copyright; Avail.: Other Sources

ONLINE: <http://dx.doi.org/10.1086/512671>

The study of magnetic connectivity in the solar corona reveals a need to generalize the field line mapping technique to arbitrary geometry of the boundaries and systems of coordinates. Indeed, the global description of the connectivity in the corona requires the use of the photospheric and solar wind boundaries. Both are closed surfaces and therefore do not admit a global regular system of coordinates. At least two overlapping regular systems of coordinates for each of the boundaries are

necessary in this case to avoid spherical-pole-like singularities in the coordinates of the footpoints. This implies that the basic characteristic of magnetic connectivity—the squashing degree or factor Q of elemental flux tubes, according to Titov and coworkers—must be rewritten in covariant form. Such a covariant expression of Q is derived in this work. The derived expression is very flexible and highly efficient for describing the global magnetic connectivity in the solar corona. In addition, a general expression for a new characteristic Q_1 , which defines a squashing of the flux tubes in the directions perpendicular to the field lines, is determined. This new quantity makes it possible to filter out the quasi-separatrix layers whose large values of Q are caused by a projection effect at the field lines nearly touching the photosphere. Thus, the value Q_1 provides a much more precise description of the volumetric properties of the magnetic field structure. The difference between Q and Q_1 is illustrated by comparing their distributions for two configurations, one of which is the Titov-Demoulin model of a twisted magnetic field.

Author

Solar Corona; Magnetic Field Configurations; Magnetic Flux; Solar Wind; Singularity (Mathematics)

20070036013 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Highly Structured Plasma Density and Associated Electric and Magnetic Field Irregularities at Sub-Auroral, Middle, and Low Latitudes in the Topside Ionosphere Observed with the DEMETER and DMSP Satellites

Pfaff, Robert F.; Liebrecht, C.; Berthelier, Jean-Jacques; Parrot, M.; Lebreton, Jean-Pierre; May 21, 2007; 1 pp.; In English; AGU 2007 General Assembly meeting, 21-26 May 2007, Acapulco, Mexico; Copyright; Avail.: Other Sources; Abstract Only

Detailed observations of the plasma structure and irregularities that characterize the topside ionosphere at sub-auroral, middle, and low-latitudes are gathered with probes on the DEMETER and DMSP satellites. In particular, we present DEMETER observations near 700 km altitude that reveal: (1) the electric field irregularities and density depletions at mid-latitudes are remarkably similar to those associated with equatorial spread-F at low latitudes; (2) the mid-latitude density structures contain both depletions and enhancements with scale lengths along the spacecraft trajectory that typically vary from 10's to 100's of km; (3) in some cases, ELF magnetic field irregularities are observed in association with the electric field irregularities on the walls of the plasma density structures and appear to be related to finely-structured spatial currents and/or Alfvén waves; (4) during severe geomagnetic storms, broad regions of nightside plasma density structures are typically present, in some instances extending from the equator to the subauroral regions; and (5) intense, broadband electric and magnetic field irregularities are observed at sub-auroral latitudes during geomagnetic storm periods that are typically associated with the trough region. Data from successive DEMETER orbits during storm periods in both the daytime and nighttime illustrate how enhancements of both the ambient plasma density, as well as sub-auroral and mid-latitude density structures, correlate and evolve with changes in the Dst. The DEMETER data are compared with near simultaneous observations gathered by the DMSP satellites near 840 km. The observations are related to theories of sub-auroral and mid-latitude plasma density structuring during geomagnetic storms and penetration electric fields and are highly germane to understanding space weather effects regarding disruption of communication and navigation signals in the near-space environment.

Author

Space Weather; Plasma Density; Space Plasmas; Upper Ionosphere; Artificial Satellites; Auroras

20070036662 NASA Goddard Space Flight Center, Greenbelt, MD, USA

A Scanning Hartmann Focus Test for the EUVI Telescopes aboard STEREO

Ohl, Ray; Antonille, Scott; Aronstein, Dave; Dean, Bruce; Eichhorn, Bil; Frey, Brad; Kubalak, Dave; Shiri, Ron; Smith, Scott; Wilson, Mark; Redman, Kevin; Janssen, Douglas; d'Entremont, Joseph; Aug. 26, 2007; 43 pp.; In English; SPIE Conference, 26-30 Aug. 2007, San Diego, CA, USA; Original contains black and white illustrations; Copyright; Avail.: CASI: [A03](#), Hardcopy

The Solar TERrestrial RELations Observatory (STEREO), the third mission in NASA's Solar Terrestrial Probes program, was launched in 2006 on a two year mission to study solar phenomena. STEREO consists of two nearly identical satellites, each carrying an Extreme Ultraviolet Imager (EUVI) telescope as part of the Sun Earth Connection Coronal and Heliospheric Investigation instrument suite. EUVI is a normal incidence, 98mm diameter, Ritchey-Chretien telescope designed to obtain wide field of view images of the Sun at short wavelengths (17.1-30.4nm) using a CCD detector. The telescope entrance aperture is divided into four quadrants by a mask near the secondary mirror spider veins. A mechanism that rotates another mask allows only one of these sub-apertures to accept light over an exposure. The EUVI contains no focus mechanism. Mechanical models predict a difference in telescope focus between ambient integration conditions and on-orbit operation. We describe an independent check of the ambient, ultraviolet, absolute focus setting of the EUVI telescopes after they were

integrated with their respective spacecraft. A scanning Hartmann-like test design resulted from constraints implied by the EUVI aperture select mechanism. This inexpensive test was simultaneously coordinated with other NASA integration and test activities in a high-vibration, clean room environment. The total focus test error was required to be better than ± 0.05 mm. We describe the alignment and test procedure, sources of statistical and systematic error, and then the focus determination results using various algorithms. The results are consistent with other tests of focus alignment and indicate that the EUVI telescopes meet the ambient focus offset requirements. STEREO is functioning well on-orbit and the EUVI telescopes meet their on-orbit image quality requirements.

Author

STEREO (Observatory); NASA Programs; Space Missions; Extreme Ultraviolet Radiation; Ultraviolet Telescopes

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