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Space Administration
Langley Research Center

Scientific and Technical
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NASA STI Program ... in Profile

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

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Introduction

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

STAR includes citations to Research & Development (R&D) results reported in:

- NASA, NASA contractor, and NASA grantee reports
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- Translations
- NASA-owned patents and patent applications
- Other U.S. Government agency and foreign patents and patent applications
- Domestic and foreign dissertations and theses

The NASA STI Program

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

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NASA STI Availability Information

NASA Center for AeroSpace Information (CASI)

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

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

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

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

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Subject Term Index
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SCIENTIFIC AND TECHNICAL AEROSPACE REPORTS

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VOLUME 41, OCTOBER 31, 2003

20030102130 Los Alamos National Lab., NM

Unsaturated Groundwater Flow beneath Upper Mortandad Canyon, Los Alamos, New Mexico

Dander, D. C.; Oct. 15, 1998; 171 pp.; In English

Report No.(s): DE2003-758752; LAUR-98-4759; No Copyright; Avail: Department of Energy Information Bridge

Mortandad Canyon is a discharge site for treated industrial effluents containing radionuclides and other chemicals at Los Alamos National Laboratory, New Mexico. This study was conducted to develop an understanding of the unsaturated hydrologic behavior below the canyon floor. The main goal of this study was to evaluate the hypothetical performance of the vadose zone above the water table. Numerical simulations of unsaturated groundwater flow at the site were conducted using the Finite Element Heat and Mass Transfer (FEHM) code. A two-dimensional cross-section along the canyon's axis was used to model flow between an alluvial groundwater system and the regional aquifer approximately 300 m below. Using recharge estimated from a water budget developed in 1967, the simulations showed waters from the perched water table reaching the regional aquifer in 13.8 years, much faster than previously thought. Additionally, simulations indicate that saturation is occurring in the Guaje pumice bed and that the Tshirege Unit 1B is near saturation. Lithologic boundaries between the eight materials play an important role in flow and solute transport within the system. Horizontal flow is shown to occur in three thin zones above capillary barriers; however, vertical flow dominates the system. Other simulations were conducted to examine the effects of changing system parameters such as varying recharge inputs, varying the distribution of recharge, and bypassing fast-path fractured basalt of uncertain extent and properties. System sensitivity was also explored by changing model parameters with respect to size and types of grids and domains, and the presence of dipping stratigraphy.

NTIS

Aquifers; Ground Water; Water Tables; Canyons

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*.

20030097989 Stabilimento Agust, Anagmi, Italy

A Study of Aeronautical Components for Optimisation of Curing Parameters

Battaglino, A.; Anamateros, E.; Amantini, L.; Compagno, F.; Lombardi, A. V.; Marchetti, M.; Low Cost Composite Structures Cost Effective Application of Titanium Alloys in Military Platforms; March 2003; 10 pp.; In English; See also 20030097962; Original contains color illustrations; Copyright; Avail: CASI; C01, CD-ROM; A02, Hardcopy

Advanced composites have provided industry with unprecedented opportunities for design freedom and improved structural performance. Although these opportunities continue to be explored, the cost effectiveness of composite structures has proved to be a large obstacle to their widespread use. This work concerns on the technical optimisation of the curing process of thermosetting matrix composites which translates into improved product quality and lower production costs. Curing optimisation involves the best setting of several parameters related to material properties, physical properties of the process, tooling properties, parts geometry etc. A study for optimisation of curing parameters has been performed on an aeronautical structural component giving results for general discussion on methods and procedures for industrial application of standard method of optimisation of curing cycles of parts.

Author

Curing; Optimization; Aeronautics; Composite Materials; Mechanical Properties; Aircraft Structures; Manufacturing

20030098019 National Renewable Energy Lab., Golden, CO
Identification of Wind Turbine Response to Turbulent Inflow Structures
Hand, M. M.; Kelley, N. D.; Balas, M. J.; Jun. 2003; In English
Report No.(s): DE2003-15003958; NREL/CP-500-33465; No Copyright; Avail: National Technical Information Service (NTIS)

The National Renewable Energy Laboratory conducted an experiment to obtain detailed wind measurements and corresponding wind turbine measurements in order to establish a causal relationship between coherent turbulent structures and wind turbine blade fatigue loads. Data were collected for one entire wind season from October 2000 to May 2001. During this period, the wind turbine operated under atmospheric conditions that support the formation of coherent turbulent structures 31% of the time. Using the equivalent fatigue load parameter as a measure of wind turbine blade fatigue and using statistical measures of the turbulent fluctuations of the wind, general correlation between the turbulence and the wind turbine response is shown. Direct correlation cannot be resolved with 10-minute statistics for several reasons. Multiple turbulent structures can exist within a 10-minute record, and the equivalent fatigue load parameter is essentially a 10-minute statistic that cannot estimate turbine response to individual turbulent structures. Large-magnitude turbulent fluctuations in the form of instantaneous Reynolds stresses do not necessarily correspond directly to large-magnitude blade root moment amplitudes. Thus, additional work must be done to quantify the negative turbine response and to correlate this response to turbulent inflow parameters over time scales less than 10 minutes.
NTIS
Wind Turbines; Turbulent Flow

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*.

20030091494 NASA Ames Research Center, Moffett Field, CA, USA
Computational Analysis of a Prototype Martian Rotorcraft Experiment
Corfeld, Kelly J.; Strawn, Roger C.; Long, Lyle N.; [2002]; 10 pp.; In English; AIAA Applied Aerodynamics Conference, 24-27 Jun. 2002, Saint Louis, MO, USA; Original contains color illustrations
Report No.(s): AIAA Paper 2002-2815; Copyright; Avail: CASI; A02, Hardcopy

This paper presents Reynolds-averaged Navier-Stokes calculations for a prototype Martian rotorcraft. The computations are intended for comparison with an ongoing Mars rotor hover test at NASA Ames Research Center. These computational simulations present a new and challenging problem, since rotors that operate on Mars will experience a unique low Reynolds number and high Mach number environment. Computed results for the 3-D rotor differ substantially from 2-D sectional computations in that the 3-D results exhibit a stall delay phenomenon caused by rotational forces along the blade span. Computational results have yet to be compared to experimental data, but computed performance predictions match the experimental design goals fairly well. In addition, the computed results provide a high level of detail in the rotor wake and blade surface aerodynamics. These details provide an important supplement to the expected experimental performance data. Author
Rotary Wing Aircraft; Navier-Stokes Equation; Low Reynolds Number; Hovering

20030098047 NASA Langley Research Center, Hampton, VA, USA
A Theoretical Investigation of Vortex-Sheet Deformation Behind a Highly Loaded Wing and Its Effect on Lift
Cone, Clarence D., Jr.; April 1961; 59 pp.; In English
Report No.(s): NASA-TN-D-657; L-1156; No Copyright; Avail: CASI; A04, Hardcopy

The induced drag polar is developed for wt-ngs capable of attaining extremely high loadings while possessing an elliptical distribution of circulation. This development is accomplished through a theoretical investigation of the vortex-wake deformation process and the deduction of the airfoil forces from the impulse and kinetic energy contents of the ultimate wake form. The investigation shows that the induced velocities of the wake limit the maximum lift coefficient to a value of 1.94 times the wing aspect ratio, for aspect ratios equal to or less than 6.5, and that the section properties of the airfoil limit the lift coefficient to 12.6 for aspect ratios greater than 6.5. Relations are developed for the rate of deformation of the vortex wake.

It is also shown that linear wing theory is app1icable up to lift coefficients equal to 1.1 times the aspect ratio.
Author
Deformation; Wings; Aerodynamic Drag

20030102184 NASA Ames Research Center, Moffett Field, CA, USA
Analysis and Design of Rotors at Ultra-Low Reynolds Numbers
Kunz, Peter J.; Strawn, Roger C.; [2003]; 1 pp.; In English; AIAA 40th Aerospace Sciences Meeting, 14-17 Jan. 2003, Reno, NV, USA
Report No.(s): AIAA Paper 2002-0099; No Copyright; Avail: Other Sources; Abstract Only

Design tools have been developed for ultra-low Reynolds number rotors, combining enhanced actuator-ring / blade-element theory with airfoil section data based on two-dimensional Navier-Stokes calculations. This performance prediction method is coupled with an optimizer for both design and analysis applications. Performance predictions from these tools have been compared with three-dimensional Navier Stokes analyses and experimental data for a 2.5 cm diameter rotor with chord Reynolds numbers below 10,000. Comparisons among the analyses and experimental data show reasonable agreement both in the global thrust and power required, but the spanwise distributions of these quantities exhibit significant deviations. The study also reveals that three-dimensional and rotational effects significantly change local airfoil section performance. The magnitude of this issue, unique to this operating regime, may limit the applicability of blade-element type methods for detailed rotor design at ultra-low Reynolds numbers, but these methods are still useful for evaluating concept feasibility and rapidly generating initial designs for further analysis and optimization using more advanced tools.
Author
Performance Prediction; Prediction Analysis Techniques; Rotors; Low Reynolds Number

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*.

20030099668 Kelly Mfg. Co., Grenola, KS, USA
Putting Safety First in the Sky
Spinoff 2003: 100 Years of Powered Flight; 2003, pp. 32-33; In English; See also 20030099639; Original contains color illustrations; No Copyright; Avail: National Technology Transfer Center (NTTC), Wheeling, WV

As a result of technology developed at NASA s Kennedy Space Center, pilots now have a hand-held personal safety device to warn them of potentially dangerous or deteriorating cabin pressure altitude conditions before hypoxia becomes a threat. The Personal Cabin Pressure Altitude Monitor and Warning System monitors cabin pressure to determine when supplemental oxygen should be used according to Federal Aviation Regulations. The device benefits both pressurized and nonpressurized aircraft operations - warning pressurized aircraft when the required safe cabin pressure altitude is compromised, and reminding nonpressurized aircraft when supplemental oxygen is needed.
Author
Aerospace Technology Transfer; Technology Utilization; Product Development; Safety Devices; Warning Systems; Hypoxia; Air Sampling; Flight Safety

20030102231 Army Command and General Staff Coll., Fort Leavenworth, KS
Considerations for the Maneuver Commander: Could the Emergence of Unmanned Aerial Vehicles Spell the Demise of the Army's RAH-66 Comanche in the Armed Reconnaissance Role?
Barnes, David W.; Jun. 6, 2003; 102 pp.; In English; Original contains color illustrations
Report No.(s): AD-A416261; ATZL-SWD-GD; No Copyright; Avail: CASI; A06, Hardcopy

The U.S. Army finds itself at a crossroad in the development and fielding of both unmanned aerial vehicles (UAVs) and the RAH-66 Comanche helicopter to fulfill the armed reconnaissance role for its future Objective Force (OF). Ever- increasing UAV capabilities, especially the ability to arm these platforms with Hellfire missiles, is forcing a blending of roles that were once solely the domain of manned platforms. This paper attempts to answer the thesis question posed above by using the OF characteristics of survivability, lethality, and responsiveness and comparing the effectiveness and efficiency of the Army's

Class IV UAV systems (Hunter TUAV, Shadow 200, the Extended Range Multi-Purpose (ERMP), the Hummingbird 160 UCAR, and the Air Force's Predator A and B) against similar capabilities found in the Comanche. The analysis also highlights what the maneuver commander should consider in employing these future combat systems. The author concludes, based on the above criteria, that future UAV capabilities (up to the 2009 year timeframe) should not preclude the need for the Army to field the Comanche.
DTIC
Helicopters; Air To Air Missiles; Air To Surface Missiles; Combat

20030105694 Army Command and General Staff Coll., Fort Leavenworth, KS
The Origin of Centralized Control and Decentralized Execution
Romero, Rene P.; Jan. 2003; 116 pp.; In English
Report No.(s): AD-A416557; No Copyright; Avail: CASI; A06, Hardcopy

Air Force Doctrine Document 1 states, Air forces must be controlled by an airman who maintains a broad perspective in prioritizing limited assets across the range of operations. Hence, centralized control by an airman becomes the essence of airpower's basic tenet, centralized control and decentralized execution. This study concentrates on the origin of U.S. airpower's core tenet, especially with regard to its essence. The search ultimately evolves into an analysis of the doctrinal evolution of centralized control by an airman from World War I through early World War II. The search begins with the American military experience in the Allies' North African campaign in late 1942, the turning point for the adoption of airpowers's core tenet. After an ineffective application of airpower culminating in the Allies' defeat at Kasserine Pass, centralized control of air forces by an airman became codified into official doctrine. This study attempts to find the origin by examining the events surrounding the American Air Service's first combat experience in World War I, the Battle of St. Mihiel. Next, it examines what the classical airpower theorists concluded about centralized control by an airman as a means to determine what shaped the interwar doctrine with which Army Air Forces entered World War II.
DTIC
Warfare; Histories; Aeronautical Engineering

04
AIRCRAFT COMMUNICATIONS AND NAVIGATION

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

20030093586 Missouri Univ., Rolla, MO, USA
Adaptive Critic Neural Network-Based Terminal Area Energy Management and Approach and Landing Guidance
Grantham, Katie; The 2002 NASA Faculty Fellowship Program Research Reports; April 2003, pp. XVII-1 - XVII-7; In English; See also 20030093576
Contract(s)/Grant(s): NAG8-1859; No Copyright; Avail: CASI; C01, CD-ROM; A02, Hardcopy

Reusable Launch Vehicles (RLVs) have different mission requirements than the Space Shuttle, which is used for benchmark guidance design. Therefore, alternative Terminal Area Energy Management (TAEM) and Approach and Landing (A/L) Guidance schemes can be examined in the interest of cost reduction. A neural network based solution for a finite horizon trajectory optimization problem is presented in this paper. In this approach the optimal trajectory of the vehicle is produced by adaptive critic based neural networks, which were trained off-line to maintain a gradual glideslope.
Derived from text
Aircraft Guidance; Aircraft Landing; Neural Nets; Reusable Launch Vehicles; Terminal Area Energy Management

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*.

20030086430 NASA Langley Research Center, Hampton, VA, USA
Full-Scale Crash Test and Finite Element Simulation of a Composite Prototype Helicopter
Jackson, Karen E.; Fasanella, Edwin L.; Boitnott, Richard L.; Lyle, Karen H.; August 2003; 121 pp.; In English
Contract(s)/Grant(s): 728-50-10-01
Report No.(s): NASA/TP-2003-212641; L-18228; NAS 1.60:212641; ARL-TR-2824; No Copyright; Avail: CASI; A06, Hardcopy

A full-scale crash test of a prototype composite helicopter was performed at the Impact Dynamics Research Facility at NASA Langley Research Center in 1999 to obtain data for validation of a finite element crash simulation. The helicopter was the flight test article built by Sikorsky Aircraft during the Advanced Composite Airframe Program (ACAP). The composite helicopter was designed to meet the stringent Military Standard (MIL-STD-1290A) crashworthiness criteria and was outfitted with two crew and two troop seats and four anthropomorphic dummies. The test was performed at 38-ft/s vertical and 32.5-ft/s horizontal velocity onto a rigid surface. An existing modal-vibration model of the Sikorsky ACAP helicopter was converted into a model suitable for crash simulation. A two-stage modeling approach was implemented and an external user-defined subroutine was developed to represent the complex landing gear response. The crash simulation was executed with a nonlinear, explicit transient dynamic finite element code. Predictions of structural deformation and failure, the sequence of events, and the dynamic response of the airframe structure were generated and the numerical results were correlated with the experimental data to validate the simulation. The test results, the model development, and the test-analysis correlation are described.
Author
Helicopters; Crashworthiness; Full Scale Tests; Finite Element Method; Mathematical Models

20030093530 NASA Langley Research Center, Hampton, VA, USA
Turbulence Model Comparisons for Supersonic Transports at Transonic and Supersonic Conditions
Rivers, S. M. B.; Wahls, R. A.; [2003]; 12 pp.; In English; 21st AIAA Applied Aerodynamics Conference, 23-26 Jun. 2003, Orlando, FL, USA
Report No.(s): AlAA Paper 2003-3418; No Copyright; Avail: CASI; A03, Hardcopy

Results of turbulence model comparisons from two studies on supersonic transport configurations performed during the NASA High-speed Research program are given. Results are presented for both transonic conditions at Mach 0.90 and supersonic conditions at Mach 2.48. A feature of these two studies was the availability of higher Reynolds number wind tunnel data with which to compare the computational results. The transonic wind tunnel data was obtained in the National Transonic Facility at NASA Langley, and the supersonic data was obtained in the Boeing Polysonic Wind Tunnel. The computational data was acquired using a state of the art Navier-Stokes flow solver with a wide range of turbulence models implemented. The results show that the computed forces compare reasonably well with the experimental data, with the Baldwin- Lomax with Degani-Schiff modifications and the Baldwin-Barth models showing the best agreement for the transonic conditions and the Spalart-Allmaras model showing the best agreement for the supersonic conditions. The transonic results were more sensitive to the choice of turbulence model than were the supersonic results.
Author
Turbulence Models; Supersonic Transports; Reynolds Number; High Speed; Baldwin-Lomax Turbulence Model

20030093540 NASA Glenn Research Center, Cleveland, OH, USA
Mixed-Phase Icing Simulation and Testing at the Cox Icing Wind Tunnel
Al-Khalil, Kamel; Irani, Eddie; Miller, Dean; September 2003; 18 pp.; In English; 41st Aerospace Sciences Meeting and Exhibit, 6-9 Jan. 2003, Reno, NV, USA
Contract(s)/Grant(s): WBS 22-708-20-03
Report No.(s): NASA/TM-2003-212395; E-13978; NAS 1.15:212395; AIAA Paper 2003-0903; No Copyright; Avail: CASI; A03, Hardcopy

A new capability was developed for indoor simulation of snow and mixed-phase icing conditions. This capability is useful for year-round testing in the Cox closed-loop Icing Wind Tunnel. Certification of aircraft for flight into these types of icing conditions is only required by the JAA in Europe. In an effort to harmonize certification requirements, the FAA in the US

sponsored a preliminary program to study the effects of mixed-phase and fully glaciated icing conditions on the performance requirements of thermal ice protection systems. This paper describes the test program and the associated results.
Author
Wind Tunnels; Thermal Protection; Aircraft Icing

20030093580 Alabama Univ., USA
Independent Review of the Failure Modes of F-1 Engine and Propellants System
Ray, Paul; The 2002 NASA Faculty Fellowship Program Research Reports; April 2003, pp. XXXV-1 - XXXV-6; In English; See also 20030093576
Contract(s)/Grant(s): NAG8-1859; No Copyright; Avail: CASI; C01, CD-ROM; A02, Hardcopy

The F-1 is the powerful engine, that hurdled the Saturn V launch vehicle from the Earth to the moon on July 16,1969. The force that lifted the rocket overcoming the gravitational force during the first stage of the flight was provided by a cluster of five F-1 rocket engines, each of them developing over 1.5 million pounds of thrust (MSFC-MAN-507). The F-1 Rocket engine used RP-1 (Rocket Propellant-1, commercially known as Kerosene), as fuel with lox (liquid Oxygen) as oxidizer. NASA terminated Saturn V activity and has focused on Space Shuttle since 1972. The interest in rocket system has been revived to meet the National Launch System (NLS) program and a directive from the President to return to the Moon and exploration of the space including Mars. The new program Space Launch Initiative (SLI) is directed to drastically reduce the cost of flight for payloads, and adopt a reusable launch vehicle (RLV). To achieve this goal it is essential to have the ability of lifting huge payloads into low earth orbit. Probably requiring powerful boosters as strap-ons to a core vehicle, as was done for the Saturn launch vehicle. The logic in favor of adopting Saturn system, a proven technology, to meet the SLI challenge is very strong. The F-1 engine was the largest and most powerful liquid rocket engine ever built, and had exceptional performance. This study reviews the failure modes of the F-1 engine and propellant system.
Derived from text
F-1 Rocket Engine; Failure Modes; Liquid Propellant Rocket Engines; Saturn 5 Launch Vehicles; Flight Tests

20030093594 Embry-Riddle Aeronautical Univ., USA
System Identification of X-33 Neural Network
Aggarwal, Shiv; The 2002 NASA Faculty Fellowship Program Research Reports; April 2003, pp. I-1 - I-5; In English; See also 20030093576
Contract(s)/Grant(s): NAG8-1859; No Copyright; Avail: CASI; C01, CD-ROM; A01, Hardcopy

Modern flight control research has improved spacecraft survivability as its goal. To this end we need to have a failure detection system on board. In case the spacecraft is performing imperfectly, reconfiguration of control is needed. For that purpose we need to have parameter identification of spacecraft dynamics. Parameter identification of a system is called system identification. We treat the system as a black box which receives some inputs that lead to some outputs. The question is: what kind of parameters for a particular black box can correlate the observed inputs and outputs? Can these parameters help us to predict the outputs for a new given set of inputs? This is the basic problem of system identification. The X33 was supposed to have the onboard capability of evaluating the current performance and if needed to take the corrective measures to adapt to desired performance. The X33 is comprised of both rocket and aircraft vehicle design characteristics and requires, in general, analytical methods for evaluating its flight performance. Its flight consists of four phases: ascent, transition, entry and TAEM (Terminal Area Energy Management). It spends about 200 seconds in ascent phase, reaching an altitude of about 180,000 feet and a speed of about 10 to 15 Mach. During the transition phase which lasts only about 30 seconds, its altitude may increase to about 190,000 feet but its speed is reduced to about 9 Mach. At the beginning of this phase, the Main Engine is Cut Off (MECO) and the control is reconfigured with the help of aerosurfaces (four elevons, two flaps and two rudders) and reaction control system (RCS). The entry phase brings down the altitude of X33 to about 90,000 feet and its speed to about Mach 3. It spends about 250 seconds in this phase. Main engine is still cut off and the vehicle is controlled by complex maneuvers of aerosurfaces. The last phase TAEM lasts for about 450 seconds and the altitude and speed, both are reduced to zero. The present attempt, as a start, focuses only on the entry phase. Since the main engine remains cut off in this phase, there is no thrust acting on the system. This considerably simplifies the equations of motion. We introduce another simplification by assuming the system to be linear after some non-linearities are removed analytically from our consideration. Under these assumptions, the problem could be solved by Classical Statistics by employing the least sum of squares approach. Instead we chose to use the Neural Network method. This method has many advantages. It is modern, more efficient, can be adapted to work even when the assumptions are diluted. In fact, Neural Networks try to model the human brain and are capable of pattern recognition.
Derived from text
Aircraft Design; Design Analysis; Flight Characteristics; Flight Control; Neural Nets; X-33 Reusable Launch Vehicle

20030093607 Alabama Univ., Birmingham, AL, USA

Enhancement and Extension of Porosity Model in the FDNS-500 Code to Provide Enhanced Simulations of Rocket Engine Components

Cheng, Gary; The 2002 NASA Faculty Fellowship Program Research Reports; April 2003, pp. XII-1 - XII-5; In English; See also 20030093576

Contract(s)/Grant(s): NAG8-1859; No Copyright; Avail: CASI; C01, CD-ROM; A01, Hardcopy

In the past, the design of rocket engines has primarily relied on the cold flow/hot fire test, and the empirical correlations developed based on the database from previous designs. However, it is very costly to fabricate and test various hardware designs during the design cycle, whereas the empirical model becomes unreliable in designing the advanced rocket engine where its operating conditions exceed the range of the database. The main goal of the 2nd Generation Reusable Launching Vehicle (GEN-II RLV) is to reduce the cost per payload and to extend the life of the hardware, which poses a great challenge to the rocket engine design. Hence, understanding the flow characteristics in each engine components is thus critical to the engine design. In the last few decades, the methodology of computational fluid dynamics (CFD) has been advanced to be a mature tool of analyzing various engine components. Therefore, it is important for the CFD design tool to be able to properly simulate the hot flow environment near the liquid injector, and thus to accurately predict the heat load to the injector faceplate. However, to date it is still not feasible to conduct CFD simulations of the detailed flowfield with very complicated geometries such as fluid flow and heat transfer in an injector assembly and through a porous plate, which requires gigantic computer memories and power to resolve the detailed geometry. The rigimesh (a sintered metal material), utilized to reduce the heat load to the faceplate, is one of the design concepts for the injector faceplate of the GEN-II RLV. In addition, the injector assembly is designed to distribute propellants into the combustion chamber of the liquid rocket engine. A porosity mode thus becomes a necessity for the CFD code in order to efficiently simulate the flow and heat transfer in these porous media, and maintain good accuracy in describing the flow fields. Currently, the FDNS (Finite Difference Navier-Stakes) code is one of the CFD codes which are most widely used by research engineers at NASA Marshall Space Flight Center (MSFC) to simulate various flow problems related to rocket engines. The objective of this research work during the 10-week summer faculty fellowship program was to 1) debug the framework of the porosity model in the current FDNS code, and 2) validate the porosity model by simulating flows through various porous media such as tube banks and porous plate.

Author

Porosity; Rocket Engine Design; Numerical Analysis; Mathematical Models

20030093611 Florida Univ., Gainesville, FL, USA

Finite Element Modeling of a Cylindrical Contact Using Hertzian Assumptions

Knudsen, Erik; The 2002 NASA Faculty Fellowship Program Research Reports; April 2003, pp. XXIV-1 - XXIV-5; In English; See also 20030093576

Contract(s)/Grant(s): NAG8-1859; No Copyright; Avail: CASI; C01, CD-ROM; A01, Hardcopy

The turbine blades in the high-pressure fuel turbopump/alternate turbopump (HPFTP/AT) are subjected to hot gases rapidly flowing around them. This flow excites vibrations in the blades. Naturally, one has to worry about resonance, so a damping device was added to dissipate some energy from the system. The foundation is now laid for a very complex problem. The damper is in contact with the blade, so now there are contact stresses (both normal and tangential) to contend with. Since these stresses can be very high, it is not all that difficult to yield the material. Friction is another non-linearity and the blade is made out of a Nickel-based single-crystal superalloy that is orthotropic. A few approaches exist to solve such a problem and computer models, using contact elements, have been built with friction, plasticity, etc. These models are quite cumbersome and require many hours to solve just one load case and material orientation. A simpler approach is required. Ideally, the model should be simplified so the analysis can be conducted faster. When working with contact problems determining the contact patch and the stresses in the material are the main concerns. Closed-form solutions for non-conforming bodies, developed by Hertz, made out of isotropic materials are readily available. More involved solutions for 3-D cases using different materials are also available. The question is this: can Hertzian1 solutions be applied, or superimposed, to more complicated problems-like those involving anisotropic materials? That is the point of the investigation here. If these results agree with the more complicated computer models, then the analytical solutions can be used in lieu of the numerical solutions that take a very long time to process. As time goes on, the analytical solution will eventually have to include things like friction and plasticity. The models in this report use no contact elements and are essentially an applied load problem using Hertzian assumptions to determine the contact patch dimensions.

Derived from text

Cylindrical Bodies; Finite Element Method; Mathematical Models; Turbine Blades; Turbine Pumps; Vibration

20030093617 Oakwood Coll., Huntsville, AL, USA

Investigation of Structural Properties of Carbon-Epoxy Composites Using Embedded Fiber-Optic Bragg Gratings

Osei, Albert J.; The 2002 NASA Faculty Fellowship Program Research Reports; April 2003, pp. XXXII-1 - XXXII-5; In English; See also 20030093576

Contract(s)/Grant(s): NAG8-1859; No Copyright; Avail: CASI; C01, CD-ROM; A01, Hardcopy

Real time monitoring of the mechanical integrity and stresses on key aerospace composite structures like aircraft wings, walls of pressure vessels and fuel tanks or any other structurally extended components and panels as in space telescopes is very important to NASA. Future military and commercial aircraft as well as NASA space systems such as Space Based Radar and International Space Station will incorporate a monitoring system to sense any degradation to the structure. In the extreme flight conditions of an aerospace vehicle it might be desirable to measure the strain every ten centimeters and thus fully map out the strain field of a composite component. A series of missions and vehicle health management requirements call for these measurements. At the moment thousands of people support a few vehicle launches per year. This number can be significantly reduced by implementing intelligent vehicles with integral nervous systems (smart structures). This would require maintenance to be performed only as needed. Military and commercial aircrafts have an equally compelling case. Annual maintenance costs are currently reaching astronomical heights. Monitoring techniques are therefore required that allow for maintenance to be performed only when needed. This would allow improved safety by insuring that necessary tasks are performed while reducing costs by eliminating procedures that are costly and not needed. The advantages fiber optical sensors have over conventional electro-mechanical systems like strain gauges have been widely extolled in the research literature. These advantages include their small size, low weight, immunity to electrical resistance, corrosion resistance, compatibility with composite materials and process conditions, and multiplexing capabilities. One fiber optic device which is suitable for distributed sensing is the fiber Bragg grating (FBG). This is a periodic perturbation in the refractive index of the fiber core. When a broadband light is coupled into the optical fiber sensor, a reflection peak will be obtained centered around a wavelength called Bragg-wavelength. The Bragg-wavelength depends on the refractive index and the period of the grating, which both change due to mechanical and thermal strain applied to the sensor. The shift in the Bragg-wavelength is directly proportional to the strain. Researchers at NASA MSFC are currently developing techniques for using FBGs for monitoring the integrity of advanced structural materials expected to become the mainstay of the current and future generation space structures. Since carbon-epoxy composites are the materials of choice for the current space structures, the initial study is concentrated on this type of composite. The goals of this activity are to use embedded FBG sensors for measuring strain and temperature of composite structures, and to investigate the effects of various parameters such as composite fiber orientation with respect to the optical sensor, unidirectional fiber composite, fabrication process etc., on the optical performance of the sensor. This paper describes an experiment to demonstrate the use of an embedded FBG for measuring strain in a composite material. The performance of the fiber optic sensor is determined by direct comparison with results from more conventional instrumentation.

Derived from text

Composite Structures; Epoxy Matrix Composites; Fiber Optics; Fiber Composites; Bragg Gratings; Aircraft Structures

20030093640 NASA Glenn Research Center, Cleveland, OH, USA

Effect of Individual Component Life Distribution on Engine Life Prediction

Zaretsky, Erwin V.; Hendricks, Robert C.; Soditus, Sherry M.; August 2003; 26 pp.; In English; Probabilistic Aspects of Life Predictions, 6-7 Nov. 2002, Miami Beach, FL, USA

Contract(s)/Grant(s): WBS 323-71-00

Report No.(s): NASA/TM-2003-212532; E-13591; NAS 1.15:212532; No Copyright; Avail: CASI; A03, Hardcopy

The effect of individual engine component life distributions on engine life prediction was determined. A Weibull-based life and reliability analysis of the NASA Energy Efficient Engine was conducted. The engine s life at a 95 and 99.9 percent probability of survival was determined based upon the engine manufacturer s original life calculations and assumed values of each of the component s cumulative life distributions as represented by a Weibull slope. The lives of the high-pressure turbine (HPT) disks and blades were also evaluated individually and as a system in a similar manner. Knowing the statistical cumulative distribution of each engine component with reasonable engineering certainty is a condition precedent to predicting the life and reliability of an entire engine. The life of a system at a given reliability will be less than the lowest-lived component in the system at the same reliability (probability of survival). Where Weibull slopes of all the engine components are equal, the Weibull slope had a minimal effect on engine L(sub 0.1) life prediction. However, at a probability of survival

of 95 percent (L(sub 5) life), life decreased with increasing Weibull slope.
Author
Engine Parts; Life (Durability); Turbine Blades; Probability Theory; Statistical Analysis; Reliability Engineering; Aircraft Engines

20030097976 Orenda Aerospace Corp., Gloucester, Ontario, Canada
Electron Beam Weld Repair and Qualification of Titanium Fan Blades for Military Gas Turbine Engines
Azar, P.; Li, Ping; Patnaik, P. C.; Thamburaj, R.; Immarigeon, J-P.; Low Cost Composite Structures Cost Effective Application of Titanium Alloys in Military Platforms; March 2003, pp. 18-1 - 18-16; In English; See also 20030097962; Original contains color and black and white illustrations; Copyright; Avail: CASI; C01, CD-ROM; A03, Hardcopy

The concept of repair and rejuvenation of service exposed gas turbine engine components is now widely accepted by most commercial aero engine users. The predominant mode of damage to gas turbine engine fan blades is foreign object damage (FOD). FOD is primarily caused in service by the ingestion of birds, rocks and ice, particularly during takeoff and landing. Impact of these objects can cause a twist in the blade airfoil, which can deflect the leading edge into the inlet guide vanes. In this paper, severely foreign object damaged Ti-6Al-4V fan blades have been refurbished to a near new condition by an electron beam welding process. The repair process involves the removal of the damaged portion of the airfoil using an abrasive water jet cutting method followed by electron beam welding of a pre-formed titanium patch. Non-destructive (visual, fluorescent penetrant and X-Ray) and metallurgical (destructive) inspections were carried out to verify the weld quality with respect to porosity, cracks, lack of fusion and microstructural texture. A coordinate measuring machine was used to establish an average data file for the original fan blade geometry taken from six new (baseline) fan blades. A numerical-control computer aided manufacturing process was used to restore the original geometry of the fan blade during machining. A number of bench tests were carried out prior to the part acceptance for spin pit and/or engine test, including: surface residual stress, surface hardness, low cycle fatigue, natural frequency, vibration, ballistic impact and engine block testing. The electron beam process yields acceptable welds within the aerospace industry standard limits. The repair cost is 65% of the new part replacement cost and provides 100% reduction in the current FOD rejection rate for the engine and fleet examined. Based on the results obtained in this study, the electron beam weld repair scheme presented was deemed viable for the repair of foreign object damaged titanium gas turbine engine fan blades.
Author
Electron Beam Welding; Titanium Alloys; Fan Blades; Gas Turbine Engines; Replacing; Numerical Control

20030097977 MTU Aero Engines, Munich, Germany
Titanium Rotors in Military Aero Engines: Designed to Weight and Life
Broede, Juergen; Low Cost Composite Structures and Cost Effective Application of Titanium Alloys in Military Platforms; March 2003, pp. 16-1 - 16-13; In English; See also 20030097962; Original contains black and white illustrations; Copyright; Avail: CASI; C01, CD-ROM; A03, Hardcopy

Aero engines for military aircraft traditionally have to fulfill the requirement of high thrust to weight ratio, what means that additionally to the high thrust also low weight is required. As the parts also have to withstand significant temperatures, materials with low specific weight but high strength even under elevated temperatures are necessary. The answer is twofold: Titanium alloys for parts under moderate temperature (e.g. compressors) and Nickel alloys for the high temperature region (e.g. turbines). A further requirement is a component life which allows for a 30 to 40 year engine life. Both requirements together call for the best and latest alloys and for highly sophisticated design and manufacturing procedures. Cost drivers in the development and production phase are demanding material properties and material quality as well as manufacturing efforts. Production cost can be influenced in the development phase if the criteria of minimum number of parts and design to manufacturing are observed. Cost of ownership is driven by maintenance efforts and spare part cost. One of the requirements is to reduce or bundle maintenance activities. Another aspect could be a trade off between new parts' cost and parts life. Cost reduction can be achieved by optimum exploitation of the parts' life potential. The means are improvement of the lifting concepts which should allow for safe extension of life in the crack propagation regime beyond the classical crack initiation life as well as improved accuracy of the life prediction procedures. Accurate records of life consumption under real operation obtained by individual life usage monitoring contribute to cost reduction, too.
Author
Aircraft Engines; Cost Reduction; Crack Initiation; Crack Propagation; Fatigue Life; Low Weight; Maintenance; Prediction Analysis Techniques

20030097981 NASA Langley Research Center, Hampton, VA, USA

Low-Cost Composite Materials and Structures for Aircraft Applications

Deo, Ravi B.; Starnes, James H., Jr.; Holzwarth, Richard C.; Low Cost Composite Structures and Cost Effective Application of Titanium Alloys in Military Platforms; March 2003, pp. 1-1 - 1-11; In English; See also 20030097962; Original contains color illustrations; Copyright; Avail: CASI; C01, CD-ROM; A03, Hardcopy

A survey of current applications of composite materials and structures in military, transport and General Aviation aircraft is presented to assess the maturity of composites technology, and the payoffs realized. The results of the survey show that performance requirements and the potential to reduce life cycle costs for military aircraft and direct operating costs for transport aircraft are the main reasons for the selection of composite materials for current aircraft applications. Initial acquisition costs of composite airframe components are affected by high material costs and complex certification tests which appear to discourage the widespread use of composite materials for aircraft applications. Material suppliers have performed very well to date in developing resin matrix and fiber systems for improved mechanical, durability and damage tolerance performance. The next challenge for material suppliers is to reduce material costs and to develop materials that are suitable for simplified and inexpensive manufacturing processes. The focus of airframe manufacturers should be on the development of structural designs that reduce assembly costs by the use of large-scale integration of airframe components with unitized structures and manufacturing processes that minimize excessive manual labor.

Author

Composite Materials; Aircraft Structures

20030097988 Acsion Industries, Inc., Pinawa, Manitoba, Canada

Electron Beam Processing for Operational Sustainment of Ageing Aircraft

Lopata, Vincent J.; Puzianowski, Allan; Biggin, Larry; Petrescue, Laura; Johnston, Andrew; Raizenne, Donald; Low Cost Composite Structures and Cost Effective Application of Titanium Alloys in Military Platforms; March 2003, pp. 13-1 - 13-8; In English; See also 20030097962; Original contains color illustrations; Copyright; Avail: CASI; C01, CD-ROM; A02, Hardcopy

Electron beam (EB) curing represents an emerging and potentially revolutionary technology for processing advanced polymeric composite materials. Using this technique, composite structures can be cured at lower temperatures, at higher rates, and at lower costs than with conventional thermal curing techniques. However, while EB curing is currently the focus of intense research activity and undergoing rapid development, the technology remains several years from seeing widespread application for fabrication of high-end aerospace composite structures. In the interim, along with applications in other industrial sectors such as transportation and infrastructure, EB curing shows considerable near-term promise in an area of significant interest to civilian and military aircraft operators world-wide: operational sustainment of ageing aircraft. This promise arises from both the reduced risk associated with gradual introduction of novel materials and processes for a small number of local repairs (and reinforcements), as well as the fact that many of the advantages of EB curing, such as reduced process time, are especially critical for repair applications. Acsion Industries Inc., and its partners have developed and implemented EB repairs of commercial aircraft structures, several of which are now in service. Acsion has recently begun a collaborative project with the Institute for Aerospace Research of the National Research Council of Canada, with the aim of studying the application of EB curing for repair of secondary and tertiary structures of military aircraft.

Author

Electron Beams; Fabrication; Service Life; Commercial Aircraft; Aircraft Maintenance

20030099672 NASA, Washington, DC, USA

One Hundred Years of Powered Flight

Spinoff 2003: 100 Years of Powered Flight; 2003, pp. 103-115; In English; See also 20030099639; Original contains color and black and white illustrations; No Copyright; Avail: National Technology Transfer Center (NTTC), Wheeling, WV

This year, Centennial of Flight celebrations across the USA are marking the tremendous achievement of the Wright brothers successful, powered, heavier-than-air flight on December 17, 1903. The vision and persistence of these two men pioneered the way for explorers, inventors, and innovators to take aeronautics from the beaches of Kitty Hawk, North Carolina, to the outer reaches of the solar system. Along this 100-year journey, NASA has played a significant role in developing and supporting the technologies that have shaped the aviation industry.

Derived from text

Aircraft Industry; Histories; Flight Operations

20030102183 Army Command and General Staff Coll., Fort Leavenworth, KS
Encouraging Risk and Embracing Uncertainty, The Need to Change US Army Culture
Ault, Robert T.; May 22, 2003; 63 pp.; In English
Report No.(s): AD-A415687; No Copyright; Avail: CASI; A04, Hardcopy

The history of unmanned aircraft from its origins before World War I through to the present has shown that unmanned aircraft in the past had not met with much success. Those that did meet with success were highly specialized and unable to accomplish a range of missions that would recommend large-scale integration into the USA military. Based on recent developments and operational successes, uninhabited combat aerial vehicles have finally reached the point where they will fulfill their promise across the spectrum of conflict. The Air Force is developing doctrine, weapons, and airframes that will yield a wealth of capability for the joint force commander by 2015. The United Stated military must be ready for the future-operating environment predicted by the Central Intelligence Agency and the Joint Staff. In order to do this, the Joint Staff has enumerated five required capabilities if joint forces in the near future: rapid global projection; forcible entry into a joint operations area; immediate and synchronized employment of scaleable joint forces tailored to conduct simultaneously a broad range of joint military operations utilizing unified action; sustainment for extended periods in an austere environment or under anti-access or area denial conditions; and continuous joint C4ISR employment and knowledge generation fusion. Additionally, given the world environment, the author has added two capabilities which will be of great benefit to the joint combatant commander: the ability to employ a weapons system in diplomatically sensitive situations and the capability to execute a portion of the theater missile defense mission. This makes a list of seven capabilities which are the criteria that define whether the uninhabited combat aerial vehicle will be of utility to the joint combatant commander.
DTIC
Combat; Military Operations; Drone Vehicles; Risk; Armed Forces (United States)

20030102199
Reduction of Thermal Residual Strains in Adhesively Bonded Composite Repairs
Crooks, Heather R.; Jun. 2003; 138 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F33615-00-D-5600
Report No.(s): AD-A415693; AFIT/GAE/ENY/03-11J; No Copyright; Avail: CASI; A07, Hardcopy

Many military and commercial aircraft are being called upon to fly well beyond their original intended service lives. This has forced the USA Air Force (USAF) to increasingly rely on structural repairs to address fatigue induced damage and to extend aircraft useful life. The focus of this research is the use of a high-strength composite patch technique to repair a fatigue crack on an aluminum aircraft structure. This study investigates the thermal residual strains that occur as a direct result of the coefficient of thermal expansion (CTE) mismatch between the repair patch and the underlying cracked metallic structure to which the patch is bonded. This research examines the response of a precracked 24 inches x 6 inches x 0.125 inch 7075-T6 aluminum panel repaired with a 15-ply graphite/epoxy patch. Two adhesives: EA 9696 and FM 73M were used with varying cure cycles. The hypothesis is that by reducing cure temperatures the CTE mismatch will be less dramatic thus yielding a more robust repair with a comparable fatigue crack growth rate. The research concluded that reducing the cure cycle temperature could decrease the thermal residual strains by as much as 26. 5% between the graphite/epoxy composite patch and structure when FM 73M adhesive is used to bond them together and 7.4% when EA 9696 is used. The research also concluded that a lower cure cycle temperature did not detrimentally affect the panels' fatigue crack growth rates.
DTIC
Commercial Aircraft; Adhesive Bonding; Graphite-Epoxy Composites

20030102202 Air Force Inst. of Tech., Wright-Patterson AFB, OH, USA
A Simulation-Based Analysis of the Impact of In-Sourcing a Major Process Element on the Coast Guard HH-60J Depot Maintenance Process
Vigus, Steven E.; Mar. 2003; 77 pp.; In English; Original contains color illustrations
Report No.(s): AD-A415691; AFIT/GAQ/ENS/03-03; No Copyright; Avail: CASI; A05, Hardcopy

Leaders at the USA Coast Guard's Aircraft Repair and Service Center (ARSC) in Elizabeth City, North Carolina recently formalized their planning and analysis functions by adding a dedicated branch to their command structure. The Planning and Analysis Branch intends to apply computer modeling and simulation to study the impact of process changes to the various Programmed Depot Maintenance (PDM) lines. This research considers the applicability of this type of modeling and simulation, using ARENA to study the current HH-6OJ PDM process. The contribution of this research is a methodology specific to ARSC needs, an analysis of methodology based on a discrete event simulation model of PDM lines, and a specific case study demonstrating the methodologies. The response variable of interest is average PDM process time as a function of

either in-sourcing or out-sourcing labor for a major process step. The research includes development and evaluation of a macro-level process model using ARENA 5.0.
DTIC
Computerized Simulation; Aircraft Maintenance

20030102204 Naval Research Lab., Stennis Space Center, MS
AV-8B Map System II: Moving-Map Composer (MMC) Version 3.5, Software User's Manual (Third Edition)
Myrick, Stephaine A.; Watkins, Jessica L.; Lohrenz, Maura C.; Trenchard, Michael E.; Gendron, Marlin L.; Jun. 27, 2003; 93 pp.; In English; Original contains color illustrations
Report No.(s): AD-A415697; NRL/FR/7440--003-10; 041; No Copyright; Avail: CASI; A05, Hardcopy

This report documents the Moving Map Composer (MMC) software system developed by scientists in NRL Code 744O. 1. This is the third edition of the MMC User's Manual (the first and second editions are NRL/FR/744l--97-9677 and NRL/FR/7440--OO-9983, respectively). The third edition reflects changes that were implemented for the latest release (version 3.5) of MMC. The MMC software is resident on the Map-II Station portion of the AV-8B Mission Support System, which NRL designed and configured in support of AV-8B mission planners and pilots in the field.system
DTIC
User Manuals (Computer Programs); Attack Aircraft; Support Systems; Harrier Aircraft

20030105754 Pisa Univ., Italy
Neural Networks and other Techniques for Fault Identification and Isolation of Aircraft Systems
Innocenti, M.; Napolitano, M.; Intelligent Systems for Aeronautics; June 2003, pp. 11-1 - 11-26; In English; See also 20030105742; Original contains color and black and white illustrations; Copyright; Avail: CASI; C01, CD-ROM; A03, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Fault identification, isolation, and accomodation have become critical issues in the overall performance of advanced aircraft systems. Neural Networks have shown to be a very attractive alternative to classic adaptation methods for identification and control of non-linear dynamic systems. The purpose of this paper is to show the improvements in neural network applications achievable through the use of learning algorithms more efficient than the classic Back-Propagation, and through the implementation of the neural schemes in parallel hardware. The results of the analysis of a scheme for Sensor Failure, Detection, Identification and Accommodation (SFDIA) using experimental flight data of a research aircraft model are presented. Conventional approaches to the problem are based on observers and Kalman Filters while more recent methods are based on neural approximators. The work described in this paper is based on the use of neural networks (NNs) as on-line learning non-linear approximators. The performances of two different neural architectures were compared. The first architecture is based on a Multi Layer Perceptron (MLP) NN trained with the Extended Back Propagation algorithm (EBPA). The second architecture is based on a Radial Basis Function (RBF) NN trained with the Extended-MRAN (EMRAN) algorithms. In addition, alternative methods for communications links fault detection and accomodation are presented, relative to multiple unmanned aircraft applications.
Derived from text
Aircraft Models; Fault Detection; Neural Nets; Research Aircraft; Aerospace Systems

20030105755 Italian Aerospace Research Center, Capua, Italy
Airfoil Design Using Navier-Stokes Equations and Hybrid Evolutionary Optimization Techniques
Quagliarella, Domenico; DAmbrosio, Domenic; Iollo, Angelo; Intelligent Systems for Aeronautics; June 2003, pp. 12-1 - 12-13; In English; See also 20030105742; Original contains color illustrations
Contract(s)/Grant(s): CEC-GRD1-1999-10752; Copyright; Avail: CASI; C01, CD-ROM; A03, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

An application of hybrid optimization techniques to airfoil design with Navier-Stokes equations is here presented and discussed. The greatest obstacle in the use of Navier-Stokes equations with evolutionary optimization procedures is the huge computational effort required. To overcome this limit, several approaches have been suggested, that range form parallel genetic algorithms [1, 2] to approximated fitness evaluation [3, 4] to hybrid techniques [5]. These three approaches can be profitably combined and an example will be here given related to transonic airfoil design. The lecture is organized as follows: an outline of hybrid optimization techniques will be given then the parallel hybrid genetic algorithm will be presented. Thereafter an application example will be reported, and finally some ongoing developments about the hybrid approach based on gradient

computation through the adjoint to Navier-Stokes equations will be described.
Author
Genetic Algorithms; Airfoils

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*.

20030093544 NASA Dryden Flight Research Center, Edwards, CA, USA
The F-15B Propulsion Flight Test Fixture: A New Flight Facility For Propulsion Research
Corda, Stephen; Vachon, M. Jake; Palumbo, Nathan; Diebler, Corey; Tseng, Ting; Ginn, Anthony; Richwine, David; July 2001; 18 pp.; In English; 37th AIAA/SAE/ASME/ASEE Joint Propulsion Conference and Exhibit, 8-11 Jul. 2001, Salt Lake City, UT, USA; Original contains color and black and white illustrations
Contract(s)/Grant(s): WU 529-35-14-00-38
Report No.(s): NASA/TM-2001-210395; H-2457; NAS 1.15:210395; AIAA Paper 2001-3303; No Copyright; Avail: CASI; A03, Hardcopy

The design and development of the F-15B Propulsion Flight Test Fixture (PFTF), a new facility for propulsion flight research, is described. Mounted underneath an F-15B fuselage, the PFTF provides volume for experiment systems and attachment points for propulsion devices. A unique feature of the PFTF is the incorporation of a six-degree-of-freedom force balance. Three-axis forces and moments can be measured in flight for experiments mounted to the force balance. The NASA F-15B airplane is described, including its performance and capabilities as a research test bed aircraft. The detailed description of the PFTF includes the geometry, internal layout and volume, force-balance operation, available instrumentation, and allowable experiment size and weight. The aerodynamic, stability and control, and structural designs of the PFTF are discussed, including results from aerodynamic computational fluid dynamic calculations and structural analyses. Details of current and future propulsion flight experiments are discussed. Information about the integration of propulsion flight experiments is provided for the potential PFTF user.
Author
Flight Tests; Aircraft Design; Rocket-Based Combined-Cycle Engines; Propulsion System Performance; F-15 Aircraft; Computational Fluid Dynamics; Test Facilities

20030093553 Modern Technologies Corp., Middleburg Heights, OH, USA
Jet Noise Modeling for Coannular Nozzles Including the Effects of Chevrons
Stone, James R.; Berton, Jeffrey J., Technical Monitor; Krejsa, Eugene A.; Clark, Bruce J.; September 2003; 211 pp.; In English
Contract(s)/Grant(s): NAS3-00178; WBS 22-781-30-12
Report No.(s): NASA/CR-2003-212522; E-14084; NAS 1.26:212522; No Copyright; Avail: CASI; A10, Hardcopy

Development of good predictive models for jet noise has always been plagued by the difficulty in obtaining good quality data over a wide range of conditions in different facilities.We consider such issues very carefully in selecting data to be used in developing our model. Flight effects are of critical importance, and none of the means of determining them are without significant problems. Free-jet flight simulation facilities are very useful, and can provide meaningful data so long as they can be analytically transformed to the flight frame of reference. In this report we show that different methodologies used by NASA and industry to perform this transformation produce very different results, especially in the rear quadrant; this compels us to rely largely on static data to develop our model, but we show reasonable agreement with simulated flight data when these transformation issues are considered. A persistent problem in obtaining good quality data is noise generated in the experimental facility upstream of the test nozzle: valves, elbows, obstructions, and especially the combustor can contribute significant noise, and much of this noise is of a broadband nature, easily confused with jet noise. Muffling of these sources is costly in terms of size as well as expense, and it is particularly difficult in flight simulation facilities, where compactness of hardware is very important, as discussed by Viswanathan (Ref. 13). We feel that the effects of jet density on jet mixing noise may have been somewhat obscured by these problems, leading to the variable density exponent used in most jet noise prediction procedures including our own. We investigate this issue, applying Occam s razor, (e.g., Ref. 14), in a search for the simplest physically meaningful model that adequately describes the observed phenomena. In a similar vein, we see no reason

to reject the Lighthill approach; it provides a very solid basis upon which to build a predictive procedure, as we believe we demonstrate in this report. Another feature of our approach is that the analyses are all conducted with lossless spectra, rather than Standard Day spectra, as is often done in industry. We feel that it is important to isolate the effects of as many physical processes as practical. Atmospheric attenuation can then be included using the relations developed for NASA by Shields and Bass (Ref. 15), which are available in both FOOTPR and ANOPP. The current approach to coannular jet noise prediction used in FOOTPR is reported in Reference 16, which updates the earlier conventional-velocity-profile (CVP, Ref. 17) and inverted-velocity-profile (IVP, Ref. 18) models.
Author
Jet Aircraft Noise; Exhaust Nozzles; Prediction Analysis Techniques

20030093663 QSS Group, Inc., Cleveland, OH, USA
A Simple Model of Pulsed Ejector Thrust Augmentation
Wilson, Jack; Deloof, Richard L., Technical Monitor; August 2003; 30 pp.; In English
Contract(s)/Grant(s): NAS3-00145; WBS 708-48-01
Report No.(s): NASA/CR-2003-212541; E-14107; NAS 1.26:212541; No Copyright; Avail: CASI; A03, Hardcopy

A simple model of thrust augmentation from a pulsed source is described. In the model it is assumed that the flow into the ejector is quasi-steady, and can be calculated using potential flow techniques. The velocity of the flow is related to the speed of the starting vortex ring formed by the jet. The vortex ring properties are obtained from the slug model, knowing the jet diameter, speed and slug length. The model, when combined with experimental results, predicts an optimum ejector radius for thrust augmentation. Data on pulsed ejector performance for comparison with the model was obtained using a shrouded Hartmann-Sprenger tube as the pulsed jet source. A statistical experiment, in which ejector length, diameter, and nose radius were independent parameters, was performed at four different frequencies. These frequencies corresponded to four different slug length to diameter ratios, two below cut-off, and two above. Comparison of the model with the experimental data showed reasonable agreement. Maximum pulsed thrust augmentation is shown to occur for a pulsed source with slug length to diameter ratio equal to the cut-off value.
Author
Thrust Augmentation; Mathematical Models

20030093721 NASA Glenn Research Center, Cleveland, OH, USA
Development of a Turbofan Engine Simulation in a Graphical Simulation Environment
Parker, Khary I.; Guo, Ten-Heui; August 2003; 19 pp.; In English
Contract(s)/Grant(s): WBS 22-704-30-01
Report No.(s): NASA/TM-2003-212543; E-14109; NAS 1.15:212543; No Copyright; Avail: CASI; A03, Hardcopy

This paper presents the development of a generic component level model of a turbofan engine simulation with a digital controller, in an advanced graphical simulation environment. The goal of this effort is to develop and demonstrate a flexible simulation platform for future research in propulsion system control and diagnostic technology. A previously validated FORTRAN-based model of a modern, high-performance, military-type turbofan engine is being used to validate the platform development. The implementation process required the development of various innovative procedures, which are discussed in the paper. Open-loop and closed-loop comparisons are made between the two simulations. Future enhancements that are to be made to the modular engine simulation are summarized.
Author
Turbofan Engines; Computerized Simulation; Control Simulation; Control Systems Design; Engine Control

20030093728 NASA Glenn Research Center, Cleveland, OH, USA
SiC Fiber-Reinforced Celsian Composites
Bansal, Narottam P.; August 2003; 28 pp.; In English
Contract(s)/Grant(s): WBS 22-708-31-11
Report No.(s): NASA/TM-2003-212555; E-14121; NAS 1.15:212555; No Copyright; Avail: CASI; A03, Hardcopy

Celsian is a promising matrix material for fiber-reinforced composites for high temperature structural applications. Processing and fabrication of small diameter multifilament silicon carbide tow reinforced celsian matrix composites are described. Mechanical and microstructural properties of these composites at ambient and elevated temperatures are presented. Effects of high-temperature exposures in air on the mechanical behavior of these composites are also given. The composites show mechanical integrity up to ~1100 C but degrade at higher temperatures in oxidizing atmospheres. A model has been

proposed for the degradation of these composites in oxidizing atmospheres at high temperatures.
Author
Fabrication; Microstructure; Silicon Carbides; Mechanical Properties; Glass; Matrix Materials; Ceramics

20030102270 NASA Glenn Research Center, Cleveland, OH, USA
Dissociation and Recombination Effects on the Performance of Pulse Detonation Engines
Povinelli, Louis A.; August 2003; 11 pp.; In English; 16th International Symposium on Airbreathing Engines, 31 Aug. - 5 Sep. 2003, Cleveland, OH, USA
Contract(s)/Grant(s): WBS-22-719-10-01
Report No.(s): NASA/TM-2003-212538; NAS 1.15:212538; E-14104; ISABE-2003-1216; No Copyright; Avail: CASI; A03, Hardcopy

This paper summarizes major theoretical results for pulse detonation engine performance taking into account real gas chemistry, as well as significant performance differences resulting from the presence of ram and compression heating. An unsteady CFD analysis, as well as a thermodynamic cycle analysis, was conducted in order to determine the actual and the ideal performance for an air-breathing pulse detonation engine (PDE) using either a hydrogen-air or ethylene-air mixture over a flight Mach number range from 0 to 4. The results clearly elucidate the competitive regime of PDE application relative to ramjets and gas turbines.
Author
Pulse Detonation Engines; Thermodynamic Cycles; Jet Thrust; Specific Impulse

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*.

20030102212 Burnette Engineering, Fairborn, OH
Automatic Legibility Control (ALC) of Electronic Displays
Burnette, Keith T.; Feb. 2003; 427 pp.; In English
Contract(s)/Grant(s): F33615-94-C-3801; Proj-2403
Report No.(s): AD-A415752; AFRL-HE-WP-TR-2003-0064; No Copyright; Avail: CASI; A19, Hardcopy

Pilot legibility requirements are investigated to establish a basis for implementing automatic control over electronic and conventional displays, in day through night aircraft cockpit viewing environments. Applicable legibility test results, published by different experimenters over much of the past century, are examined and analyzed, and comparisons are used to assess their validity as display control criteria. The mathematical model of the human visual system developed provides a basis for the design of display automatic legibility controls, suitable for use in aircraft cockpits, by predicting the pilot's image difference luminance requirements, in the presence of luminance specularly and diffusely reflected from the display viewing surfaces, and with discrete and distributed glare sources incident on the pilot's eyes. Although this general automatic legibility control (ALC) model and the automatic brightness control (ABC) model, used in the newer Boeing airliners, appear quite different, comparisons show that, when properly implemented, the two models give equivalent results. The advantage of the ALC model is its greater design flexibility, owing to its better defined physical relationship to vision. Various practical design choices that should be taken into consideration to achieve a successful application of automatic legibility controls are explored in the balance of the report. This includes, for example: methods of achieving compatibility with light reflective, transflective, emissive and transmissive operating mode displays; the relative merits of viable alternatives to the recommended constant legibility control characteristic strategy; interactions between controls for legibility and sensor-video signal conditioning; the type and need for pilot legibility trim controls; and possible response time compensations for the light and dark adaptation of the pilot's eyes during the following glare source exposures.
DTIC
Pilots; Display Devices; Luminance

20030102216 NASA Goddard Space Flight Center, Greenbelt, MD, USA
18-Degree-of-Freedom Controller Design for the ST7 Disturbance Reduction System
Markley, F. L.; Maghami, P. G.; Houghton, M. B.; Hsu, O. C.; June 20, 2003; 11 pp.; In English; AAS Astrodynamics Specialist Conference, 3-7 Aug. 2003, Big Sky, MT, USA
Report No.(s): AAS-03-586; No Copyright; Avail: CASI; A03, Hardcopy

The Space Technology 7 experiment will perform an on-orbit system-level validation of a Disturbance Reduction System employing gravitational reference sensors and micronewton colloidal thrusters to maintain a spacecraft s position with respect to free-floating test masses in the gravitational reference sensors to less than 10 nm/dHz over the frequency range 1 to 30 mHz. This paper presents the design and analysis of the control system that closes the loop between the gravitational reference sensors and the micronewton thrusters while incorporating star tracker data at low frequencies. The effects of disturbances and actuation and measurement noise are evaluated in a eighteen-degree-of-freedom model.
Author
Degrees Of Freedom; Spacecraft Control; Control Systems Design; Space Technology Experiments; Star Trackers

20030105455 Aeronautical Systems Div., Wright-Patterson AFB, OH
Aircraft Attitude Awareness Workshop Proceedings
McNaughton, Grant B.; Apr. 1987; 669 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): Proj-2403
Report No.(s): AD-A416260; ASD-TR-89-5020; WRDC-TR-89-7009; No Copyright; Avail: CASI; A99, Hardcopy

This report constitutes the proceedings of a workshop on Aircraft Attitude Awareness held at WPAFB, OH. 8- 10 Oct 1985. The purpose of the workshop was to address the problem of loss of aircraft attitude awareness, primarily in the single-seat fighter attack aircraft, to recommend practical fixes to current operational aircraft and training measures to overcome their deficiencies, and to recommend initiatives to ensure that problems in the pilot-vehicle - interface of present aircraft be considered in the design of future aircraft, e.g., ATF. There were a number of findings and recommendations to prevent collisions with the surface, to improve displays for orientation and other critical control parameters, to improve aircraft for the enhanced night-weather role, to improve training, and to improve communications.
DTIC
Aircraft Design; Aircraft Compartments; Attitude (Inclination)

20030105743 Pisa Univ., Italy
Intelligent Management Control for Unmanned Aircraft Navigation and Formation Keeping
Innocenti, M.; Giulietti, F.; Pollini, L.; Intelligent Systems for Aeronautics; June 2003, pp. 2-1 - 2-22; In English; See also 20030105742; Original contains color illustrations; Copyright; Avail: CASI; C01, CD-ROM; A03, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The paper presents some aspects that have become critical in the context of guidance, navigation, and control of unmanned aerial vehicles. The envisioned cost-effectiveness of unmanned air vehicles in support of a variety of military and civilian applications has introduced basic and applied research challenges in areas such as levels of autonomy and intelligence of the platform, interaction with manned control centers, reliability and safety of operations, and control management of single vehicle, as well as formation flights. The paper addresses issues such as dynamic modeling, formation management and control, and guidance aspects. Their origin and potential solutions are presented with particular attention to flexible formation keeping.
Author
Air Navigation; Autonomy; Pilotless Aircraft; Formation Flying; Military Technology; Aerospace Vehicles; 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 astronautical facilities see *14 Ground Support Systems and Facilities (Space)*.

20030098032 NASA Langley Research Center, Hampton, VA, USA
Improvements to Wall Corrections at the NASA Langley 14 x 22-Ft Subsonic Tunnel
Iyer, Venkit; Kuhl, David D.; Walker, Eric L.; [2003]; 15 pp.; In English; 21st AIAA Applied Aerodynamics Conference, 23-26 Jun. 2003, Orlando, FL, USA
Report No.(s): AIAA Paper 2003-3950; Copyright; Avail: CASI; A03, Hardcopy

The new wall pressure measurement system and the TWICS wall correction system for the 14x22-Ft subsonic tunnel are described. Results from a recent semispan test and a full-span test are presented. Comparison with existing classical methods of correction is shown. A modification of the TWICS code to treat the effect due to a deflected wake from a high-lift wing

is also discussed. The current implementation of TWICS for the 14x22-Ft tunnel is shown to be an improvement over existing methods.
Author
Pressure Measurement; Wall Pressure; Subsonic Wind Tunnels; Wind Tunnel Walls

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*.

20030098026, NASA, Washington, DC, USA
U.S. Aerospace and Aviation Industry: A State-by-State Analysis
Oct. 2002; 116 pp.
Report No.(s): PB2003-106681; No Copyright; Avail: CASI; A06, Hardcopy

President George W. Bush and the Congress created the Commission on the Future of the USA Aerospace Industry to evaluate the current and future health of the industry as well as the challenges that lie ahead for the U.S. workforce and the economy. To accomplish our mission, we commissioned a study on the economic impact of the aerospace industry nationally and on a state-by-state basis, using the best available U.S. government data. This study sought to define the core of the aerospace industry. The resulting data represents that very core those jobs specifically tied to commercial and civilian aerospace. U.S. Aerospace and Aviation: A State-by-State Analysis examines the civilian and commercial aerospace and aviation industry by employment, wages, payroll, and establishments. The report found that the U.S. civilian and commercial aerospace and aviation industry employed over 2 million workers in 2001.
NTIS
Aerospace Industry; Government/Industry Relations; United States

13
ASTRODYNAMICS

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

20030105665 NASA Glenn Research Center, Cleveland, OH, USA
A Comparison of Electric Propulsion Systems for Mars Exploration
Fiehler, Douglas; Oleson, Steve; September 2003; 12 pp.; In English; 39th Joint Propulsion Conference and Exhibit, 20-23 Jul. 2003, Huntsville, AL, USA
Contract(s)/Grant(s): WBS 22-982-10-03
Report No.(s): NASA/TM-2003-212593; E-14150; NAS 1.15:212593; AIAA Paper 2003-4574; No Copyright; Avail: CASI; A03, Hardcopy

Earth-Mars trajectories for multiple solar-powered spacecraft configurations were generated using Hall and ion propulsion systems utilizing the Direct Trajectory Optimization Method. Payload and power trades versus trip time were examined. Performance was compared for purely interplanetary flight and interplanetary flight with estimated spiral in to Mars orbit. Evaluating current ion and Hall thruster technologies, similar payload masses were delivered by each at equivalent trip times, but with the Hall thruster operating at a power level 10 kilowatts, on average, less than the ion thruster. The power difference for equivalent payload delivered should result in a significant cost savings.
Author
Mars Exploration; Earth-Mars Trajectories; Electric Propulsion; Solar Powered Aircraft; Spacecraft Configurations

15
LAUNCH VEHICLES AND LAUNCH OPERATIONS

Includes all classes of launch vehicles, launch/space vehicle systems, and boosters; and launch operations. For related information see also *18 Spacecraft Design, Testing and Performance*; and *20 Spacecraft Propulsion and Power*.

20030093740 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Correlation of the Hubble Space Telescope (HST) Space Telescope Imaging Spectrometer (STIS) On-Orbit Data with Pre-launch Predictions and Ground Contamination Controls
Hansen, Patricia A.; April 2003; 7 pp.; In English; 9th International Symposium on Materials in a Space Environment, 16-20 Jun. 2003, Amsterdam,, Netherlands; No Copyright; Avail: CASI; A02, Hardcopy

The Hubble Space Telescope (HST) Space Telescope Imaging Spectrograph (STIS) was deployed on-orbit in February 1997. The contamination program for STIS was stringently controlled as the five-year end-of-life deposition was set at 158, per optical element. Contamination was controlled through materials selection, extensive vacuum outgassing certifications, cleaning techniques, and environmental controls. In addition to ground contamination controls, on-orbit contamination controls were implemented for both the HST servicing mission activities and early post-servicing mission checkout. The extensive contamination control program will be discussed and the STIS on-orbit data will be correlated with the prelaunch analytical predictions.
Author
Contamination; Environmental Control; Hubble Space Telescope; Imaging Spectrometers; Spaceborne Telescopes; Prelaunch Tests

20030102198 Elizabeth City State Univ., NC, USA
Nurturing ECSU Research Talent (NERT)
Hayden, Linda; Jan. 2003; 97 pp.; In English
Contract(s)/Grant(s): N00014-98-1-0749; N00014-99-1-0990
Report No.(s): AD-A415685; No Copyright; Avail: CASI; A05, Hardcopy

The remote sensing field has seen an increase in the availability of data. There has been an increase in the satellites that have been launched and those scheduled to launch. With the increased availability of data and advancements, satellites data providers are able to supply researches with the data needed to conduct new and innovative projects. Sea Space, based in California, has designed TeraScan, a system for reception and processing of satellite data. During July 2002 a TeraScan system was installed on the campus of Elizabeth City State University. Its capabilities include receiving and processing HRPT and SWCRPT data from polar-orbiting satellites NOAA and Orbview-2. The Remote Sensing Research Team for 2003 learned how to process HRPT data from the NOAA satellites and decrypt and process the data for sea surface temperature. This project will lay the foundation for future projects by providing the necessary experience and training with the TeraScan data and software.
DTIC
Remote Sensing; Artificial Satellites; Data Processing; Telemetry; Spacecraft Launching

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*.

20030093584 Alabama Univ., Huntsville, AL, USA
An Accident in History: Challenger in Perspective
Waring, Stephen P.; The 2002 NASA Faculty Fellowship Program Research Reports; April 2003, pp. LII-1 - LII-5; In English; See also 20030093576
Contract(s)/Grant(s): NAG8-1859; No Copyright; Avail: CASI; C01, CD-ROM; A01, Hardcopy

For several years since the publication of a history of Marshall Space Flight Center, I have been studying the origins and meaning of the Space Shuttle Challenger accident. My long-term goal is to write a book on the history of the accident, and the 2002 NASA Faculty Fellowship allowed me to make substantial progress toward that goal. This summer I wrote about half the manuscript chapters, filled in numerous gaps in my research, interviewed several Marshall officials, and scanned dozens

of photographs and engineering illustrations. My book will differ in several respects from previous studies. It will cover a longer span of time and events most books begin with the test phase of the solid rocket motor and end shortly after the accident. Mine will go back to the Apollo Program and discuss the testing and quality control methods used on the Saturn rockets. It will also include considerable coverage of the origins of the shuttle configuration and program management system. In addition, it will also go forward beyond the accident, with almost half the book discussing the post-accident investigations, the redesign of the shuttle and boosters, and the interpretations about the tragedy that appeared in scholarly publications. Its focus will be comprehensive, but will concentrate on the history of solid rocket motor engineering and technology.
Author
Challenger (Orbiter); Accident Investigation

20030093634 Columbia Accident Investigation Board, Arlington, VA, USA, Federal Aviation Administration, Cambridge, MA, USA, NASA Ames Research Center, Moffett Field, CA, USA, Department of the Navy, Washington, DC, USA
Columbia Accident Investigation Board. Volume One
Gehmann, H. W.; Barry, J. L.; Deal, D. W.; Hallock, J. N.; Hess, K. W.; Aug. 26, 2003; In English
Report No.(s): PB2003-107244; No Copyright; Avail: National Technical Information Service (NTIS)

The Columbia Accident Investigation Board's independent investigation into the February 1, 2003, loss of the Space Shuttle Columbia and its seven-member crew lasted nearly seven months. A staff of more than 120, along with some 400 NASA engineers, supported the Board's 13 members. Investigators examined more than 30,000 documents, conducted more than 200 formal interviews, heard testimony from dozens of expert witnesses, and reviewed more than 3,000 inputs from the general public. In addition, more than 25,000 searchers combed vast stretches of the Western USA to retrieve the spacecraft's debris. In the process, Columbia's tragedy was compounded when two debris searchers with the U.S. Forest Service perished in a helicopter accident. This report concludes with recommendations, some of which are specifically identified and prefaced as 'before return to flight.' These recommendations are largely related to the physical cause of the accident, and include preventing the loss of foam, improved imaging of the Space Shuttle stack from liftoff through separation of the External Tank, and on-orbit inspection and repair of the Thermal Protection System. The remaining recommendations, for the most part, stem from the Board's findings on organizational cause factors. While they are not 'before return to flight' recommendations, they can be viewed as 'continuing to fly' recommendations, as they capture the Board's thinking on what changes are necessary to operate the Shuttle and future spacecraft safely in the mid- to long-term. These recommendations reflect both the Board's strong support for return to flight at the earliest date consistent with the overriding objective of safety, and the Board's conviction that operation of the Space Shuttle, and all human space-flight, is a developmental activity with high inherent risks.
NTIS
Accident Investigation; Columbia (Orbiter)

20030102266 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Prevention of Spacecraft Anomalies: The Role of Space Climate and Space Weather Models
Barth, Janet L.; [2003]; 23 pp.; In English; No Copyright; Avail: CASI; A03, Hardcopy

Space-based systems are developing into critical infrastructure to support the quality of life on Earth. Mission requirements along with rapidly evolving technologies have outpaced efforts to accommodate detrimental space environment impacts on systems. This chapter describes approaches to accommodate space climate and space weather impacts on systems and notes areas where gaps in model development limit our ability to prevent spacecraft anomalies.
Author
Aerospace Environments; Mission Planning

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*.

20030093535 NASA Glenn Research Center, Cleveland, OH, USA
Architecture Study of Space-Based Satellite Networks for NASA Missions
Ivancic, William D.; August 2003; 16 pp.; In English; 2003 Aerospace Conference, 8-15 Mar. 2003, Big Sky, MT, USA
Contract(s)/Grant(s): WBS 22-258-90-03
Report No.(s): NASA/TM-2003-212187; E-13790; NAS 1.15:212187; No Copyright; Avail: CASI; A03, Hardcopy

Traditional NASA missions, both near Earth and deep space, have been stovepipe in nature and point-to-point in architecture. Recently, NASA and others have conceptualized missions that required space-based networking. The notion of networks in space is a drastic shift in thinking and requires entirely new architectures, radio systems (antennas, modems, and media access), and possibly even new protocols. A full system engineering approach for some key mission architectures will occur that considers issues such as the science being performed, stationkeeping, antenna size, contact time, data rates, radio-link power requirements, media access techniques, and appropriate networking and transport protocols. This report highlights preliminary architecture concepts and key technologies that will be investigated.
Author
Satellite Networks; Architecture (Computers); Satellite Communication

20030093569 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Orbit Determination (OD) Error Analysis Results for the Triana Sun-Earth L1 Libration Point Mission and for the Fourier Kelvin Stellar Interferometer (FKSI) Sun-Earth L2 Libration Point Mission Concept
Marr, Greg C.; [2003]; 12 pp.; In English; 2003 AAS/AIAA Astrodynamics Specialist Conference Meetings, Aug. 2003, Big Sky, MT; No Copyright; Avail: CASI; A03, Hardcopy

The Triana spacecraft was designed to be launched by the Space Shuttle. The nominal Triana mission orbit will be a Sun-Earth L1 libration point orbit. Using the NASA Goddard Space Flight Center's Orbit Determination Error Analysis System (ODEAS), orbit determination (OD) error analysis results are presented for all phases of the Triana mission from the first correction maneuver through approximately launch plus 6 months. Results are also presented for the science data collection phase of the Fourier Kelvin Stellar Interferometer Sun-Earth L2 libration point mission concept with momentum unloading thrust perturbations during the tracking arc. The Triana analysis includes extensive analysis of an initial short arc orbit determination solution and results using both Deep Space Network (DSN) and commercial Universal Space Network (USN) statistics. These results could be utilized in support of future Sun-Earth libration point missions.
Author
Orbit Determination; Perturbation; Error Analysis; Libration; Spacecraft Orbits

20030093602 Rose-Hulman Inst. of Tech., Terre Haute, IN, USA
Fuzzy Logic Trajectory Design and Guidance for Terminal Area Energy Management
Burchett, Bradley; The 2002 NASA Faculty Fellowship Program Research Reports; April 2003, pp. IX-1 - IX-5; In English; See also 20030093576
Contract(s)/Grant(s): NAG8-1859; No Copyright; Avail: CASI; C01, CD-ROM; A01, Hardcopy

The second generation reusable launch vehicle will leverage many new technologies to make flight to low earth orbit safer and more cost effective. One important capability will be completely autonomous flight during reentry and landing, thus making it unnecessary to man the vehicle for cargo missions with stringent weight constraints. Implementation of sophisticated new guidance and control methods will enable the vehicle to return to earth under less than favorable conditions. The return to earth consists of three phases--Entry, Terminal Area Energy Management (TAEM), and Approach and Landing. The Space Shuttle is programmed to fly all three phases of flight automatically, and under normal circumstances the astronaut-pilot takes manual control only during the Approach and Landing phase. The automatic control algorithms used in the Shuttle for TAEM and Approach and Landing have been developed over the past 30 years. They are computationally efficient, and based on careful study of the spacecraft's flight dynamics, and heuristic reasoning. The gliding return trajectory is planned prior to the mission, and only minor adjustments are made during flight for perturbations in the vehicle energy state. With the advent of the X-33 and X-34 technology demonstration vehicles, several authors investigated implementing advanced control methods to provide autonomous real-time design of gliding return trajectories thus enhancing the ability of the vehicle to adjust to unusual energy states. The bulk of work published to date deals primarily with the approach and landing phase of flight where changes in heading angle are small, and range to the runway is monotonically decreasing. These benign flight conditions allow for model simplification and fairly straightforward optimization. This project focuses on the TAEM phase of flight where mathematically precise methods have produced limited results. Fuzzy Logic methods are used to make onboard autonomous gliding return trajectory design robust to a wider energy envelope, and the possibility of control surface failures, thus increasing the flexibility of unmanned gliding recovery and landing.
Derived from text
Fuzzy Systems; Logic Design; Trajectories; Terminal Area Energy Management; Automatic Control

20030093645 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Testing of Gyroless Estimation Algorithms for the FUSE Spacecraft
Harman, Rick; Thienel, Julie; Oshman, Yaakov; [2003]; 18 pp.; In English; 2003 AAS/AIAA Astrodynamics Specialist Conference Meeting, 3-7 Aug. 2003, Big Sky, MT, USA
Report No.(s): AAS-03-605; No Copyright; Avail: CASI; A03, Hardcopy

The Far Ultraviolet Spectroscopic Explorer (FUSE) is equipped with two ring laser gyros on each of the spacecraft body axes. In May 2001 one gyro failed. It is anticipated that all of the remaining gyros will fail, based on intensity warnings. In addition to the gyro failure, two of four reaction wheels failed in late 2001. The spacecraft control now relies heavily on magnetic torque to perform the necessary science maneuvers and hold on target. The only sensor consistently available during slews is a magnetometer. This paper documents the testing and development of magnetometer-based gyroless attitude and rate estimation algorithms for FUSE. The results of two approaches are presented, one relies on a kinematic model for propagation, a method used in aircraft tracking. The other is a pseudo-linear Kalman filter that utilizes Euler's equations in the propagation of the estimated rate. Both algorithms are tested using flight data collected over a few months after the reaction wheel failure. Finally, the question of closed-loop stability is addressed. The ability of the controller to meet the science slew requirements, without the gyros, is analyzed.
Author
Far UV Spectroscopic Explorer; Spacecraft Control; Algorithms; Magnetometers

20030093732 NASA Glenn Research Center, Cleveland, OH, USA
Beam-Switch Transient Effects in the RF Path of the ICAPA Receive Phased Array Antenna
Sands, O. Scott; September 2003; 17 pp.; In English
Contract(s)/Grant(s): WBS 22-322-70-01
Report No.(s): NASA/TM-2003-212588; E-14145; NAS 1.15:212588; No Copyright; Avail: CASI; A03, Hardcopy

When the beam of a Phased Array Antenna (PAA) is switched from one pointing direction to another, transient effects in the RF path of the antenna are observed. Testing described in the report has revealed implementation-specific transient effects in the RF channel that are associated with digital clocking pulses that occur with transfer of data from the Beam Steering Controller (BSC) to the digital electronics of the PAA under test. The testing described here provides an initial assessment of the beam-switch phenomena by digitally acquiring time series of the RF communications channel, under CW excitation, during the period of time that the beam switch transient occurs. Effects are analyzed using time-frequency distributions and instantaneous frequency estimation techniques. The results of tests conducted with CW excitation supports further Bit-Error-Rate (BER) testing of the PAA communication channel.
Author
Beam Switching; Phased Arrays; Antenna Arrays

20030093808 NASA Goddard Space Flight Center, Greenbelt, MD, USA
LISA Optics and Orbital Motions
Waluschka, Eugene; Scherr, Lawrence M.; [2003]; 1 pp.; In English; Almaldi-5 Conference, 7-12 Jul. 2003, Piza, Italy; No Copyright; Avail: Other Sources; Abstract Only

The Laser Interferometer Space Antenna (LISA) telescopes must be able to send to and receive light from the other two distant spacecraft. The angle between the distant spacecraft will vary by about one degree in the course of a year. In addition the send and receive directions, for any one telescope, will also vary because of changes in distance, relative velocities of the spacecraft and the flight time of the light. All of these (angular) motions place requirements on the telescope pointing mechanism and the compensating proof mass motions. In this paper we will present the magnitudes of these angular motions, within the context of Keplerian orbits, and the resulting image motions on the detectors.
Author
Lisa (Observatory); Spaceborne Telescopes; Spacecraft Orbits; Angular Velocity

20030102233 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Demonstrating a Realistic IP Mission Prototype
Rash, James; Ferrer, Arturo B.; Goodman, Nancy; Ghazi-Tehrani, Samira; Polk, Joe; Johnson, Lorin; Menke, Greg; Miller, Bill; Criscuolo, Ed; Hogie, Keith, et al.; [2003]; 6 pp.; In English; Earth Science Technology Conference (ESTC0 03), 24-26 Jun. 2003, Adelphi, MD, USA; Copyright; Avail: CASI; A02, Hardcopy

Flight software and hardware and realistic space communications environments were elements of recent demonstrations

of the Internet Protocol (IP) mission concept in the lab. The Operating Missions as Nodes on the Internet (OMNI) Project and the Flight Software Branch at NASA/GSFC collaborated to build the prototype of a representative space mission that employed unmodified off-the-shelf Internet protocols and technologies for end-to-end communications between the spacecraft/instruments and the ground system/users. The realistic elements used in the prototype included an RF communications link simulator and components of the TRIANA mission flight software and ground support system. A web-enabled camera connected to the spacecraft computer via an Ethernet LAN represented an on-board instrument creating image data. In addition to the protocols at the link layer (HDLC), transport layer (UDP, TCP), and network (IP) layer, a reliable file delivery protocol (MDP) at the application layer enabled reliable data delivery both to and from the spacecraft. The standard Network Time Protocol (NTP) performed on-board clock synchronization with a ground time standard. The demonstrations of the prototype mission illustrated some of the advantages of using Internet standards and technologies for space missions, but also helped identify issues that must be addressed. These issues include applicability to embedded real-time systems on flight-qualified hardware, range of applicability of TCP, and liability for and maintenance of commercial off-the-shelf (COTS) products. The NASA Earth Science Technology Office (ESTO) funded the collaboration to build and demonstrate the prototype IP mission.
Author
Ethernet; Spacecraft Communication; Mission Planning; Protocol (Computers); Prototypes

20030105557 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Near Earth Architectural Options for a Future Deep Space Optical Communications Network
Edwards, B. L.; Liebrecht, P. E.; Fitzgerald, R. J.; [2003]; 3 pp.; In English; Space OPS 2004, Montreal, Canada; No Copyright; Avail: Other Sources; Abstract Only

In the near future the National Aeronautics and Space Administration anticipates a significant increase in demand for long-haul communications services from deep space to Earth. Distances will range from 0.1 to 40 AU, with data rate requirements in the 1's to 1000's of Mbits/second. The near term demand is driven by NASA's Space Science Enterprise which wishes to deploy more capable instruments onboard spacecraft and increase the number of deep space missions. The long term demand is driven by missions with extreme communications challenges such as very high data rates from the outer planets, supporting sub-surface exploration, or supporting NASA's Human Exploration and Development of Space Enterprise beyond Earth orbit. Laser communications is a revolutionary communications technology that will dramatically increase NASA's ability to transmit information across the solar system. Lasercom sends information using beams of light and optical elements, such as telescopes and optical amplifiers, rather than RF signals, amplifiers, and antennas. This paper provides an overview of different network options at Earth to meet NASA's deep space lasercom requirements. It is based mainly on work done for the Mars Laser Communications Demonstration Project, a joint project between NASA's Goddard Space Flight Center (GSFC), the Jet Propulsion Laboratory, California Institute of Technology (JPL), and the Massachusetts Institute of Technology Lincoln Laboratory (MIT/LL). It reports preliminary conclusions from the Mars Lasercom Study conducted at MIT/LL and on additional work done for the Tracking and Data Relay Satellite System Continuation Study at GSFC. A lasercom flight terminal will be flown on the Mars Telesat Orbiter (MTO) to be launched by NASA in 2009, and will be the first high rate deep space demonstration of this revolutionary technology.
Author
Spacecraft Communication; Optical Communication; Interplanetary Spacecraft; Communication Networks; Architecture (Computers)

20030105599 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Increasing the Operational Value of Event Messages
Li, Zhenping; Savkli, Cetin; Smith, Dan; [2003]; 7 pp.; In English; Reducing the Cost of Spacecraft Ground Systems and Operations, 8-12 Jul. 2003, Pasadena, MD, USA; No Copyright; Avail: CASI; A02, Hardcopy

Assessing the health of a space mission has traditionally been performed using telemetry analysis tools. Parameter values are compared to known operational limits and are plotted over various time periods. This presentation begins with the notion that there is an incredible amount of untapped information contained within the mission s event message logs. Through creative advancements in message handling tools, the event message logs can be used to better assess spacecraft and ground system status and to highlight and report on conditions not readily apparent when messages are evaluated one-at-a-time during a real-time pass. Work in this area is being funded as part of a larger NASA effort at the Goddard Space Flight Center to create component-based, middleware-based, standards-based general purpose ground system architecture referred to as GMSEC - the GSFC Mission Services Evolution Center. The new capabilities and operational concepts for event display, event data analyses and data mining are being developed by Lockheed Martin and the new subsystem has been named GREAT - the GMSEC

Reusable Event Analysis Toolkit. Planned for use on existing and future missions, GREAT has the potential to increase operational efficiency in areas of problem detection and analysis, general status reporting, and real-time situational awareness. Author

Architecture (Computers); Space Missions; Telemetry; Systems Engineering; Message Processing

20030105757 Draper (Charles Stark) Lab., Inc., Cambridge, MA, USA

The Earth Phenomena Observing System: Intelligent Autonomy for Satellite Operations

Ricard, Michael; Abramson, Mark; Carter, David; Kolitz, Stephan; Intelligent Systems for Aeronautics; June 2003, pp. 3-1 - 3-12; In English; See also 20030105742; Original contains color illustrations

Contract(s)/Grant(s): NAS3-00163; Copyright; Avail: CASI; C01, CD-ROM; A03, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Earth monitoring systems of the future may include large numbers of inexpensive small satellites, tasked in a coordinated fashion to observe both long term and transient targets. For best performance, a tool which helps operators optimally assign targets to satellites will be required. We present the design of algorithms developed for real-time optimized autonomous planning of large numbers of small single-sensor Earth observation satellites. The algorithms will reduce requirements on the human operators of such a system of satellites, ensure good utilization of system resources, and provide the capability to dynamically respond to temporal terrestrial phenomena. Our initial real-time system model consists of approximately 100 satellites and large number of points of interest on Earth (e.g., hurricanes, volcanoes, and forest fires) with the objective to maximize the total science value of observations over time. Several options for calculating the science value of observations include the following: 1) total observation time, 2) number of observations, and the 3) quality (a function of e.g., sensor type, range, slant angle) of the observations. An integrated approach using integer programming, optimization and astrodynamics is used to calculate optimized observation and sensor tasking plans.

Author

Artificial Satellites; Earth Observations (From Space); Satellite Control; Artificial Intelligence; Autonomous Navigation

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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*.

20030093625 Alabama Univ., Huntsville, AL, USA

Active and Passive Control of ISS Rack Shelf Vibrations

Shepard, W. Steve, Jr.; The 2002 NASA Faculty Fellowship Program Research Reports; April 2003, pp. 1-5; In English; See also 20030093576; No Copyright; Avail: CASI; C01, CD-ROM; A01, Hardcopy

One of the main goals of the International Space Station (ISS) is to provide a platform for performing laboratory experiments in a microgravity environment. These experiments are typically housed in experiment racks that may contain multiple experiments occurring simultaneously. System functions as well as experiments can produce both vibratory and transient disturbances than can be transmitted through the rack shelf, into the rack, and subsequently into the Station. Of course, Station vibrations can also be transmitted into the experiment rack and subsequently into a shelf-based experiment. The experiments on ISS rely on the calm microgravity environment that can potentially be provided. Consequently, the vibrations mentioned above can have an adverse on impact these experiments. Therefore, methods are needed for preventing these vibrations from impacting experiments. In controlling the vibrations that can impact experiments, there are two vibratory transmission paths that must be considered. One path is between each rack and the ISS structure. Some experiment racks use the Active Rack Isolation System (ARIS), a control system designed to mitigate these vibrations. However, internal vibrations must still be limited to the levels required by ARIS. For example, a motor automating an experiment on the same shelf could produce vibrations that enter other components requiring a calm environment. Of course, this issue is important with regard to vibration transmission between multiple shelves, multiple racks, and the Station. Some vibration isolators have been developed for use in a microgravity environment. One approach uses a electromagnetic voice coil to provide active vibration control while another approach uses an arced piezoelectric film beam to provide passive and active vibration control. While these arced beams can potentially provide a large degree of passive isolation, they require a relatively large clearance between the two structures. In a space-limited rack, this can be a major concern. The goal of this research is to examine new methods

for using adaptive structure technologies to provide active vibration control and enhanced passive vibration control of ISS rack shelf vibrations.
Author
International Space Station; Vibration Damping; Active Control; Racks (Frames); Spaceborne Experiments

20030093646 NASA Goddard Space Flight Center, Greenbelt, MD, USA
WMAP Observatory Thermal Design and On-Orbit Thermal Performance
Glazer, Stuart D.; Brown, Kimberly D.; Michalek, Theodore J.; Ancarrow, Walter C.; [2003]; 11 pp.; In English
Report No.(s): SAE-2003-01-2343; Copyright; Avail: CASI; A03, Hardcopy

The Wilkinson Microwave Anisotropy Probe (WMAP) observatory, launched June 30, 2001, is designed to measure the cosmic microwave background radiation with unprecedented precision and accuracy while orbiting the second Lagrange point (L2). The instrument cold stage must be cooled passively to <95K, and systematic thermal variations in selected instrument components controlled to less than 0.5 mK (rms) per spin period. This paper describes the thermal design and testing of the WMAP spacecraft and instrument. Flight thermal data for key spacecraft and instrument components are presented from launch through the first year of mission operations. Effects of solar flux variation due to the Earth's elliptical orbit about the sun, surface thermo-optical property degradations, and solar flares on instrument thermal stability are discussed.
Author
Microwave Anisotropy Probe; Thermal Stability; Cooling; Spacecraft Design; Temperature Control

20030093738 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Measurement of the Earth-Observer-1 Satellite X-Band Phased Array
Perko, Kenneth; Dod, Louis; Demas, John; [2003]; 6 pp.; In English; Antenna Measurement Techniques Association, 19 Oct. 2003, Irvine, CA, USA; Copyright; Avail: CASI; A02, Hardcopy

The recent launch and successful orbiting of the EO-1 Satellite has provided an opportunity to validate the performance of a newly developed X-Band transmit-only phased array aboard the satellite. This paper will compare results of planar near-field testing before and after spacecraft installation as well as on-orbit pattern characterization. The transmit-only array is used as a high data rate antenna for relaying scientific data from the satellite to earth stations. The antenna contains distributed solid-state amplifiers behind each antenna element that cannot be monitored except for radiation pattern measurements. A unique portable planar near-field scanner allows both radiation pattern measurements and also diagnostics of array aperture distribution before and after environmental testing over the ground-integration and prelaunch testing of the satellite. The antenna beam scanning software was confirmed from actual pattern measurements of the scanned beam positions during the spacecraft assembly testing. The scanned radiation patterns on-orbit were compared to the near-field patterns made before launch to confirm the antenna performance. The near-field measurement scanner has provided a versatile testing method for satellite high gain data-link antennas.
Author
Phased Arrays; Superhigh Frequencies; Earth Observing System (Eos); Data Acquisition; Satellite Antennas; Spacecraft Design

20030093748 Swales Aerospace, USA
Contamination in Orbit of GOES-8
Sanders, Jack T.; September 05, 2002; 5 pp.; In English; IEST Space Simulation Conference 2002, 21-24 Oct. 2002, Ellicott City, MD, USA
Contract(s)/Grant(s): NAS5-01090; No Copyright; Avail: CASI; A01, Hardcopy

The GOES-8 satellite has lost some of its ability to dissipate heat over time. This is shown by the temperature increases over time of spacecraft and instrument components that are cooled with optical solar reflector (OSR) radiators. Contamination has a significant, well-documented effect on the solar absorptance (a(sub s)) of OSRs. This document attempts to discern how much molecular contamination has collected on the Imager and Sounder radiant coolers by analyzing the increase in temperature of the vacuum cooler housing. In the first part, temperature change is transformed into solar absorptance units by a method devised by ITT. The second part transfomis the solar absorptance gain into a molecular film thickness.
Author
Goes 8; Solar Energy Absorbers; Spacecraft Configurations; Optical Equipment; Solar Reflectors; Spacecraft Contamination

20030093749 Naval Research Lab., USA
Pulsed Thrust Method for Hover Formation Flying
Hope, Alan; Trask, Aaron; April 15, 2003; 3 pp.; In English; 2003 AAS/AIAA Astrodynamics Specialist Conference Meeting, 3-7 Aug. 2003, Big Sky, MT, USA
Contract(s)/Grant(s): NDPR-S-65018-Y; No Copyright; Avail: Other Sources; Abstract Only

A non-continuous thrust method for hover type formation flying has been developed. This method differs from a true hover which requires constant range and bearing from a reference vehicle. The new method uses a pulsed loop, or pogo, maneuver sequence that keeps the follower spacecraft within a defined box in a near hover situation. Equations are developed for the hover maintenance maneuvers. The constraints on the hover location, pulse interval, and maximum/minimum ranges are discussed.
Author
Formation Flying; Hovering; Thrust; Delta Launch Vehicle; Spacecraft Maneuvers; Pulse Amplitude

20030095934 NASA Goddard Space Flight Center, Greenbelt, MD, USA
The Neptune/Triton Explorer Mission: A Concept Feasibility Study
Esper, Jaime; [2003]; 8 pp.; In English; No Copyright; Avail: CASI; A02, Hardcopy

Technological advances over the next 10 to 15 years promise to enable a number of smaller, more capable science missions to the outer planets. With the inception of miniaturized spacecraft for a wide range of applications, both in large clusters around Earth, and for deep space missions, NASA is currently in the process of redefining the way science is being gathered. Technologies such as 3-Dimensional Multi-Chip Modules, Micro-machined Electromechanical Devices, Multi Functional Structures, miniaturized transponders, miniaturized propulsion systems, variable emissivity thermal coatings, and artificial intelligence systems are currently in research and development, and are scheduled to fly (or have flown) in a number of missions. This study will leverage on these and other technologies in the design of a lightweight Neptune orbiter unlike any other that has been proposed to date. The Neptune/Triton Explorer (NExTEP) spacecraft uses solar electric earth gravity assist and aero capture maneuvers to achieve its intended target orbit. Either a Taurus or Delta-class launch vehicle may be used to accomplish the mission.
Author
Explorer Satellites; Feasibility; Neptune (Planet); Space Missions; Triton; Spacecraft Configurations

20030095955 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Evaluation of a Drag-Free Control Concept for Missions in Low Earth Orbit
Fleck, Melissa E.; Starin, Scott R.; [2003]; 9 pp.; In English; AIAA Guidance, Navigation and Control Conference and Exhibit, 11-14 Aug. 2003, Austin, TX, USA; No Copyright; Avail: CASI; A02, Hardcopy

Atmospheric drag causes the greatest uncertainty in the equations of motion for spacecraft in Low Earth Orbit (LEO). If atmospheric drag eflects can be continuously and autonomously counteracted through the use of a drag-fee control system, drag may essentially be eliminated from the equations of motion for the spacecraft. The main perturbations on the spacecraft will then be those due to the gravitational field, which are much more easily predicted Through dynamical analysis and numerical simulation, this paper presents some potential costs and benefits associated with the fuel used during continuous drag compensation. In light of this cost-benefit analysis, simulation results are used to validate the concept of drag-free control for LEO spacecraft missions having certain characteristics.
Author
Drag Reduction; Low Earth Orbits; Equations Of Motion

20030102150 NASA Goddard Space Flight Center, Greenbelt, MD, USA
The Effect of Sensor Failure on the Attitude and Rate Estimation of MAP Spacecraft
Bar-Itzhack, Itzhack Y.; Harman, Richard R.; [2003]; 9 pp.; In English; AIAA GN&C Conference, 11-14 Aug. 2003, Austin, TX, USA; No Copyright; Avail: CASI; A02, Hardcopy

This work describes two algorithms for computing the angular rate and attitude in case of a gyro and a Star Tracker failure in the Microwave Anisotropy Probe (MAP) satellite, which was placed in the L2 parking point from where it collects data to determine the origin of the universe. The nature of the problem is described, two algorithms are suggested, an observability study is carried out and real MAP data are used to determine the merit of the algorithms. It is shown that one of the algorithms yields a good estimate of the rates but not of the attitude whereas the other algorithm yields a good estimate of the rate as well as two of the three attitude angles. The estimation of the third angle depends on the initial state estimate. There is a

contradiction between this result and the outcome of the observability analysis. An explanation of this contradiction is given in the paper. Although this work treats a particular spacecraft, its conclusions are more general.
CASI
Angular Velocity; Failure; Microwave Anisotropy Probe; Star Trackers; Algorithms; Spacecraft Instruments; Attitude (Inclination)

20030102156 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Single Event Effects Results for Candidate Spacecraft Electronics for NASA
O'Bryan, Martha; LaBel, Kenneth A.; Kniffin, Scott D.; Howard, James W., Jr.; Poivey, Christian; Ladbury, Ray L.; Buchner, Stephen P.; Xapsos, Michael; Reed, Robert A.; Sanders, Anthony B., et al.; [2003]; 12 pp.; In English; Nuclear and Space Radiation Effects Conference, 21-25 Jul. 2003, Monterey, CA, USA; No Copyright; Avail: CASI; A03, Hardcopy

We present data on the vulnerability of a variety of candidate spacecraft electronics to proton and heavy ion induced single event effects. Devices tested include digital, analog, linear bipolar, and hybrid devices, among others.
Author
Single Event Upsets; Spacecraft Design; Radiation; NASA Space Programs; Spacecraft Electronic Equipment

20030102177 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Navigation Accuracy Guidelines for Orbital Formation Flying Missions
Carpenter, J. Russell; Alfriend, Kyle T.; [2003]; 7 pp.; In English; AIM GNC Conference, 11-14 Aug. 2003, Austin, TX, USA; No Copyright; Avail: CASI; A02, Hardcopy

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

20030105590 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Novel Design Aspects of the Space Technology 5 Mechanical Subsystem
Rossoni, Peter; McGill, William; [2003]; 10 pp.; In English; Utah State University Small Satellite Conference, 11 Aug. 2003, Logan, UT, USA; No Copyright; Avail: CASI; A02, Hardcopy

This paper describes several novel design elements of the Space Technology 5 (ST5) spacecraft mechanical subsystem. The spacecraft structure itself takes a significant step in integrating electronics into the primary structure. The deployment system restrains the spacecraft during launch and imparts a predetermined spin rate upon release from its secondary payload accommodations. The deployable instrument boom incorporates some traditional as well as new techniques for lightweight and stiffness. Analysis and test techniques used to validate these technologies are described. Numerous design choices were necessitated due to the compact spacecraft size and strict mechanical subsystem requirements.
Author
Spacecraft Design; Spacecraft Components; Design Analysis; Structural Analysis

20030105708 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Benchmark Problems for Spacecraft Formation Flying Missions
Carpenter, J. Russell; Leitner, Jesse A.; Burns, Richard D.; Folta, David C.; May 02, 2003; 5 pp.; In English; AIAA Guidance, Navigation, and Control Conference, 11-13 Aug. 2003, Austin, TX, USA
Report No.(s): AIAA Paper 2003-5364; Copyright; Avail: CASI; A01, Hardcopy

To provide high-level focus to distributed space system flight dynamics and control research, several benchmark problems are suggested. These problems are not specific to any current or proposed mission, but instead are intended to capture high-level features that would be generic to many similar missions.
Author
Formation Flying; Spacecraft

20030105750 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
The TechSat-21 Autonomous Sciencecraft Experiment
Chien, Steve; Sherwood, Rob; Doyle, Richard; Intelligent Systems for Aeronautics; June 2003, pp. 7-1 - 7-10; In English; See also 20030105742; Original contains color illustrations; Copyright; Avail: CASI; C01, CD-ROM; A02, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The Autonomous Sciencecraft Experiment flight demonstration (ASE) will fly onboard the US Air Force's TechSat-21 constellation, an unclassified mission scheduled for launch in 2004. ASE will use onboard science analysis, replanning, robust execution, and formation flying to radically increase science return by enabling intelligent downlink selection and autonomous retargeting. Demonstration of these capabilities in a flight environment will open up tremendous new opportunities in planetary science, space physics, and earth science that would be unreachable without this technology.
Author
Autonomy; Microsatellites; Airborne/Spaceborne Computers; Aerospace Sciences; Flight Tests; NASA Space Programs

20030105751 Sverdrup Technology, Inc., Eglin AFB, FL, USA
Genetic Algorithms In Aerospace Design: Substantial Progress, Tremendous Potential
Anderson, Murray B.; Intelligent Systems for Aeronautics; June 2003, pp. 8-1 - 8-20; In English; See also 20030105742; Original contains color and black and white illustrations; Copyright; Avail: CASI; C01, CD-ROM; A03, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Since the mid to late 1980's, Genetic Algorithms have been increasingly applied to aerospace problems, producing some exciting results. Almost every discipline in aerospace, from Guidance, Navigation, and Control to Propulsion and Structures, has yielded itself to the power of genetic algorithms. The shear volume of applications that GA's have been applied to has grown tremendously over the past decade. This growth can, to a large degree, be attributed to a growth in computer speed coupled with a growth in the understanding that advanced computing techniques can often produce designs vastly superior to those possible by trial and error or by experience alone. As the design and analysis space grows more nonlinear for advanced systems, engineers and their managers are beginning to realize the potential of using a non-linear design and analysis tool to help produce better products.
Author
Genetic Algorithms; Aerospace Engineering; General Overviews; Artificial Intelligence

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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*.

20030095987 NASA Marshall Space Flight Center, Huntsville, AL, USA
Development of Enhanced Avionics Flight Hardware Selection Process
Smith, K.; Watson, G. L.; August 2003; 18 pp.; In English
Report No.(s): NASA/TM-2003-212690; M-1086; NAS 1.15:212690; No Copyright; Avail: CASI; A03, Hardcopy

The primary objective of this research was to determine the processes and feasibility of using commercial off-the-shelf PC104 hardware for flight applications. This would lead to a faster, better, and cheaper approach to low-budget programs as opposed to the design, procurement. and fabrication of space flight hardware. This effort will provide experimental evaluation with results of flight environmental testing. Also, a method and/or suggestion used to bring test hardware up to flight standards will be given. Several microgravity programs, such as the Equiaxed Dendritic Solidification Experiment, Self-Diffusion in

Liquid Elements, and various other programs, are interested in PC104 environmental testing to establish the limits of this technology.
Author
Astrionics; Avionics; Commercial Off-The-Shelf Products; Spacecraft Equipment

20030102158 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Hybrid Synthetic/Real Aperture Antenna for High Resolution Microwave Imaging
Doiron, Terence A.; Piepmeier, Jeffrey R.; May 02, 2003; 3 pp.; In English; No Copyright; Avail: CASI; A01, Hardcopy

Observations of key hydrological parameters at the spatial and temporal scales required in the post-2002 era face significant technological challenges. These measurements are based on relatively low frequency thermal microwave emission (at 1.4 GHz for soil moisture and salinity, 10 GHz and up for precipitation, and 19 and 37 GHz for snow). The long wavelengths at these frequencies coupled with the high spatial and radiometric resolutions required by the various global hydrology missions necessitate the use of very large apertures. Two-dimensional Synthetic Thinned Array Radiometry (2-D STAR), though promising in the long term, has many technical challenges in the areas of power, and sensitivity for very large apertures (i.e. greater than 300 wavelengths). This paper will discuss an alternative approach to the pure 2-D STAR, which uses an offset parabolic cylinder reflector fed by multiple elements to form a 1-D STAR. In essence a single STAR element is composed of a feedhorn and parabolic cylinder reflector. The elements are sparsely arrayed and thus can share a single reflector. This antenna would have no moving parts once deployed, have much higher sensitivity than a Y-shaped 2-D STAR of equivalent size, many fewer receivers than that 2-D STAR, and the reflector could be made of a thin film and lightweight deployment system for high packing density. The instrument using this approach would be a cross track push broom imager. An overview of the design parameters, potential deployment mechanisms and applications will be presented.
Author
High Resolution; Microwave Imagery; Radiometers; Synthetic Apertures; Microwave Emission; Spacecraft Instruments; Antenna Design

20030102221 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Precision Select Mechanisms for the GLAS and SOLSE2 Instruments
Budinoff, Jason G.; June 2003; 5 pp.; In English; 10th ESMATS International Mechanisms Symposium, 23-25 Sep. 2003, San Sebastian,, Spain; No Copyright; Avail: CASI; A01, Hardcopy

The Geoscience Laser Altimeter System (GLAS) instrument had requirements for a 2-position mechanism to rotate mirrors into and out of the optical path of the altimetry detectors and the lasers. The Solar Ozone Limb Sounding Experiment II (SOLSE2) instrument had a similar requirement of rotating a visible (VIS) or ultraviolet (W) filter into the instrument optical path. Both GLAS and SOLSE2 had similar operational and survival environments and lifetime requirements. A novel, precision rotational latching mechanism was designed to fulfill the needs of both missions. The GLAS instrument had driving stability and repeatability requirements, such that if the mechanism met these stringent requirements, it would more than surpass the required performance for the SOLSE2 mechanism. The resulting mechanism, referred to as a 'select mechanism' since it allows selection between 2 positions, was successfully designed and implemented for both missions.
Author
Satellite-Borne Instruments; Laser Altimeters; Satellite Sounding; Rotating Mirrors; Optical Filters; Rotation

20030105554 NASA Goddard Space Flight Center, Greenbelt, MD, USA
In-Flight Thermal Performance of the Geoscience Laser Altimeter System (GLAS) Instrument
Grob, Eric; Baker, Charles; McCarthy, Tom; [2003]; 11 pp.; In English; 33rd International Conference on Environmental Systems, 2003, Vancouver, British Columbia, Canada
Report No.(s): Rept-2003-01-2421; Rept-03ICES-274; No Copyright; Avail: CASI; A03, Hardcopy

The Geoscience Laser Altimeter System (GLAS) instrument is NASA Goddard Space Flight Center's first application of Loop Heat Pipe technology that provides selectable/stable temperature levels for the lasers and other electronics over a widely varying mission environment. GLAS was successfully launched as the sole science instrument aboard the Ice, Clouds, and Land Elevation Satellite (ICESat) from Vandenberg AFB at 4:45pm PST on January 12, 2003. After SC commissioning, the LHPs started easily and have provided selectable and stable temperatures for the lasers and other electronics. This paper discusses the thermal development background and testing, along with details of early flight thermal performance data.
Author
Laser Altimeters; Heat Pipes

20030105563 NASA Goddard Space Flight Center, Greenbelt, MD, USA, Ohio Univ., Athens, OH, USA

Resource Management for Real-Time Adaptive Agents

Welch, Lonnie; Chelberg, David; Pfarr, Barbara; Fleeman, David; Parrott, David; Tan, Zhen-Yu; Jain, Shikha; Drews, Frank; Bruggeman, Carl; Shuler, Chris, et al.; September 10, 2003; 31 pp.; In English

Contract(s)/Grant(s): NAG5-10349

Report No.(s): TR-CIDDS-03-026; No Copyright; Avail: CASI; A03, Hardcopy

Increased autonomy and automation in onboard flight systems offer numerous potential benefits, including cost reduction and greater flexibility. The existence of generic mechanisms for automation is critical for handling unanticipated science events and anomalies where limitations in traditional control software with fixed, predetermined algorithms can mean loss of science data and missed opportunities for observing important terrestrial events. We have developed such a mechanism by adding a Hierarchical Agent-based ReaLTime technology (HART) extension to our Dynamic Resource Management (DRM) middleware. Traditional DRM provides mechanisms to monitor the realtime performance of distributed applications and to move applications among processors to improve real-time performance. In the HART project we have designed and implemented a performance adaptation mechanism to improve reaktime performance. To use this mechanism, applications are developed that can run at various levels of quality. The DRM can choose a setting for the quality level of an application dynamically at run-time in order to manage satellite resource usage more effectively. A groundbased prototype of a satellite system that captures and processes images has also been developed as part of this project to be used as a benchmark for evaluating the resource management framework A significant enhancement of this generic mission-independent framework allows scientists to specify the utility, or 'scientific benefit,' of science observations under various conditions like cloud cover and compression method. The resource manager then uses these benefit tables to determine in redtime how to set the quality levels for applications to maximize overall system utility as defined by the scientists running the mission. We also show how maintenance functions llke health and safety data can be integrated into the utility framework. Once thls framework has been certified for missions and successfully flight tested it can be reused with little development overhead for other missions. In contrast, current space missions llke Swift manage similar types of resource trade -off completely with the scientific application code itself, and such code must be re-certified and tested for each mission even if a large portion of the code base is shared. This final report discusses some of the major issues motivating this research effort, provides a literature review of the related work, discusses the resource management framework and ground-based satellite system prototype that has been developed, indicates what work is yet to be performed, and provides a list of publications resulting from this work.
Author

Algorithms; Automatic Control; Real Time Operation; Satellites

20030105591 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Bandwidth Efficient Baseband Multi-Modulator

Fong, Wai; Gray, Andrew; Yeh, Pen-Shu; [2003]; 3 pp.; In English; ESTC 2003, 24-26 Jun. 2003, College Park, MD, USA; No Copyright; Avail: CASI; A01, Hardcopy

The High Rate Baseband Multi-Modulator (HRBM) ASIC is being developed to provide High-speed Bandwidth Efficient Modulations to NASA missions. Bandwidth efficiencies from 2.0 bits/symbol/Hz to 2.75 bits/symbl/Hz are selectable from three CCSDS modulations: Gaussian Minimum Shift Keying (GMSK), Filter Offset Quadrature Phase Shift Keying (Filtered-OQSK) and 8-Phase Shift Keying Trellis Coded Modulation (8-PSK TCM). An FPGA version of the HRBM is developed first to verify the individual modulation designs and characterize timing and performance issues involved with digital baseband modulation synthesis. A Finite Input Response (FIR) filter is included to provided baseband pulse shaping to reduce out-of-band spectral emissions. This is filter is programmable and can be tailored to meet system requirements. The ASIC is targeted to provide up to 600 Mbps throughput and will provide serial as well as parallel input. This paper provides an overview of the technology development and current status.
Author

Bandwidth; Modulators; High Speed; Modulation; Quadrature Phase Shift Keying; Fir Filters

20
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*.

20030093603 Memphis Univ., Memphis, TN, USA
Magnetized Target Fusion Propulsion: Plasma Injectors for MTF Guns
Griffin, Steven T.; The 2002 NASA Faculty Fellowship Program Research Reports; April 2003, pp. XVIII-1 - XVIII-7; In English; See also 20030093576
Contract(s)/Grant(s): NAG8-1859; No Copyright; Avail: CASI; C01, CD-ROM; A02, Hardcopy

To achieve increased payload size and decreased trip time for interplanetary travel, a low mass, high specific impulse, high thrust propulsion system is required. This suggests the need for research into fusion as a source of power and high temperature plasma. The plasma would be deflected by magnetic fields to provide thrust. Magnetized Target Fusion (MTF) research consists of several related investigations into these topics. These include the orientation and timing of the plasma guns and the convergence and interface development of the 'pusher' plasma. Computer simulations of the gun as it relates to plasma initiation and repeatability are under investigation. One of the items under development is the plasma injector. This is a surface breakdown driven plasma generator designed to function at very low pressures. The performance, operating conditions and limitations of these injectors need to be determined.
Derived from text
Plasma Guns; Injectors; High Temperature Plasmas; Rocket Thrust; Magnetic Fields

20030093608 Louisiana Univ., Lafayette, LA, USA
The Physics of Solar Sails
Hollerman, William Andrew; The 2002 NASA Faculty Fellowship Program Research Reports; April 2003, pp. XXII-1 - XXII-6; In English; See also 20030093576
Contract(s)/Grant(s): NAG8-1859; No Copyright; Avail: CASI; C01, CD-ROM; A02, Hardcopy

The concept of using photon pressure for propulsion has been considered since Tsiolkovsky in 1921. In fact, Tsiolkovsky and Tsander wrote of 'using tremendous mirrors of very thin sheets' and 'using the pressure of sunlight to attain cosmic velocities' in 1924. The term 'solar sailing' was coined in the late 1950s and was popularized by Arthur C. Clarke in the short story Sunjammer (The Wind From the Sun) in May 1964. The National Aeronautics and Space Administration (NASA) used sailing techniques to extend the operational life of the Mariner 10 spacecraft in 1974-1975. A problem in the control system was causing Mariner 10 to go off course. By controlling the attitude of Mariner 10 and the angle of the solar power panels relative to the Sun, ground controllers were able to correct the problem without using precious fuel. Once thought to be difficult or impossible, solar sailing has come out of science fiction and into the realm of possibility. Any spacecraft using this method would need to deploy a thin sail that could be as large as many kilometers in extent. Candidate sail materials should be: 1) strong, 2) ultra-lightweight (density of a few g/sq m), 3) able to be folded or crushed until deployed, 4) subject to minimal sagging or stretching, and 5) resistant to ionizing radiation, such as galactic and solar particles (electrons and protons), x-rays, ultraviolet light, and magnetically trapped charged particles. Solar sails must be resistant to each of these types of radiation.
Author
Solar Sails; Solar Propulsion; Materials

20030093609 Alabama Agricultural and Mechanical Univ., Normal, AL, USA
Magnetized Target Fusion in Advanced Propulsion Research
Cylar, Rashad; The 2002 NASA Faculty Fellowship Program Research Reports; April 2003, pp. XIII-1 - XIII-5; In English; See also 20030093576
Contract(s)/Grant(s): NAG8-1859; No Copyright; Avail: CASI; C01, CD-ROM; A01, Hardcopy

The Magnetized Target Fusion (MTF) Propulsion lab at NASA Marshall Space Flight Center in Huntsville, Alabama has a program in place that has adopted to attempt to create a faster, lower cost and more reliable deep space transportation system. In this deep space travel the physics and development of high velocity plasma jets must be understood. The MTF Propulsion lab is also in attempt to open up the solar system for human exploration and commercial use. Fusion, as compared to fission, is just the opposite. Fusion involves the light atomic nuclei combination to produce denser nuclei. In the process, the energy is created by destroying the mass according to the distinguished equation: E = mc2 . Fusion energy development is being

pursued worldwide as a very sustainable form of energy that is environmentally friendly. For the purposes of space exploration fusion reactions considered include the isotopes of hydrogen-deuterium (D2) and tritium (T3). Nuclei have an electrostatic repulsion between them and in order for the nuclei to fuse this repulsion must be overcome. One technique to bypass repulsion is to heat the nuclei to very high temperatures. The temperatures vary according to the type of reactions. For D-D reactions, one billion degrees Celsius is required, and for D-T reactions, one hundred million degrees is sufficient. There has to be energy input for useful output to be obtained form the fusion To make fusion propulsion practical, the mass, the volume, and the cost of the equipment to produce the reactions (generally called the reactor) need to be reduced by an order of magnitude or two from the state-of-the-art fusion machines. Innovations in fusion schemes are therefore required, especially for obtaining thrust for propulsive applications. Magnetized target fusion (MTF) is one of the innovative fusion concepts that have emerged over the last several years. MSFC is working with Los Alamos National Laboratory and other research groups in studying the underlying principles involved in MTF. Magnetized Target Fusion is an attempt to combine MCF (magnetic confinement fusion) for energy confinement and ICF (inertial confinement fusion) for efficient compression heating and wall free containment of the fusing plasma. It also seeks to combine the best features to these two main commonplace approaches to fusion.

Derived from text

Fusion Propulsion; Magnetization; Targets; Controlled Fusion; Confinement; Plasma Control; Plasmas (Physics); Plasma Jets

20030093731 QSS Group, Inc., Cleveland, OH, USA

Comparison of On-Orbit and Ground Based Hollow Cathode Operation

Burke, Tom, Technical Monitor; Carpenter, Christian; September 2003; 13 pp.; In English; 39th Joint Propulsion Conference and Exhibit, 20-23 Jul. 2003, Huntsville, AL, USA

Contract(s)/Grant(s): NAS3-00145; WBS 22-755-04-11

Report No.(s): NASA/CR-2003-212585; E-14140; NAS 1.26:212585; AIAA Paper 2003-5145; No Copyright; Avail: CASI; A03, Hardcopy

The Plasma Contactor Unit (PCU) was developed by the Rocketdyne division of Boeing to control charging of the International Space Station (ISS). Each PCU contains a Hollow Cathode Assembly (HCA), which emits the charge control electrons. The HCAs were designed and fabricated at NASA's Glenn Research Center (GRC). GRC's HCA development program included manufacture of engineering, qualification, and flight model HCAs as well as wear tests and qualification tests. GRC is currently tracking the on-orbit data for the flight HCAs. This data will be discussed with comparison to operating parameters verified by ground based HCA tests. The flight HCAs continue to operate flawlessly. The first unit has accumulated more than 3650 hours of on-orbit operation and the second unit has accumulated over 5550 hours.

Author

Hollow Cathodes; Plasmas (Physics); Spacecraft Charging; International Space Station

20030105580 NASA Glenn Research Center, Cleveland, OH, USA

Performance Expectations of Closed-Brayton-Cycle Heat Exchangers in 100-kWe Nuclear Space Power Systems

Barrett, Michael J.; September 2003; 13 pp.; In English; First International Energy Conversion Engineering Conference, 17-21 Aug. 2003, Portsmouth, VA, USA

Contract(s)/Grant(s): WBS 22-982-10-03

Report No.(s): NASA/TM-2003-212597; AIAA Paper 2003-5956; NAS 1.15:212597; E-14139; No Copyright; Avail: CASI; A03, Hardcopy

Performance expectations of closed-Brayton-cycle heat exchangers to be used in 100-kWe nuclear space power systems were forecast. Proposed cycle state points for a system supporting a mission to three of Jupiter s moons required effectiveness values for the heat-source exchanger, recuperator and rejection exchanger (gas cooler) of 0.98,0.95 and 0.97, respectively. Performance parameters such as number of thermal units (Nm), equivalent thermal conductance (UA), and entropy generation numbers (Ns) varied from 11 to 19,23 to 39 kWK, and 0.019 to 0.023 for some standard heat exchanger configurations. Pressure-loss contributions to entropy generation were significant; the largest frictional contribution was 114% of the heat-transfer irreversibility. Using conventional recuperator designs, the 0.95 effectiveness proved difficult to achieve without exceeding other performance targets; a metallic, plate-fin counterflow solution called for 15% more mass and 33% higher pressure-loss than the target values. Two types of gas-coolers showed promise. Single-pass counterflow and multipass cross-counterflow arrangements both met the 0.97 effectiveness requirement. Potential reliability-related advantages of the cross-countefflow design were noted. Cycle modifications, enhanced heat transfer techniques and incorporation of advanced

materials were suggested options to reduce system development risk. Carbon-carbon sheeting or foam proved an attractive option to improve overall performance.
Author
Brayton Cycle; Heat Exchangers; Systems Engineering; Aerospace Systems; Nuclear Electric Power Generation; Closed Cycles

20030105581 NASA Glenn Research Center, Cleveland, OH, USA
A Power Conversion Concept for the Jupiter Icy Moons Orbiter
Mason, Lee S.; September 2003; 15 pp.; In English; First International Energy Conversion Engineering Conference, 17-21 Aug. 2003, Portsmouth, VA, USA
Contract(s)/Grant(s): WBS 22-973-90-01
Report No.(s): NASA/TM-2003-212596; E-14153; NAS 1.15:212596; AIAA Paper 2003-6007; No Copyright; Avail: CASI; A03, Hardcopy

The Jupiter Icy Moons Orbiter (JIMO) mission is currently under study by the Office of Space Science under the Project Prometheus Program. JIMO is examining the use of Nuclear Electric Propulsion (NEP) to carry scientific payloads to three Jovian moons. A potential power system concept includes dual 100 kWe Brayton converters, a deployable pumped loop heat rejection subsystem, and a 400 Vac Power Management and Distribution (PMAD) bus. Many trades were performed in aniving at this candidate power system concept. System-level studies examined design and off-design operating modes, determined startup requirements, evaluated subsystem redundancy options, and quantified the mass and radiator area of reactor power systems from 20 to 200 kWe. In the Brayton converter subsystem, studies were performed to investigate converter packaging options, and assess the induced torque effects on spacecraft dynamics due to rotating machinery. In the heat rejection subsystem, design trades were conducted on heat transport approaches, material and fluid options, and deployed radiator geometries. In the PMAD subsystem, the overall electrical architecture was defined and trade studies examined distribution approaches, voltage levels, and cabling options.
Author
Nuclear Electric Propulsion; Electric Power; Jupiter Satellites; NASA Space Programs; Spacecraft Maneuvers

20030105588 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Propulsion Options for the Global Precipitation Measurement Core Satellite
Cardiff, Eric H.; Davis, Gary T.; Folta, David C.; [2003]; 11 pp.; In English; AIAA Joint Propulsion Conference, 20-23 Jul. 2003, Huntsville, AL, USA; No Copyright; Avail: CASI; A03, Hardcopy

This study was conducted to evaluate several propulsion system options for the Global Precipitation Measurement (GPM) core satellite. Orbital simulations showed clear benefits for the scientific data to be obtained at a constant orbital altitude rather than with a decay/reboost approach. An orbital analysis estimated the drag force on the satellite will be 1 to 12 mN during the five-year mission. Four electric propulsion systems were identified that are able to compensate for these drag forces and maintain a circular orbit. The four systems were the UK-10/TS and the NASA 8 cm ion engines, and the ESA RMT and RITl0 EVO radio-frequency ion engines. The mass, cost, and power requirements were examined for these four systems. The systems were also evaluated for the transfer time from the initial orbit of 400 x 650 km altitude orbit to a circular 400 km orbit. The transfer times were excessive, and as a consequence a dual system concept (with a hydrazine monopropellant system for the orbit transfer and electric propulsion for drag compensation) was examined. Clear mass benefits were obtained with the dual system, but cost remains an issue because of the larger power system required for the electric propulsion system. An electrodynamic tether was also evaluated in this trade study.
Author
Precipitation (Meteorology); Precipitation Measurement; Systems Engineering; Propulsion System Configurations; Satellite Design

20030105604 BUSEK CO INC NATICK MA, Natick, MA, USA
A Torsional Balance for the Characterization of MicroNewton Thrusters
Gamero-Castano, Manuel; May 19, 2003; 30 pp.; In English
Contract(s)/Grant(s): F04611-99-C-0025; Proj-1011
Report No.(s): AD-A416494; AFRL-PR-ED-TP-2003-135; No Copyright; Avail: CASI; A03, Hardcopy

We describe the performance of a torsional balance suitable for the study of microNewton thrusters. A design based on flexural pivots and electrostatic forces (for calibration and active damping) makes it possible to test thrusters with a mass of

a few kilograms, and measure sub- microNewton level forces with high accuracy and a resolution better than 0.03 micro N. The usefulness of the balance is proved by measuring the performance of two different electric propulsion accelerators: a colloid thruster generating thrust in the 2 to 15 micro N range, and a micro pulsed plasma thruster yielding single impulse bits of 19 micro Ns. The low noise figure of the balance (below 0.1 micro N/ square root of Hz in the 7 mHz to 1 Hz bandwidth) will make it possible to measure the thrust noise requirements imposed in colloid thrusters by missions such as the Space Technology 7 and the Laser Interferometer Space Antenna.
DTIC
Balance; Electric Propulsion; Torsion; Thrust; Electrostatics

20030105670 NASA Glenn Research Center, Cleveland, OH, USA
Fault Tolerant Homopolar Magnetic Bearings
Li, Ming-Hsiu; Palazzolo, Alan; Kenny, Andrew; Provenza, Andrew; Beach, Raymond; Kascak, Albert; September 2003; 23 pp.; In English; First International Energy Conversion Engineering Conference, 17-21 Aug. 2003, Portsmouth, VA, USA
Contract(s)/Grant(s): NRA-GRC-99-01; WBS 22-755-60-12
Report No.(s): NASA/TM-2003-212592; E-14149; NAS 1.15:212592; AIAA Paper 2003-6110; No Copyright; Avail: CASI; A03, Hardcopy

Magnetic suspensions (MS) satisfy the long life and low loss conditions demanded by satellite and ISS based flywheels used for Energy Storage and Attitude Control (ACESE) service. This paper summarizes the development of a novel MS that improves reliability via fault tolerant operation. Specifically, flux coupling between poles of a homopolar magnetic bearing is shown to deliver desired forces even after termination of coil currents to a subset of failed poles . Linear, coordinate decoupled force-voltage relations are also maintained before and after failure by bias linearization. Current distribution matrices (CDM) which adjust the currents and fluxes following a pole set failure are determined for many faulted pole combinations. The CDM s and the system responses are obtained utilizing 1D magnetic circuit models with fringe and leakage factors derived from detailed, 3D, finite element field models. Reliability results are presented vs. detection/correction delay time and individual power amplifier reliability for 4, 6, and 7 pole configurations. Reliability is shown for two success criteria, i.e. (a) no catcher bearing contact following pole failures and (b) re-levitation off of the catcher bearings following pole failures. An advantage of the method presented over other redundant operation approaches is a significantly reduced requirement for backup hardware such as additional actuators or power amplifiers.
Author
Magnetic Bearings; Fault Tolerance; Magnetic Suspension; Mathematical Models; Three Dimensional Models; Reliability Analysis

20030105838 Air Force Research Lab., Edwards AFB, CA, USA
Upper Stage Engine Technology (USET) Effort
Wright, Daniel; Jul. 17, 2003; 73 pp.; In English
Contract(s)/Grant(s): Proj-5026
Report No.(s): AD-A416574; AFRL-PR-ED-VG-2003-197; No Copyright; Avail: CASI; A04, Hardcopy

No abstract available
Rocket Engines; Combustion Chambers

20030105889 Army Research Lab., Adelphi, MD
Force on an Asymmetric Capacitor
Bahder, Thomas B.; Fazi, Christian; Jun. 2003; 37 pp.; In English
Report No.(s): AD-A416740; ARL-TR-3005; No Copyright; Avail: CASI; A03, Hardcopy

When a high voltage (approx. 30 kV) is applied to a capacitor whose electrodes have different physical dimensions, the capacitor experiences a net force toward the smaller electrode (Biefeld-Brown effect). We have verified this effect by building four capacitors of different shapes. The effect may have applications to vehicle propulsion and dielectric pumps. We review the history of this effect briefly through the history of patents by Thomas Townsend Brown. At present, the physical basis for the Biefeld-Brown effect is not understood. The order of magnitude of the net force on the asymmetric capacitor is estimated assuming two different mechanisms of charge conduction between its electrodes: ballistic ionic wind and ionic drift. The calculations indicate that ionic wind is at least 3 orders of magnitude too small to explain the magnitude of the observed force on the capacitor. The ionic drift transport assumption leads to the correct order of magnitude for the force, however, it is difficult to see how ionic drift enters into the theory. Finally, we present a detailed thermodynamic treatment of the net force

on an asymmetric capacitor. In the future, to understand this effect. a detailed theoretical model must be constructed that takes into account plasma effects: ionization of gas (or air) in the high electric field region. charge transport, and resulting dynamic forces on the electrodes. The next series of experiments should determine whether the effect occurs in vacuum, and a careful study should be carried out to determine the dependence of the observed force on gas pressure, gas species and applied voltage. DTIC

Charge Transfer; Electric Propulsion; Capacitors; Asymmetry; Electric Potential

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*.

20030086330 Illinois Univ., Urbana-Champaign, IL, USA

Material Microcharacterization Collaboratory

Mabon, J. C.; Metze, G.; Petrov, I.; Feb. 2003; 29 pp.; In English

Report No.(s): DE2003-807949; No Copyright; Avail: Department of Energy Information Bridge

The Center for Microanalysis of Materials (CMM) is a user-oriented and user-friendly facility that provides the modern analytical capabilities essential to today's materials science. The Center is an integral part of the Frederick Seitz Materials Research Laboratory on the campus of the University of Illinois at Urbana-Champaign. The CMM emphasizes the microstructural and microchemical composition of materials; chemistry and electronics of surfaces; crystal structures; phase transitions and defect structures of materials; the relationship between structure and properties of solids. By using the center, materials researchers can access over 30 major instruments in the areas of electron microscopy, scanning probes, surface microanalysis, X-ray diffraction, and back-scattering spectroscopy's. The breadth of instrumentation available through the center enables researchers to find the best combination of analytical techniques for their specific needs.
NTIS

Microanalysis; Materials Tests; Research Facilities

20030093538 NASA Glenn Research Center, Cleveland, OH, USA

CuInS2 Films Deposited by Aerosol-Assisted Chemical Vapor Deposition Using Ternary Single-Source Precursors

Jin, Michael; Banger, Kal; Harris, Jerry; Hepp, Aloysius; September 2003; 17 pp.; In English

Contract(s)/Grant(s): NCC3-947; WBS 22-755-60-01

Report No.(s): NASA/TM-2003-212390; E-13967; NAS 1.15:212390; No Copyright; Avail: CASI; A03, Hardcopy

Polycrystalline CuInS2 films were deposited by aerosol-assisted chemical vapor deposition using both solid and liquid ternary single-source precursors (SSPs) which were prepared in-house. Films with either (112) or (204/220) preferred orientation, had a chalcopyrite structure, and (112)-oriented films contained more copper than (204/220)-oriented films. The preferred orientation of the film is likely related to the decomposition and reaction kinetics associated with the molecular structure of the precursors at the substrate. Interestingly, the (204/220)-oriented films were always In-rich and were accompanied by a secondary phase. From the results of post-growth annealing, etching experiments, and Raman spectroscopic data, the secondary phase was identified as an In-rich compound. On the contrary, (112)-oriented films were always obtained with a minimal amount of the secondary phase, and had a maximum grain size of about 0.5 micron. Electrical and optical properties of all the films grown were characterized. They all showed p-type conduction with an electrical resistivity between 0.1 and 30 Omega-cm, and an optical band gap of approximately 1.46 eV +/- 0.02, as deposited. The material properties of deposited films revealed this methodology of using SSPs for fabricating chalcopyrite-based solar cells to be highly promising. Author

Metal Films; Polycrystals; Vapor Deposition; Copper Sulfides; Indium Sulfides

20030093543 NASA Glenn Research Center, Cleveland, OH, USA

Coupling of 3,8-Dibromo-1,10-Phenanthroline With 3,5-Diethynylheptyloxybenzene: A Suzuki/Miyaura Versus a Sonogashira Perspective

Yang, Jinhua; Oh, Woon Su; Elder, Ian A.; Leventis, Nicholas; Sotiriou-Leventis, Chariklia; September 2003; 11 pp.; In English

Contract(s)/Grant(s): NIH-1-R15-CA82141-01A2; PRF-35154-ACS; WBS 22-708-93-05

Report No.(s): NASA/TM-2003-212485; E-14027; NAS 1.15:212485; No Copyright; Avail: CASI; A03, Hardcopy

We report a new application of the Suzuki-Miyaura reaction whereas two bifunctional reactants, 3,8-dibromo-1,10-phenanthroline and 3,5-diethynylheptyloxylbenzene (9), yield 3,8-bis (3-ethynyl-5-heptyloxyphenylethynyl)-1,10-phenanthroline (2) efficiently (74% yield) without polymerization. This was achieved by reacting a stoichiometric amount of 9 and (Me3Si)2NLi to obtain quantitatively the monoacetylide anion of 9 (10). The latter was activated with B-methoxy-9-BBN and reacted in analogy to the alkynyl copper complex of a Sonogashira route. However, in the Sonogashira reaction, the alkynyl copper complex is present in small equilibrium concentrations and polymerization takes place even when reagents are mixed slowly. Actually the Sonogashira route gave no desired product 2, as the latter polymerizes easily via homo-coupling in the presence of air and Cu(I). Sonogashira coupling involves the palladium(0) catalyzed reaction of terminal alkynes.
Author
Phenyls; Alkynes; Synthesis (Chemistry); Reaction Products; Polymerization

20030095996 Dayton Univ. Research Inst., OH
The Wipe Solvent Program: Delivery Order 0005: Fluids, Lubricants, and Related Materials
Roberts, Marcie B.; Gschwender, Lois J.; Snyder, Carl E., Jr; Feb. 2003; 41 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F33615-00-D-5021; Proj-4347
Report No.(s): AD-A415754; AFRL-ML-WP-TR-2003-4040; No Copyright; Avail: CASI; A03, Hardcopy

Freon 113 TF(Registered) solvent, 1,1,2 -trichloroethane (Freon 113(Registered)) was widely used to clean equipment. With the banning of many halogenated solvents due to ozone depleting tendencies, users desperately sought substitute environmentally friendly solvents. In many cases, the substitutes did not work as well and had other issues that made them less than ideal. Often, it was difficult to assess various solvents based on the manufacturers' claims. In this work, which was directed to the development of replacement solvents for wipe and liquid cleaning of liquid and gaseous oxygen systems, the authors evaluated seven solvents, plus Freon 113 as a baseline, that were advocated as Freon 113 replacements. First, the cleaning ability was evaluated on oxygen system components. These solvents were also tested for compatibility with oxygen systems using the Liquid Oxygen Mechanical Impact Test and by determining the Autogenous Ignition Temperature in pure oxygen. In addition, elastomers seals Nitrile, Silicone, Viton A, Buna N, polytetrafluoroethylene, and Kel F were evaluated with the solvents. Elastomer damage on prolonged contact with most solvents was similar to Freon 113(Registered). No single solvent performed as well as nor as universally as did Freon 113(Registered), but some were close.
DTIC
Solvents; Fluids; Cleaning; Lubricants

20030102141 National Inst. of Standards and Technology, Gaithersburg, MD
Bench-Scale Flammability Measures for Electronic Equipment
Bundy, M.; Ohlemiller, T.; Jul. 2003; 28 pp.
Report No.(s): PB2003-106471; NISTIR-7031; No Copyright; Avail: CASI; A03, Hardcopy

An experimental study of the bench-scale fire performance of 18 commercial polymeric materials was conducted by the National Institute of Standards and Technology. The performance of these materials was characterized using three standard flammability tests. The ignition resistance, self-extinguishing behavior, heat release rate, and combustion product yields for these burning materials were evaluated at two material thicknesses and are discussed in terms of fire safety. This report details the first of a two part study in which the relationship between bench-scale and full-scale fire performance will be examined. Several of the materials characterized in this report will be selected for use in the full-scale study.
NTIS
Electronic Equipment; Flammability; Polymers

20030102196
Modeling and Operation of Single and Multiple Tube Membrane Bioreactors
England, Ellen C.; Jan. 2003; 289 pp.; In English
Report No.(s): AD-A415660; No Copyright; Avail: CASI; A13, Hardcopy

A mathematical model was developed and experimental work completed to examine the removal of volatile organic compounds from air using single and multiple tube membrane bioreactors. Both bench-sale and a small pilot-scale reactor's performance were reasonably predicted by the mathematical model. Both model predictions and experimental work indicated the liquid suspension does not significantly contribute to the removal of contaminants from air. Experimental results indicate that membrane bioreactor performance is not detrimentally affected by phosphorous or nitrogen limitation after an initial

period with adequate nutrient supply. Stopping the liquid flow in the reactor module also did not lead to a declination in performance. VOC removal in a polyporous membrane reactor remained constant under diurnal loading conditions when compared with continuously operated bioreactors. A heated bioreactor also was found to remove contaminant at the same rate as a reactor operated at ambient temperature while measured heat transfer coefficients for several module configurations ranged from 2. 9-17.4 W/sq m/K. Bioreactors operated in series provided additional removal of contaminant from the air.
DTIC
Contaminants; Chemical Reactors; Air Filters

20030105600 Northwestern Univ., Evanston, IL
Femtosecond Photoacoustic Equipment for Materials Characterization
Krishnaswamy, Sridhar; Jul. 2003; 11 pp.; In English
Contract(s)/Grant(s): F49620-02-1-0276
Report No.(s): AD-A416417; AFRL-SR-AR-TR-03-0304; No Copyright; Avail: CASI; A03, Hardcopy

The objective of this project was to configure non- contact nondestructive photo-acoustic measurement systems for characterization of micro- and nano-structured material systems including thin films and coatings. Specifically, a femtosecond photo-acoustic materials characterization facility has been established. At Northwestern University, we are actively pursuing research efforts to increase the sensitivity of photo-acoustic metrology. These efforts have led to advance: in laser-based ultrasonics, fiber-optic ultrasonic sensors, and photo-acoustic characterization of thin films. The femtosecond photo-acoustic system has now extended our acoustic frequency reach to the Gigahertz range. Specific research projects that we are continuing to pursue include: transient grating and pump-probe photo-acoustic experiments on very thin films, MEMS devices, and nano-structured composites. Specific material and geometric properties that can be characterized using the photo-acoustics facility include: elastic moduli, thickness, and residual stress.
DTIC
Photoacoustic Spectroscopy; Acoustic Measurement; Nondestructive Tests; Acoustic Properties

20030105601
Acute Toxicity Assessment of Break-Free CLP: A Weapons Cleaning and Maintenance Compound
Arfsten, Darryl P.; Johnson, Eric W.; Thitoff, Angie R.; Still, Kenneth R.; Brinkley, William W.; Aug. 2003; 20 pp.; In English; Original contains color illustrations
Report No.(s): AD-A416474; NHRC/EHEL-03-10; No Copyright; Avail: CASI; A03, Hardcopy

Break-Free CLP(R) ('Break-Free CLP') is a commercial cleaning, lubricating, and preserving compound used in both the military and civilian sectors for maintenance of small and large caliber weapons. Break-Free CLP is a complex mixture made up of polyalphaolefin oil (65%), synthetic oils, esters and other synthetic proprietary ingredients (27%), isoparaffinic hydrocarbons (5%), and dibasic ester (3%). Like many commercial mixtures, there is very little information available on the toxicity of Break-Free CLP. Studies were conducted to characterize the biological effects of single or repeat dermal application of Break-Free CLP to the clipped backs of CD-1 mice.
DTIC
Toxicity; Chemical Cleaning; Biological Effects; Cleaners

20030105875 Army Research Lab., Aberdeen Proving Ground, MD
Qualification of Ammunition Coatings for Renovating 155-mm M549A1 Projectiles
Smith, Pauline M.; Chesonis, Kestutis G.; May 2003; 18 pp.; In English
Contract(s)/Grant(s): DAAD17-02-P-0152
Report No.(s): AD-A416729; ARL-TR-2966; No Copyright; Avail: CASI; A03, Hardcopy

Increasingly stringent environmental regulations have forced ammunition manufacturers and maintenance facilities to reconsider their traditional coating processes. The demands on the ammunition coating specifications have changed over the years. The treatments of hazardous emissions and waste generation at all levels of production are very costly, and any reduction in emissions through improved coatings will save money. The current coating system for high explosive ammunition is an alkyd enamel topcoat, which contains high levels of volatile organic compounds applied to a pretreated surface. The need to reduce or eliminate these hazardous substances is dictated by federal and state environmental regulations, controlling the amount and types of solvents and methods for waste disposal, and by changes in the coating process. This regulatory and performance-driven process led to a major consolidation effort by the US Army Research Laboratory Coatings Team and the US Army Armament Research, Development, and Engineering Center Munitions Metal Parts to eliminate coatings with

hazardous materials and high levels of polluting solvents. Eventually, these improvements will reduce life-cycle costs Experimental stress tests such as corrosion resistance, impact resistance, and adhesion were used to characterize and identify the optimal coatings.
DTIC
Waste Disposal; Hazardous Wastes; Corrosion Resistance; Ammunition; Metal Coatings

24
COMPOSITE MATERIALS

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

20030093595 Alabama Agricultural and Mechanical Univ., Normal, AL, USA
Advanced Ceramic Technology for Space Applications at NASA MSFC
Alim, Mohammad A.; The 2002 NASA Faculty Fellowship Program Research Reports; April 2003, pp. II-1 - II-5; In English; See also 20030093576; Original contains color illustrations
Contract(s)/Grant(s): NAG8-1859; No Copyright; Avail: CASI; C01, CD-ROM; A01, Hardcopy

The ceramic processing technology using conventional methods is applied to the making of the state-of-the-art ceramics known as smart ceramics or intelligent ceramics or electroceramics. The sol-gel and wet chemical processing routes are excluded in this investigation considering economic aspect and proportionate benefit of the resulting product. The use of ceramic ingredients in making coatings or devices employing vacuum coating unit is also excluded in this investigation. Based on the present information it is anticipated that the conventional processing methods provide identical performing ceramics when compared to that processed by the chemical routes. This is possible when sintering temperature, heating and cooling ramps, peak temperature (sintering temperature), soak-time (hold-time), etc. are considered as variable parameters. In addition, optional calcination step prior to the sintering operation remains as a vital variable parameter. These variable parameters constitute a sintering profile to obtain a sintered product. Also it is possible to obtain identical products for more than one sintering profile attributing to the calcination step in conjunction with the variables of the sintering profile. Overall, the state-of-the-art ceramic technology is evaluated for potential thermal and electrical insulation coatings, microelectronics and integrated circuits, discrete and integrated devices, etc. applications in the space program.
Derived from text
Ceramics; Technology Utilization; NASA Space Programs; Microelectronics; Ceramic Coatings

20030093612 Embry-Riddle Aeronautical Univ., USA
Torque Limit for Bolted Joint For Composites, Part B, Experimentation
Kostreva, Kristian M.; The 2002 NASA Faculty Fellowship Program Research Reports; April 2003, pp. XXV-1 - XXV-5; In English; See also 20030093576
Contract(s)/Grant(s): NAG8-1859; No Copyright; Avail: CASI; C01, CD-ROM; A01, Hardcopy

Today, aerospace quality composite parts are generally made from either a unidirectional tape or a fabric prepreg form depending on the application. The matrix material, typically epoxy because of it dimensional stability, is pre-impregnated onto the fibers to ensure uniform distribution. Both of these composite forms are finding themselves used in applications where a joint is required. Two widely used joint methods are the classic mechanically fastened joint, and the contemporary bonded joint; however, the mechanically fastened joint is most commonly used by design engineers. A major portion of the research up-to-date about bolted composite joints has dealt with the inplane static load capacity. This work has helped to spawn standards dealing with filled-hole static joint strength. Other research has clearly shown that the clamp-up load in the mechanical fastener significantly affects the joint strength in a beneficial manner by reducing the bearing strength dependence of the composite laminate. One author reported a maximum increase in joint strength of 28%. This finding has helped to improve the reliability and efficiency of the joint in a composite structure.
Derived from text
Torque; Bolted Joints; Compressive Strength; Static Loads; Composite Structures

20030097962 Research and Technology Organization, Neuilly-sur-Seine, France
Low Cost Composite Structures and Cost Effective Application of Titanium Alloys in Military Platforms
March 2003; 612 pp.; In English; In French; Low Cost Composite Structures, 7-11 May 2001, Loen, Norway; See also 20030097963 - 20030098008
Report No.(s): RTO-MP-069(II); AC/323(AVT-076/077)TP/47; Copyright; Avail: CASI; C01, CD-ROM; A99, Hardcopy

The development of military systems that utilise composite materials for their structures has continued to increase, but one of the factors which still limits their applicability is their cost, compared to metallic systems. Composites have demonstrated in both the land, sea and air environments that their use can substantially reduce the weight and consequently increase the performance of military equipment. Composite may also offer maintenance cost reduction due to their better corrosion and fatigue properties. But, as defence budgets continue to decline in real terms, the cost of new equipment is becoming increasingly important, to the detriment of potentially increased capability. The objective of this Specialists Meeting was to explore the recent advances in the design and manufacture composite structures for military systems to identify both common themes and unique differences between the services and how each in addressing the requirement for reduced cost. The drawing together of representatives from all three environments (air, sea and land) was a rather unique feature of the meeting, which contributed to both the high levels of interest of the papers and exchange of ideas during the discussions. A total of 21 papers were presented with authors representing 11 member countries. It was felt by many of attendees of the meeting that the meeting s emphasis on products and lessons learnt from producing hardware, rather than pure scientific research, was one of the key factors that contributed to the success of the meeting.
Author
Titanium Alloys; Composite Materials; Composite Structures

20030097963 Defence Science and Technology Organisation, Victoria, Australia
An Affordable Methodology for Replacing Metallic Aircraft Panels with Advanced Composite Materials
Baker, A. A.; Callus, P. J.; Leong, K. H.; Georgiadis, S.; Falzon, P. J.; Dutton, S. E.; Low Cost Composite Structures and Cost Effective Application of Titanium Alloys in Military Platforms; March 2003, pp. 8-1 - 8-12; In English; See also 20030097962; Original contains color illustrations; Copyright; Avail: CASI; C01, CD-ROM; A03, Hardcopy

This paper describes an affordable approach to substitute metallic honeycomb panels with more durable stiffened graphite/epoxy composite panels. Although the program is generic, the technology is being demonstrated on a honeycomb panel for the Royal Australian Air Force (RAAF) F-111 aircraft. This panel was selected with the aim of validating the novel design, manufacture and certification approaches. Future studies will address service related issues and composite substitution of other types of metallic components.
Author
Aircraft Structures; Panels; F-111 Aircraft; Fabrication; Metal Surfaces; Honeycomb Structures; Methodology

20030097964 Instituto Nacional de Tecnica Aeroespacial, Madrid, Spain
Mechanical Characterizsation of Carbon/Epoxy Composite Materials Manufactured by Resin Film Infusion Method with Stitching Reinforcement
Blas, F.; Fernandez, I.; Low Cost Composite Structures and Cost Effective Application of Titanium Alloys in Military Platforms; March 2003, pp. 16-1 - 16-12; In English; See also 20030097962; Original contains color illustrations; Copyright; Avail: CASI; C01, CD-ROM; A03, Hardcopy

In the recent years, carbon fibre reinforced polymers (CFRP) have experimented a strongly development, especially in Aerospace Industry, due to their excellent specific properties and their low structural weight, which provide economical benefits. But traditional methods of fabrication, laying up preimpregnated plies of reinforcement and resin, present poor interlaminar fracture toughness, being susceptible to delamination when subjected interlaminar stresses. To improve damage tolerance of composites structures, through thickness reinforcement can be introduced into the laminate. But, when prepregs are reinforced other inplane mechanical properties result altered. Resin Film Infusion (RFI) is a fabrication method that allows reinforcing the structure in the through thickness direction by stitching dry fibre plies together, and infiltrate the resin system later on. The stitching reinforcement stops considerably the progress of cracks and delaminations, which results interesting in the manufacture of wing structures for war aircrafts. This work characterizes compression strength of carbon/epoxy specimens fabricated using the RFI technique, and reinforced with stitching. An exhaustive study has also been made about the propagation of mode I delaminations crack in stitched carbon/epoxy specimens, considering different distances between the beginning of the delamination and the stitched reinforcement.
Author
Carbon Fiber Reinforced Plastics; Epoxy Matrix Composites; Resin Film Infusion; Mechanical Properties; Fabrication

20030097967 FiReCo A.S., Fredrikstad, Norway
GRP in Naval Applications, Possibilities and Production Aspects
Taby, Jon; Hoyning, Bjorn; Hjelmseth, Anders; Low Cost Composite Structures and Cost Effective Application of Titanium Alloys in Military Platforms; March 2003, pp. 11-1 - 11-18; In English; See also 20030097962; Original contains color and black and white illustrations; Copyright; Avail: CASI; C01, CD-ROM; A03, Hardcopy

Low cost is a phrase with many definitions. A naval structure that fulfils the technical requirements to a lowest possible life cycle cost may be named a low cost structure. An advanced structure is not synonymous to a structure made of costly materials, but a structure that utilize materials in an advanced and economic way, often fairly irrespective of the initial specific materials costs. This complexity is especially apparent when dealing with naval structures as they involve a long list of compromises, often more pronounced compared to commercial vessel design. Some of these conflicts are the need for weapon load, speed and stability, and also low vulnerability and susceptibility. For some vessels, e.g. the SKJOLD class FPB, the selection of composite materials in the hull structure where the only possible solution in order to fulfil the requirements of the vessel within the limited cost of the project. By using a variety of construction principles and composite materials, SKJOLD fulfils all requirements to speed, range, structural strength, radar cross section, EMC, etc. A presentation of SKJOLD is given later in the paper. The number of requirements and the number of material possibilities makes composites a very interesting alternative also with respect to cost, as many of the required properties may be combined into a single structural element.The paper also describes two state of the art RnoN class of FRP vessels The Oksoy and Alta class MCMV s and the Skjold class FPB (very fast gun and missile launch vessel). The production technology, facilities, equipment and techniques used to make these vessels are also presented.
Derived from text
Composite Materials; Composite Structures; Ships

20030097968 European Aeronautic Defence and Space Co., Cedex, Framce
Aeronautical Composite Structure Cost Reduction from the Material Aspect
Cinquin, Jacques; Low Cost Composite Structures and Cost Effective Application of Titanium Alloys in Military Platforms; March 2003, pp. 19-1 - 19-7; In English; See also 20030097962; Copyright; Avail: CASI; C01, CD-ROM; A02, Hardcopy

The introduction of composite materials on Aeronautical structures to replace metallic structures was driven at the beginning by the performance and the weight reduction. Today s composite structural parts mainly made from carbon fibre and epoxy resins take a non negligible share of the aerospace structural parts. (about 25% in weight for civil Aircraft application and sometimes up to 50% for military aircraft or helicopter). Due to the pressure on the price of the final product, the future of the composite structure will be a reality if the final cost of the structural composite parts are not too much higher compare to the price of a metallic structure. Various directions for composite structure cost reduction are possible: the process, the material cost, the part design with function integration, the quality insurance, the maintenance, the material qualification, the part certification This paper will present some first results from the material aspect and how the cost could be reduced by using less expensive materials or materials designed for less expensive process. A comparison of the obtained properties between these low cost materials and traditional ones will be done and a discussion on the adaptation of the material solution to the real needs and requirement will be presented taking in account the material standardisation, harmonization of requirements and testing methods that could also help to reduce the cost.
Author
Aeronautics; Composite Structures; Cost Reduction; Mechanical Properties; Manufacturing

20030097969 Royal Aircraft Establishment, Farnborough, UK
New Low Cost Titanium Extraction and Processing
Ward-Close, M.; Low Cost Composite Structuresand Cost Effective Application of Titanium Alloys in Military Platforms; March 2003, pp. KN3; In English; See also 20030097962; Copyright; Paper was not available at time of publication

No abstract available
Extraction; Low Cost; Titanium Alloys; Fabrication; Composite Materials; Manufacturing

20030097980 Defence Evaluation Research Agency, Chertsey, UK
Technical Evaluation Report
French, M. A.; Low Cost Composite Structures and Cost Effective Application of Titanium Alloys in Military Platforms; March 2003, pp. T1-1 - T1-6; In English; See also 20030097962; Copyright; Avail: CASI; C01, CD-ROM; A02, Hardcopy

The development of military systems that utilise composite materials for their structures has continued to increase, but one of the factors which still limits their applicability is their cost, compared to metallic systems. Composites have demonstrated in both the land, sea and air environments that their use can substantially reduce the weight and consequently increase the performance of military equipment. But, as defence budgets continue to decline in real terms, the cost of new equipment is becoming increasingly important, to the detriment of potentially increased capability. The objective of this specialist meeting was to explore the recent advances in the design and manufacture composite structures for military systems

to identify both common themes and unique differences between the services and how each is addressing the requirement for reduced cost. Naturally due to the higher level of use of composites in both military and civil aircraft structures compared to ships and land vehicles, the greatest number of speakers were from an aerospace background. However, this did not weight the meeting towards aircraft only issues since the methods being devised to reduce costs were applicable across all environments. The drawing together of representatives from all three environments was a rather unique feature of the meeting, which contributed to both the high levels of interest of the papers and exchange of ideas during the discussions.
Author
Composite Materials; Aircraft Structures

20030097982 DCN Ingenierie, Paris, France
Composite Materials in Warship Construction
Parneix, Patrick; LeLan, Jean Yves; Lucas, Dominique; Low Cost Composite Structures and Cost Effective Application of Titanium Alloys in Military Platforms; March 2003, pp. 2-17 - 2-31; In English; See also 20030097962; Copyright; Avail: CASI; C01, CD-ROM; A03, Hardcopy

We are at a turning point in the history of the use of composites in the warship field. If these materials have essentially been used for their natural properties; lightness, absence of corrosion, nonmagnetism; it would seem that we have not yet taken full advantage of the very concept of composite technology. Unlike in the aeronautical industry, the often modest demands stipulated in technical requirement files have not always drawn these materials to the forefront. So, composites can do better and the market requires it. The requirements of ship speed and mobility are going to force designers and yards to optimize structures and, therefore, to have recourse to ever more sophisticated technologies and materials. A recent study [31] showed that maritime cargo shipping, if it wishes to be financially viable, will have to be more and more rapid and, therefore, will have to use ships that are both longer and lighter. Very high-performance composites find their natural place in this scenario. There is no doubt that warship construction will follow the same pattern. The 50-metre barrier which for so long appeared to naval architects to be the upper limit for a composite hull, is disappearing. Thus, the hull of the frigates built for the Swedish navy is over 70 metres in length, for a weight of 124 tonnes (about 20% of the ship s displacement). As far as we can tell, only high-performance composites can meet this challenge. Another determining factor in the evolution of the use of composites in the warship field will be their ability to provide multifunctionality. Over and above the basic structural function, composites are capable, and will become more and more so, of integrating functions associated with the ship s vulnerability and stealth. Examples illustrating this evolution are mentioned.Finally, there is one field which remains to be conquered: that of the great ocean depths with the ambition, clearly, to build the pressure hulls of future submarines out of composites.
Derived from text
Composite Materials; Mechanical Properties; Corrosion

20030097983 Defence Evaluation Research Agency, Chertsey, UK
Composite Materials and New Modelling Techniques for Lighter AFVs
French, Mark A.; Low Cost Composite Structures and Cost Effective Application of Titanium Alloys in Military Platforms; March 2003, pp. 3-1 - 3-12; In English; See also 20030097962; Original contains color illustrations; Copyright; Avail: CASI; C01, CD-ROM; A03, Hardcopy

The requirement to provide light weight armoured fighting vehicle (AFV) structures while maintaining or increasing the survivability of these structures has increased the need to develop new materials and design processes. One way to address this problem is to use composite materials to increase the structural and ballistic efficiency of the hull. Composite materials offer a number of advantages including weight reduction by the elimination of the spall liner and integral stealth protection leading to signature reductions. DERA in partnership with Vickers Defence Systems, have produced a full-sized composite demonstrator AFV called the Advanced Composite Armoured Vehicle Platform (ACAVP). With a bare hull weight of around 6,000 kg, the ACAVP hull is one of the largest and possibly the thickest high performance resin transfer mouldings (RTM) produced in Europe. The aim of the ACAVP programme is to identify where composite materials can be best utilised in the production of future AFVs. This will be achieved by quantifying the advantages that composite materials offer compared to traditional materials used to manufacture AFVs. This paper provides details on the design and manufacture of the ACAVP demonstrator, which employs the composite hull as a combined structural and ballistic structure, as well as a brief summary of the research undertaken on composite materials for AFVs on other programmes. The paper also describes new modelling techniques and identifies the potential advantages that these techniques offer.
Author
Military Vehicles; Composite Materials

20030097987 Advanced Composites Group Ltd., Heanor, UK

LTM(Registered Trademark): A Flexible Processing Technology for Polymer Composite Structures

Francombe, R.; Low Cost Composite Structures and Cost Effective Application of Titanium Alloys in Military Platforms; March 2003, pp. 12-1 - 12-11; In English; See also 20030097962; Original contains color illustrations; Copyright; Avail: CASI; C01, CD-ROM; A03, Hardcopy

There have been many advances in the structural performance of advanced composite materials during the last 30 years. Initially the high cost of these materials was easily justified by the weight saving and design flexibility advantages. The early materials research and development effort was almost entirely devoted to improving fibre and resin matrix performance and to understanding the interaction between them. During the last 10 years, however, the emphasis has moved to affordability and the R&D effort has been re-directed towards process technology and development of the material formats needed for process cost savings. The targets have been reduced tooling costs, automated lay-up and reduction of lay-up times, reduced cure times/temperatures/pressures, reduced material wastage and lower capital equipment costs. All composite processes have advantages and disadvantages, process selection is usually governed by the size and shape of the component, the quantity to be manufactured, the equipment available, and the end-use performance required. It is not the intention to compare the merits of these various processes, but this paper is based on the widely held view that prepreg moulding gives the best control of fibre and resin distribution, leading to high fibre volumes fractions, and the ultimate quality and performance capability. In the early 1990s, the Advanced Composites Group (ACG) Ltd introduced the resin chemistry and impregnation techniques for structural prepregs, which could be initially moulded at low temperatures, yet still achieve high temperature end-use performance. This allowed the use of low cost tooling methods, similar to those used in wet-lay-up processes and, in many applications, eliminated the expensive plant and equipment needed for high temperature, high pressure cures. There were, however, limitations in the early LTM technology, which restricted the available material formats, and hence process options. This paper describes the latest developments in low temperature cure resins, which enables them to be used in a much wider range of material formats, especially those designed specifically for the various low cost processes now being introduced. Most importantly the new developments allow low cost processing of large structures with the quality and performance previously associated only with the most expensive autoclave processes.

Derived from text

Composite Materials; Technology Utilization; Resins; Fabrication; Honeycomb Structures; Polymer Blends

20030097990 Army Research Lab., Aberdeen Proving Ground, MD, USA

Achieving Low Cost Composite Processes through Intelligent Design and Control

Walsh, Shawn M.; Fink, Bruce K.; Low Cost Composite Structures and Cost Effective Application of Titanium Alloys in Military Platforms; March 2003, pp. 15-1 - 15-12; In English; See also 20030097962; Original contains color illustrations; Copyright; Avail: CASI; C01, CD-ROM; A03, Hardcopy

Although the application of polymer-based composite materials continues to enjoy steady growth, the cumulative cost of these materials often limits their competitive advantage. While the constituents (e.g., resin, fibers) are relatively inexpensive, the processes ultimately responsible for integrating the materials into a structurally sound component typically dominate the expense of the composite. It is estimated that current processes account for 40-60% of end item cost. Labor generally accounts for a significant portion of these costs. The U.S. Army Research Laboratory (ARL) has followed a successful strategy of first rigorously defining the end-item performance requirements and then selecting, developing, or otherwise modifying a basic process to optimize production subject to an implicit cost constraint. It is argued that intelligent processing begins with choosing the right process and proceeds to include appropriate levels of computer and sensor-based modeling and control to reduce labor and increase reliability and quality. To that end, ARL has developed a suite of processing technologies which have since been adopted in a wide range of ground vehicle, rotor and aircraft, and armor applications. The present paper will focus on how these technologies are integrated into a low cost, intelligent composite processing system. Core technologies include: CIRTM (Co-Injection Resin Transfer Molding) which permits simultaneous fabrication of a unitized composite structure containing two distinct resin systems (e.g., one for structural, the other for flame retardance); SMARTweave sensor-based optimization of resin impregnation in Resin Transfer Molding (RTM) and Vacuum Resin Transfer Molding (VARTM) processes; High Performance Process Simulation which allows a priori optimization of key process parameters in a purely virtual environment, substantially reducing trial and error; and FASTRAC (Fast Remotely Actuated Channeling) which permits a 30-40% reduction in necessary labor and waste in VARTM processing. The paper will disclose details of each of these key technologies, as well as provide examples of their successful application to military and commercial composite systems.

Author

Composite Structures; Low Cost; Computerized Simulation; Smart Materials; Fabrication; Resin Transfer Molding

20030097996 London Univ., UK

Novel Toughening Mechanisms for Low Cost Composite Structures

Hogg, P. J.; Smith, F. C.; Low Cost Composite and Structures Cost Effective Application of Titanium Alloys in Military Platforms; March 2003, pp. 21-1 - 21-16; In English; See also 20030097962; Original contains color and black and white illustrations; Copyright; Avail: CASI; C01, CD-ROM; A03, Hardcopy

The difficulty with using conventional aerospace grade epoxies in resin infusion processes lies in their high viscosity. These resins are typically heavily formulated systems and include thermoplastic toughening additives to satisfy end-use damage tolerance and notch test requirements. Infusion of high viscosity resins is both highly complicated and time consuming, and therefore costly, or incompatible with part quality. Low viscosity resins, which are ideal for this process, in general cannot offer comparable toughness. The study described introduces a concept in which toughening agents are added to the preform or textile used to reinforce the part such that comparatively brittle low viscosity resins can be used without compromising part toughness. Tension, penetrative impact, compression after impact, double cantilever beam and end-notched flexure tests were performed on toughened and untoughened carbon fibre/epoxy laminates and the results compared. The net result is an improvement in mechanical properties, which is thought to be due to the fact that the thermoplastic fibres can deform and debond thereby absorbing energy without detriment to the load carrying capability of the material.

Author

Composite Structures; Low Cost; Mechanical Properties; Tolerances (Mechanics); Notch Sensitivity; Toughness; Resins

20030099651 Minnesota Mining and Mfg. Co., Saint Paul, MN, USA

Solutions for Hot Situations

Spinoff 2003: 100 Years of Powered Flight; 2003, pp. 80-81; In English; See also 20030099639; Original contains color illustrations; No Copyright; Avail: National Technology Transfer Center (NTTC), Wheeling, WV

From the company that brought the world an integral heating and cooling food service system after originally developing it for NASA's Apollo Program, comes yet another orbital offshoot: a product that can be as thin as paper and as strong as steel. Nextel Ceramic Textiles and Composites from 3M Company offer space-age protection and innovative solutions for hot situations, ranging from NASA to NASCAR. With superior thermal protection, Nextel fabrics, tape, and sleevings outperform other high temperature textiles such as aramids, carbon, glass, and quartz, permitting engineers and manufacturers to handle applications up to 2,500 F (1,371 C). The stiffness and strength of Nextel Continuous Ceramic Fibers make them a great match for improving the rigidity of aluminum in metal matrix composites. Moreover, the fibers demonstrate low shrinkage at operating temperatures, which allow for the manufacturing of a dimensionally stable product. These novel fibers also offer excellent chemical resistance, low thermal conductivity, thermal shock resistance, low porosity, and unique electrical properties.

Derived from text

Ceramic Fibers; Textiles; Technology Utilization; Manufacturing; Thermal Protection

20030105831 Army Construction Engineering Research Lab., Champaign, IL, USA

Investigation of Fiber-Reinforced Polymer for Seismic Rehabilitation of Concrete Structural Frames with Unreinforced Masonry Infill

Al-Chaar, Ghassan K.; Berman, Justin B.; Sweeney, Steven C.; May 2003; 181 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): Proj-4A162784AT41

Report No.(s): AD-A416538; ERDC/CERL-TR-03-10; No Copyright; Avail: CASI; A09, Hardcopy

The U.S. Army currently operates approximately 1300 older buildings that use masonry-infilled concrete frames as their principal structural system. About 700 of these buildings do not meet current seismic code requirements and are considered vulnerable to damage during an earthquake. The primary objective of this research was to investigate the performance of FRP composite materials when used to rehabilitate masonry-infilled concrete frame systems. A secondary objective was to investigate the seismic performance of multi-bay, multi-story masonry-infilled concrete frame systems similar to those still in use on Army installations in U.S. areas of high seismicity. The models used in this study were half-scale in order to conform to the physical limitations of the testing facility. Four experimental tests were conducted on two physical models. The results of four tests were analyzed and compared to determine the influence of their distinguishable variables. The general conclusion drawn from these studies is that CFRP overlay material can be bonded to concrete to provide effective rehabilitation of masonry infilled concrete frames. The test results indicate that CFRP can improve structural strength and deformation capabilities.

DTIC

Composite Materials; Structural Engineering; Seismology; Biopolymers; Mechanical Properties

20030105953 Case Western Reserve Univ., Cleveland, OH

Focused Topical Session: Oxide/Oxide Ceramics and Composites Meeting; Annual Cocoa Beach Conference (27th) and Exposition on Advanced Ceramics and Composites Held in Cocoa Beach on 26-31 January 2003

Sayir, A.; Jun. 15, 2003; 170 pp.; In English

Contract(s)/Grant(s): F49620-02-1-0088

Report No.(s): AD-A415889; AFRL-SR-AR-TR-03-0261; No Copyright; Avail: CASI; A08, Hardcopy

Advanced materials are usually composite materials for structural components to carry loads and/or functional components to accomplish specific tasks. Oxide ceramic, oxide fiber reinforced ceramic composites and in-situ composites stand out as those which provide best properties in oxidizing environment. The oxide materials are essential to withstand severe loads in the oxidizing environment a severe conditions. The oxide ceramics and oxide composites is a crucial research area because it's importance to air breathing engine technology of US Air Force, Department of defense and US civilian industry. The components of the oxide ceramics and their composites are essential for the future aerospace industry and the information of their behavior is critical to understand the response of composites. Three focused topical session on the Oxide ceramics and Composites has been organized at the 27 Annual Cocoa Beach Conference and Exposition on Advanced Ceramics & Composites meeting. These sessions were: (i) Intrinsic Properties of Oxides (Magnetic, Electrical, Optical, Mechanical), (ii) Microstructures and Mechanical Behavior (iii) Novel Processing Techniques. The proposed meeting provided a forum for discussing the essential scientific issues involved in the development and use of high temperature materials.

DTIC

Composite Materials; Ceramics; Oxides

25
INORGANIC, ORGANIC AND PHYSICAL CHEMISTRY

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

20030086328 Rensselaer Polytechnic Inst., Troy, NY, USA

Metal Carbonyl-Hydrosilane Reactions and Hydrosilation Catalysis

Cutler, A. R.; Apr. 14, 2001; 34 pp.; In English

Report No.(s): DE2003-805815; No Copyright; Avail: Department of Energy Information Bridge

Manganese carbonyl complexes serve as hydrosilation precatalysts for selectively transforming a carbonyl group into a siloxy methylene or a fully reduced methylene group. Substrates of interest include (1) aldehydes, ketones, carboxylic acids, silyl esters, and esters, and (2) their organometallic acyl counterparts. Two types of manganese precatalysts have been reported: (a) alkyl and acyl complexes (L)(CO)(sub 4)MnR(L=CO, PPh(sub 3); R=COCH(sub 3), COPh, CH(sub 3)) and (b) halides (CO)(sub 5)MnX and ((CO)(sub 4)MnX)(sub 2) (X=Br, I). The former promote hydrosilation and deoxygenation catalysis; the latter promote dehydrogenative silation of alcohols and carboxylic acids as well as hydrosilation and deoxygenation of some metallocarboxylic acid derivatives. In every case studied, these Mn precatalysts are far more reactive or selective than traditional Rh(l) precatalysts. The reaction chemistry of the above and other Mn alkyl complexes with hydrosilanes was studied in order to probe catalysis mechanism(s).

NTIS

Carbonyl Compounds; Catalysis; Chemical Reactions

20030093604 Spelman Coll., Atlanta, GA, USA

Interfacial Reaction Studies Using ONIOM

Cardelino, Beatriz H.; The 2002 NASA Faculty Fellowship Program Research Reports; April 2003, pp. XI-1 - XI-5; In English; See also 20030093576; Original contains color illustrations

Contract(s)/Grant(s): NAG8-1859; No Copyright; Avail: CASI; C01, CD-ROM; A01, Hardcopy

In this report, we focus on the calculations of the energetics and chemical kinetics of heterogeneous reactions for Organometallic vapor phase epitaxy (OMVPE). The work described in this report builds upon our own previous thermochemical and chemical kinetics studies. The first of these articles refers to the prediction of thermochemical properties, and the latter one deals with the prediction of rate constants for gaseous homolytic dissociation reactions. The calculations of this investigation are at the microscopic level. The systems chosen consisted of a gallium nitride (GaN) substrate, and

molecular nitrogen (N2) and ammonia (NH3) as adsorbants. The energetics for the adsorption and the adsorbant dissociation processes were estimated, and reaction rate constants for the dissociation reactions of free and adsorbed molecules were predicted. The energetics for substrate decomposition was also computed. The ONIOM method, implemented in the Gaussian98 program, was used to perform the calculations. This approach has been selected since it allows dividing the system into two layers that can be treated at different levels of accuracy. The atoms of the substrate were modeled using molecular mechanics6 with universal force fields, whereas the adsorbed molecules were approximated using quantum mechanics, based on density functional theory methods with B3LYP functionals and 6-311G(d,p) basis sets. Calculations for the substrate were performed in slabs of several unit cells in each direction. The N2 and NH3 adsorbates were attached to a central location at the Ga-lined surface.
Derived from text
Organometallic Compounds; Vapor Phase Epitaxy; Interfacial Tension; Chemical Reactions; Computer Programs

20030093627 Embry-Riddle Aeronautical Univ., USA
A Computational Method for Determining the Equilibrium Composition and Product Temperature in a LH2/LOX Combustor
Sozen, Mehmet; The 2002 NASA Faculty Fellowship Program Research Reports; April 2003, pp. XLVIII-1 - XLVIII-10; In English; See also 20030093576
Contract(s)/Grant(s): NAG8-1859; No Copyright; Avail: CASI; C01, CD-ROM; A02, Hardcopy
In what follows, the model used for combustion of liquid hydrogen (LH2) with liquid oxygen (LOX) using chemical equilibrium assumption, and the novel computational method developed for determining the equilibrium composition and temperature of the combustion products by application of the first and second laws of thermodynamics will be described. The modular FORTRAN code developed as a subroutine that can be incorporated into any flow network code with little effort has been successfully implemented in GFSSP as the preliminary runs indicate. The code provides capability of modeling the heat transfer rate to the coolants for parametric analysis in system design.
Author
Combustion; Liquid Hydrogen; Liquid Oxygen

20030093638 Lawrence Livermore National Lab., Livermore, CA
IR Extinction Coefficient Measurements of CH and CD GDP Shells
Cook, B.; Nikroo, A.; Mar. 31, 2003; In English
Report No.(s): DE2003-15003834; UCRL-ID-152574; No Copyright; Avail: National Technical Information Service (NTIS)
We report wavelength dependent extinction coefficients for both CH and CD glow discharge polymer (GDP) shells. Because these measurements are made on shells opposed to the more ideal coatings made previously on salt plates they represent a more reliable and realistic measure of what can be expected for NIF capsules. The results are listed in Table 111 on Page 6 for the current wavelengths of interest. For CD the values are similar to what was reported earlier' for CD coatings on salt plates. The values for CH are significantly higher than the rough estimate in that report.
NTIS
Polymers; Glow Discharges

20030095857 Lawrence Livermore National Lab., Livermore, CA
Insulator to Metal Transition in Fluid Hydrogen
Hood, R. Q.; Galli, G.; Jan. 15, 2003; 10 pp.; In English
Report No.(s): DE2003-15003860; UCRL-ID-152690; No Copyright; Avail: Department of Energy Information Bridge
We have investigated the insulator to metal transition (ITM) in fluid hydrogen using first principles simulations. Both density functional and quantum Monte Carlo calculations show that the electronic energy gap of the liquid vanishes at about 9 fold compression and 3000 K. At these conditions the computed conductivity values are characteristic of a poor metal. These findings are consistent with those of recent shock wave experiments but the computed conductivity is larger than the measured value. From our ab-initio results we conclude that the ITM is driven my molecular dissociation rather than disorder and that both temperature and pressure play a key role in determining structural changes in the fluid.
NTIS
Insulators; Metals; Metallic Hydrogen; Liquid Hydrogen

20030096005 Cornell Univ., Ithaca, NY

Crossed-Plane Imaging of Premixed Turbulent Combustion Processes

Gouldin, F. C.; Mar. 28, 2003; 17 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAAD19-99-1-0324

Report No.(s): AD-A415774; MAE-1-03-FCG; ARO-38966.2-EG; No Copyright; Avail: CASI; A03, Hardcopy

During the last several years we have developed and applied advanced imaging methods - crossed-plane laser tomography and crossed-plane laser Rayleigh imaging -- for high-resolution studies of scalar fields in premixed combustion. Laser tomography with micron sized, silicone oil droplets marks 650 K isothermal surfaces, and we have used crossed-plane tomography to measure for the first time in three dimensions the instantaneous orientation of these surfaces and to determine the probability density function of the surface normal vector, a statistical measure of surface wrinkling. Rayleigh scattering from premixed flames can be used for temperature imaging, and we have developed crossed-plane Rayleigh imaging in order to measure with high-resolution instantaneous temperature fields, temperature gradient vectors and isothermal surface densities in premixed reacting flows. Most recently we have combined crossed-plane tomography with stereo particle image velocimetry to measure for the first time reactant flow velocities and the components of this velocity both perpendicular and tangent to the reaction sheet. In this report progress from the inception of Grant number DAAD 19-99-1-0324 is summarized, and relevant information regarding publications and participants in the research is presented.

DTIC

Combustion; Rayleigh Scattering

20030098052 Pennsylvania State Univ., University Park, PA

Theory of Gas Adsorption in Carbon Nanostructures

Cole, Milton W.; Crespi, Vincent H.; Johnson, J. K.; May 20, 2003; 5 pp.; In English

Contract(s)/Grant(s): DAAD19-99-1-0167

Report No.(s): AD-A415612; ARO-39194.7-CH; No Copyright; Avail: CASI; A01, Hardcopy

This report is a brief summary of the results of studies conducted by faculty, students, and postdoctoral fellows at Pennsylvania State University (Department of Physics) and the University of Pittsburgh (Department of Chemical and Petroleum Engineering) on gas adsorption in carbon nanostructures. The principal research methods employed in these studies were analytical or numerical theory and computer simulation. In addition, successful collaborations with experimental scientists at these institutions and elsewhere took place. The research focused on the prediction of the thermodynamic properties of gases adsorbed on nanotubes. Studies also were conducted on the spectroscopic properties and momentum distribution of hydrogen. In most cases, experimental data on gas adsorption were consistent with the predictions. In some cases, especially in the case of hydrogen, the data were particularly dependent on material preparation and the kind of experimental study of adsorption that was performed. The authors have developed sophisticated models that improve upon conventional assumptions about carbon nanotubes' electronic properties and their effects on adsorption. They also have investigated the consequences of polydisperse tube size distribution and dilation of the tube lattice in a nanotube bundle on adsorption. The report contains bibliographic references to the 27 research publications that were completed by this group of investigators during the course of this contract with the Army Research Office.

DTIC

Adsorption; Carbon Nanotubes; Nanostructures (Devices); Thermodynamic Properties; Gas Dynamics

20030102207

Characteristics and Sampling Efficiencies of Aerosol Samplers Manufactured by Mesosystem Technology, Inc

Kesavan, Jana; Carlile, Donna; Doherty, Robert W.; Hottell, Aubrey K.; Sutton, Tiffany; Mar. 2003; 21 pp.; In English

Contract(s)/Grant(s): Proj-622384/ACB2

Report No.(s): AD-A415715; ECBC-TN-014; No Copyright; Avail: CASI; A03, Hardcopy

Characteristics and sampling efficiencies of five aerosol samplers designed and built by MesoSyetem Technology, Incorporated (Kennewick, WA) were determined. The samplers tested were three BioCapture(TM) (BT-550) samplers, one MicroVIC(TM) concentrator connected to a filter (MV-F), and one MicroVIC(TM) concentrator connected to an SKC BioSampler (MV-SKC). Monodisperse fluorescent oleic acid particles and monodisperse fluorescent polystyrene latex particles were used in the tests. The analysis was by fluorometry. The results showed that all samplers had a peak sampling efficiency for 2-micrometers particles. The average peak sampling efficiencies of the samplers BT-550, MV-F, and MV-SKC were 38%, 63%, and 27%, respectively.

DTIC

Aerosols; Mesometeorology; Manufacturing; Sampling

20030105446 Oklahoma State Univ., Stillwater, OK
Theoretical Studies of the Sensitivity of Energetic Materials
Thompson, Donald L.; Apr. 2003; 11 pp.; In English
Contract(s)/Grant(s): F49620-00-1-0273
Report No.(s): AD-A416281; AFRL-SR-AR-TR-03-0270; No Copyright; Avail: CASI; A03, Hardcopy

The purpose of this research program is to develop atomic-level models for high energy density materials (HEDM), and to study their fundamental properties and behaviors that determine their suitability as practical propellants and explosives. The central focus of our research during this grant period was ionic energetic materials, although some studies of the interactions and reactions of energetic molecules with solid Al and Al(2)O(3), and of the hydrogen- bonded energetic solid 1,1 -diamino-2,2-dinitroethylene (FOX- 7) were performed. The primary purpose of the work was to develop accurate models for describing the physical properties of strong oxidizing salts. We have successfully modeled crystal structures, melting, and liquid properties of ammonium dinitramide as a test case for our approaches, and we have partially developed models for ammonium nitrate and hydroxylammonium nitrate. A long-term goal of this work is to model the chemistry of ionic liquids and thus we have performed several quantum chemistry studies to determine the pathways for proton transfer and chemical decomposition of these three prototypical salts.
DTIC
Numerical Analysis; Atomic Energy Levels; Density (Mass/Volume); Flux Density

20030105447 Pennsylvania Univ., Philadelphia, PA
Chemical Precursor Routes to Ceramic Nanocylinders
Sneddon, Larry G.; Jun. 24, 2003; 6 pp.; In English
Contract(s)/Grant(s): F49620-01-1-0443
Report No.(s): AD-A416277; 1-2003; AFRL-SR-AR-TR-03-0246; No Copyright; Avail: CASI; A02, Hardcopy

The objective this AFOSR sponsored project was to design and synthesize new processable chemical precursors to nonoxide ceramics that allow the formation of the ceramics in nano-structured forms. These studies demonstrated that the use of a suitably designed molecular or polymeric single-source precursor in conjunction with porous alumina nano-templating methods can be used for the systematic generation of aligned, monodispersed ensembles of boron carbide, boron nitride and silicon carbide ceramic nanocylinders. These methods should now be useful for the production of a wide range of nanostructured ceramics.
DTIC
Ceramics; Synthesis (Chemistry); Porosity

20030105548 Arkansas Univ., Fayetteville, AR
Efficient Modeling of Large Molecules: Geometry Optimization Dynamics and Correlation Energy
Pulay, Peter; Baker, Jon; Apr. 2003; 25 pp.; In English
Contract(s)/Grant(s): F49620-00-1-0281; Proj-3484
Report No.(s): AD-A416248; AFRL-SR-AR-TR-03-0271; No Copyright; Avail: CASI; A03, Hardcopy

The original grant proposal comprised three parts, two of which were continuation of previous successful projects. The first project involves more efficient optimization techniques for very large molecules (containing several thousand atoms). The second is the development of algorithms for molecular dynamics in internal coordinates. The third project involves the efficient calculation of correlation energies for large (a few hundred atoms) molecules. This report summarizes our work in all three areas. Progress has been excellent throughout.
DTIC
Algorithms; Molecules; Coordinates

20030105565 National Center for Microgravity Research on Fluids and Combusiton, Cleveland, OH, USA
Laser Synthesis of Supported Catalysts for Carbon Nanotubes
VanderWal, Randall L.; Ticich, Thomas M.; Sherry, Leif J.; Hall, Lee J.; Schubert, Kathy, Technical Monitor; September 2003; 16 pp.; In English
Contract(s)/Grant(s): NCC3-975; NCC3-544; WBS 22-101-12-06
Report No.(s): NASA/CR-2003-212582; E-14122; NAS 1.26:212582; No Copyright; Avail: CASI; A03, Hardcopy

Four methods of laser assisted catalyst generation for carbon nanotube (CNT) synthesis have been tested. These include pulsed laser transfer (PLT), photolytic deposition (PLD), photothermal deposition (PTD) and laser ablation deposition

(LABD). Results from each method are compared based on CNT yield, morphology and structure. Under the conditions tested, the PLT was the easiest method to implement, required the least time and also yielded the best pattemation. The photolytic and photothermal methods required organometallics, extended processing time and partial vacuums. The latter two requirements also held for the ablation deposition approach. In addition to control of the substrate position, controlled deposition duration was necessary to achieve an active catalyst layer. Although all methods were tested on both metal and quartz substrates, only the quartz substrates proved to be inactive towards the deposited catalyst particles.
Author
Carbon Nanotubes; Catalysts; Deposition

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METALS AND METALLIC MATERIALS

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

20030086327 Department of Energy, Washington, DC
Steel Foundry Refractory Lining Optimization
2002; 13 pp.
Report No.(s): DE2003-805266; No Copyright; Avail: Department of Energy Information Bridge
The overall objective of the steel foundry refractory lining optimization program was to review established refractory and steelmaking practices to identify opportunities for improvements that would yield substantial energy savings for steel foundries. Energy savings were expected to arise from improved efficiency of the electric arc furnaces and from reductions in the postcasting welding and grinding that are normally required.
NTIS
Refractories; Steels; Electric Furnaces

20030093726 NASA Glenn Research Center, Cleveland, OH, USA
A High Temperature Cyclic Oxidation Data Base for Selected Materials Tested at NASA Glenn Research Center
Barrett, Charles A.; September 2003; 31 pp.; In English
Contract(s)/Grant(s): WBS 22-708-31-22
Report No.(s): NASA/TM-2003-212546; E-14112; NAS 1.15:212546; No Copyright; Avail: CASI; A03, Hardcopy
The cyclic oxidation test results for some 1000 high temperature commercial and experimental alloys have been collected in an EXCEL database. This database represents over thirty years of research at NASA Glenn Research Center in Cleveland, Ohio. The data is in the form of a series of runs of specific weight change versus time values for a set of samples tested at a given temperature, cycle time, and exposure time. Included on each run is a set of embedded plots of the critical data. The nature of the data is discussed along with analysis of the cyclic oxidation process. In addition examples are given as to how a set of results can be analyzed. The data is assembled on a read-only compact disk which is available on request from Materials Durability Branch, NASA Glenn Research Center, Cleveland, Ohio.
Author
Data Bases; NASA Programs; Heat Resistant Alloys; Materials Tests; Oxidation

20030093815 Lawrence Livermore National Lab., Livermore, CA
Comparison of the Effect of Temperature on the Crevice Breakdown and Repassivation Potentials of Wrought and Welded Alloy 22 in 5 M CaCl(sub 2)
IIevbare, G. O.; Mar. 03, 2003; In English
Report No.(s): DE2003-15003839; UCRL-JC-149940; No Copyright; Avail: National Technical Information Service (NTIS)
The study of the electrochemical behavior of wrought and welded Alloy 22 was carried out in 5 M CaCl(sub 2) at various temperatures. Comparisons were made between the electrochemical behaviors of the wrought and welded forms of Alloy 22 Multiple Crevice Assembly (MCA) specimens. The susceptibility to corrosion was found to increase with increase in temperature in both the wrought and the welded forms of the alloy. Nevertheless, degree of susceptibility was found to be similar in both the wrought and welded. Alloy 22 (N06022) is a nickel alloy rich in chromium and molybdenum, with a high degree of corrosion resistance. It exhibits a low general corrosion rate under most conditions and has formidable localized corrosion resistance in most environments compared with other nickel alloys. Consequently, Alloy 22 has emerged as the

leading candidate for the fabrication of high-level nuclear waste containers, containers that are intended for use for disposal of high-level radioactive waste and spent nuclear fuel.
NTIS
Nickel Alloys; Wrought Alloys; Corrosion Prevention; Welding

20030097965 Army Research Office, Research Triangle Park, NC, USA
Titanium Structures for Army Systems
Mullins, W. M.; Low Cost Composite Structures and Cost Effective Application of Titanium Alloys in Military Platforms; March 2003, pp. KN4-1 - KN4-8; In English; See also 20030097962; Copyright; Avail: CASI; C01, CD-ROM; A02, Hardcopy

The FCS (Future Combat System) programme seeks to maintain the U.S. Army's current advantages in lethality and survivability provided by the M1 Abrams while achieving a dramatic improvement in tactical and strategic mobility. Air transport requirements limits the total transport weight of the vehicle to less than 18.9 tonnes. These severe weight and volume restrictions change the fundamental problems of system design from those of a ground vehicle to those of an aerospace structure. Because of these requirements, the use of aerospace materials for structure and armour applications becomes reasonable. For these reasons, FCS potentials for titanium are very great. This talk will discuss recent and ongoing research that addresses the design, processing and performance of titanium alloys and titanium matrix composites for ground-based applications of Army interest.
Author
Titanium Alloys; Aircraft Construction Materials; Aerospace Engineering; Metal Matrix Composites; Armor; Air Transportation

20030097970 Instituto Nacional de Tecnica Aeroespacial, Torrejon de Ardoz, Spain
A Study of Low Temperature Diffusion Bonding Processing of TI-6AL-4V Alloy for Reducing Costs in SPF/DB Structures
Carrion, J. G.; Low Cost Composite Structures and Cost Effective Application of Titanium Alloys in Military Platforms; March 2003, pp. 8-1 - 8-12; In English; See also 20030097962; Original contains black and white illustrations; Copyright; Avail: CASI; C01, CD-ROM; A03, Hardcopy

Solid-state diffusion bonding (DB) process is a joining technology based on the diffusion capacity of materials. Being activated by a combination of variables, mainly temperature, pressure and time, a couple of materials can be bonded by diffusion across the surface contact. Metallurgical nature of materials to be bonded condition their DB capacity but, in the case of titanium (Ti) and Ti alloys, and specially for the most known one, Ti-6Al-4V, no problems arise if oxygen level is controlled during the bonding cycle (i.e., inert atmosphere). DB can be successfully developed together with superplastic forming (SPF) as they share similar process parameters, although for SPF the requirements are normally more restrictive, due to the nature of the superplastic deformation phaenomenon. However, a wise introduction of DB during SPF cycle can lead to overall processing cost reduction, as DB take place in a wider range of temperature-pressure-time combinations. SPF Ti alloys structures are considered as one of the most interesting solutions for weight reduction in military aircrafts in operative conditions that aluminium alloys can not support. Some examples of these materials can be found in Tornado and EF2000 aircrafts. DB in Ti-6Al-4V alloy devoted to SPF, has been studied and assessed for different specimen configurations, focusing on mechanical behaviour of joints produced and metallurgical effects on the material that could adverse SPF. Results show that appreciable mechanical performances can be obtained for DB conditions involving temperatures well below SPF one.
Author
Aluminum Alloys; Titanium Alloys; Vanadium Alloys; Diffusion; Low Temperature; Metal Bonding

20030097971 Academy of Sciences of the Ukraine, Kyiv, Ukraine
New Methods for Welding Titanium and Manufacture of Unique Large-Sized Titanium Semi-Finished Products
Zamkov, V. N.; Akhonin, V. S.; Low Cost Composite Structures and Cost Effective Application of Titanium Alloys in Military Platforms; March 2003, pp. INV1-1 - INV1-20; In English; See also 20030097962; Original contains black and white illustrations; Copyright; Avail: CASI; C01, CD-ROM; A03, Hardcopy

Titanium welding and manufacturing technologies at the E.O. Paton Electric Welding Institute in the Ukraine are profiled. The Institute's welding techniques include: TIG welding, narrow-gap magnetically impelled arc welding, mechanized TIG welding, and vertical TIG welding. Alloys used at the Institute include: heat-hardenable (alpha + beta) alloys and pseudo

beta-titanium alloys. This paper also discusses the production of titanium ingots by electrom beam melting.
CASI
Gas Tungsten Arc Welding; Titanium; Manufacturing; Titanium Alloys

20030097972 Army Research Lab., Aberdeen Proving Ground, MD, USA
A Ballistic Evaluation of Ti-6Al-4V vs. Long Rod Penetrators
Gooch, William A.; Burkins, Matthew; Low Cost Composite Structures and Cost Effective Application of Titanium Alloys in Military Platforms; March 2003, pp. 13-1 - 13-10; In English; See also 20030097962; Original contains black and white illustrations; Copyright; Avail: CASI; C01, CD-ROM; A02, Hardcopy

Over the past ten years, the US Army Research Laboratory (ARL) has analyzed the ballistic performance of titanium alloys against long rod penetrators with different aspect ratios (L/D). This paper presents a compendium of the published penetration data for tungsten alloy and depleted uranium laboratory rods of 65-250-g weight with L/D ratios between 10 and 20 at impact velocities from 500 m/s to 2500 m/s. The titanium examined was the Ti-6Al-4V alloy, manufactured to Mil-T-9046J and Mil-DTL-46077E specifications. The unique properties of titanium alloys, i.e. low density, uniform hardness, and high strength over the total thickness range, result in ballistic performance improvements of up to 85% on a mass basis as compared to rolled homogeneous armor (RHA) steel. The titanium and RHA penetration data are represented by concise two-parameter non-linear analytic functions that describe the penetration-velocity relationship over the range of impact velocities.
Author
Ballistics; Evaluation; Titanium Alloys; Aluminum Alloys; Vanadium Alloys; Penetration; Rods

20030097973 Army Research Lab., Aberdeen Proving Ground, MD, USA
Effect of Thermomechanical Processing on the Ballistic Performance of Titanium
Burkins, Matthew; Gooch, William A.; Hansen, Jeffrey; Paige, Jack; Turner, Paul; Low Cost Composite Structures and Cost Effective Application of Titanium Alloys in Military Platforms; March 2003, pp. 14-1 - 14-10; In English; See also 20030097962; Original contains color and black and white illustrations; Copyright; Avail: CASI; C01, CD-ROM; A02, Hardcopy

Although titanium alloys have been well characterized for aerospace uses, characterization for use in armor systems is very limited. In an effort to provide increased information to armored vehicle designers, the U.S. Army Research Laboratory and the U.S. Department of Energy Albany Research Center performed a joint research program to evaluate the effect of thermomechanical processing on the ballistic limit velocity for an extra-low interstitial grade of Ti-6Al-4V. MIL-T-9046J, AB-2 plates were obtained from RMI Titanium Company, rolled to final thickness, annealed, and the mechanical and microstructural information was obtained. The plates were then ballistically tested with 20- mm fragment-simulating projectiles and 12.7-mm armor-piercing bullets to determine the ballistic limit velocity of each plate. Titanium processing and annealing had an effect on the ballistic limit velocity, but the magnitude of the effect depended on the penetrator.
Author
Aluminum Alloys; Titanium Alloys; Vanadium Alloys; Microstructure

20030097974 Army Research Lab., Aberdeen Proving Ground, MD, USA
Development and Ballistic Testing of a Functionally Gradient Ceramic/Metal Applique
Gooch, William A.; Burkins, Matthew S.; Palicka, Richard; Low Cost Composite Structures and Cost Effective Application of Titanium Alloys in Military Platforms; March 2003, pp. 15-1 - 15-11; In English; See also 20030097962; Original contains color and black and white illustrations
Contract(s)/Grant(s): DAAL01-96-C-0081; Copyright; Avail: CASI; C01, CD-ROM; A03, Hardcopy

The U.S. Army Research Laboratory has undertaken a two year Small Business Initiative Research program with Cercom Incorporated of Vista, CA to develop a ballistic applique that transitions from a ceramic cermet hard face to a metal back face which can be fabricated to near net shape during the densification process. These functionally gradient materials offer significant advantages in armor applications over conventional adhesive bonded ceramic-metal appliques. This paper will discuss the conceptional requirements, material development process and highlight the 14.5-mm ballistic testing conducted to date.
Author
Functionally Gradient Materials; Hot Pressing; Titanium Borides; Cermets

20030097975 E.O. Paton Electric Welding Inst., Kiev, Ukraine

The State of the Art in Welding Metallic Composite Materials

Ryabov, V.; Low Cost Composite Structures and Cost Effective Application of Titanium Alloys in Military Platforms; March 2003, pp. INV2-1- INV2-19; In English; See also 20030097962; Original contains black and white illustrations; Copyright; Avail: CASI; C01, CD-ROM; A03, Hardcopy

The industry currently shows a tendency for expansion of the fields of application of the composite materials (CM). The main scope of the CM application is in aerospace engineering. In the current flying vehicles the weight of the CM parts exceeds 6 to 10 %. The advantages of the newly developed flying vehicles are, primarily, assessed in terms of reliability, cost-effectiveness of service and material content of structures. These characteristics directly depend on the physico-mechanical properties of materials.

Derived from text

Composite Materials; Welding; Metals; Reliability Analysis

20030097978 Tecnocentro Engineering s.r.l., Terni, Italy

Titanium Desalting Mobile Equipment for Low Cost Applications

Moriconi, A.; Corradi, S.; Marchetti, M.; Guglielmi, F.; Colavita, M.; Pugliatti, D.; Low Cost Composite Structures and Cost Effective Application of Titanium Alloys in Military Platforms; March 2003, pp. 21-1 - 21-10; In English; See also 20030097962; Original contains color illustrations; Copyright; Avail: CASI; C01, CD-ROM; A02, Hardcopy

Summary. During the period 1996-1998, Tecnocentro Eng. s.r.l. and Titania S.p.A successfully implemented a European Community-financed innovative project referred to the world first 100%- titanium desalinator of sizeable but still compact proportions to be operated either by multiple effect, or by steam thermal compression technology. The positive results of the project after one year of operation allowed the start-up of a cooperation programme between Tecnocentro Eng. s.r.l., Titania S.p.A., the University of Rome La Sapienza , and the Italian Air Force DASRS which was intended for the Titanium wide application in desalting mobile equipment. Namely, the titanium desalting mobile equipment for low cost application must be compact, light, reliable and easy to transport, suitable for mobile operative units, ground and marine military platforms. As a fundamental step of that cooperation programme, a pilot unit, manufactured by Tecnocentro Eng. s.r.l. and the University of Rome, is under operation for the assessment of the various mechanism of the fouling (scaling, corrosion, bio-fouling, etc) when high salinity water, or dirty water, is in contact with titanium surface. The pilot unit and the mobile desalinating equipment, here described, are going to be installed by the sea, at San Marco base, near Malindi (Kenia). This way the apparatus is going to be tested in a real harsh environment and, at the same time fresh water is produced to be used within the base itself and in the Ngomeni village, where no natural source of potable water is available.

Author

Metal Surfaces; Salinity; Titanium; Low Cost

20030097997 Virginia Univ., Charlottesville, VA, USA

Technical Evaluation Report

Starke, Edgar A., Jr.; Low Cost Composite Structures and Cost Effective Application of Titanium Alloys in Military Platforms; March 2003, pp. T2-1 - T2-10; In English; See also 20030097962; Copyright; Avail: CASI; C01, CD-ROM; A02, Hardcopy

This paper presents a technical evaluation of the Specialists Meeting on the Cost Effective Application of Titanium Alloys in Military Platforms held at the Applied Vehicle Technology Panel (AVT) meeting in Loen, Norway on May 9-11, 2001. The meeting was successful in providing a forum for information exchange and discussions by specialists for the cost effective application of titanium alloys to military platforms. The areas of casting technology, component fabrication processes, use for ballistic protection, and the manufacture of platform subsystems were discussed. The attendees concluded that reducing costs associated with the insertion of titanium and its alloys into military systems requires that all aspects of processing, design and manufacturing be addressed. Modeling can have a significant impact on total costs, from that associated with castings directed at reducing defects, to finite element modeling of processing, e.g. extrusion and forging in order to reduce the number of trials for process optimization, to taking into account the presence of residual stresses during machining to avoid warping, etc. Modeling of microstructure/property relationship may also reduce the number of tests required for qualification of new materials and allow for more accurate life predictions.

Author

Manufacturing; Titanium Alloys; Microstructure; Military Technology; Technology Utilization

20030097999 Timet UK Ltd., Birmingham, UK

Improving Affordability of Titanium

Thomas, Roger; Low Cost Composite Structures and Cost Effective Application of Titanium Alloys in Military Platforms;

March 2003, pp. KN2-1 - KN2-11; In English; See also 20030097962; Original contains color illustrations; Copyright; Avail: CASI; C01, CD-ROM; A03, Hardcopy

The global titanium industry began in the 1950s; the main initial uses for titanium were for strategic uses such as armor and aircraft components. Titanium has steadily become a more affordable material, in part because of new titanium alloys and manufacturing techniques, new titanium materials, such as sponge, increased economic competition and trade in titanium, and consolidation in the titanium industry. This trend in affordability is expected to continue.

CASI

Titanium; Titanium Alloys; Industries; Manufacturing; Trends; Cost Reduction

20030098000 Naval Air Systems Command, Patuxent River, MD, USA

Applications, Benefits, and Implementation of Ti-6Al-4V Castings

Frazier, William E.; Low Cost Composite Structures and Cost Effective Application of Titanium Alloys in Military Platforms; March 2003, pp. 1-1 - 1-16; In English; See also 20030097962; Original contains color and black and white illustrations; Copyright; Avail: CASI; C01, CD-ROM; A03, Hardcopy

Increased attention has been given to the use of structural Ti-6Al-4V castings on navy aircraft because of their potential to reduce weight and cost. Advanced castings have improved mechanical properties and reduced mechanical property variability. Combined, these improvements have put the use of a casting factor (an additional safety factor used only for cast components) in the design of structural cast components into question. Consequently, the Navy has partnered with the Air Force and the commercial sector in order to address impediments to the wide spread use of castings. Two round robin studies are described. The first explores the affect of Beta Vs. Mil annealed heat treatments on fatigue properties. The second is focused on the development of reliable design data for cast, thick section Ti-6Al-4V. It was concluded that the fatigue properties of Beta Vs. Mil annealed Ti-6Al-4V castings were comparable for thin section castings. Further, caution should be exercised in using AMS-4985 minimum property values for the design of thick Ti-6Al-4V investment cast components as minimum property values listed may not be achieved.

Author

Aluminum Alloys; Titanium Alloys; Safety Factors; Castings; Heat Treatment; Structural Design

20030098001 Bridges (P. J.), Sutton Culdfield, UK

Manufacture of Titanium Alloy Components for Aerospace and Military Applications

Bridges, P. J.; Magnus, B.; Low Cost Composite Structures and Cost Effective Application of Titanium Alloys in Military Platforms; March 2003, pp. 2-1 - 2-11; In English; See also 20030097962; Original contains color illustrations; Copyright; Avail: CASI; C01, CD-ROM; A03, Hardcopy

The advantages of titanium alloys in engineering applications are well known. They offer high strengths and good corrosion resistance, together with useful performance at temperatures up to about 600 C with a density about 60% of engineering steels and almost half that of nickel alloys. Although there have been problems with its cost and supply, and the perception of it as an exotic metal, the use of titanium in aerospace and military projects is increasing. The particular properties of titanium and its alloys mean that the cost-effective manufacture of components requires special techniques. DONCASTERS plc has considerable experience in the forming of titanium alloys by forging, sheet forming, casting and machining. Several hundred tonnes of such alloys are processed by the Group each year. This paper describes the forming methods used for titanium and discusses some of the factors affecting the costs associated with the products

Author

Aerospace Engineering; Titanium Alloys; Corrosion Resistance; Cost Effectiveness

20030098002 Howmet Research Corp., Whitehall , MI, USA

Investment Cast Titanium for Aeroengine and Aircraft Structural Applications

Veeck, Stewart; Klepeisz, John; Low Cost Composite Structures and Cost Effective Application of Titanium Alloys in Military Platforms; March 2003, pp. 3-1 - 3-14; In English; See also 20030097962; Original contains color illustrations; Copyright; Avail: CASI; C01, CD-ROM; A03, Hardcopy

Investment cast titanium alloys are increasingly being recognized as affordable solutions that are capable of meeting the stringent requirements for structural airframe components. A number of innovative technology advancements have been made in the casting industry over the past five years to promote increased acceptance of castings in fracture critical airframe structures. These process improvements have resulted in higher quality castings, along with a better fundamental understanding of the static and dynamic mechanical properties associated with investment cast titanium. The U.S. government

has fostered many of these improvements in order to reduce the cost of military aircraft. The following is an overview of the status of the titanium casting industry, along with a discussion of the more recent technology innovations that have made cast titanium products more attractive.
Author
Titanium Alloys; Aircraft Engines; Aircraft Structures; Structural Design; Airframes; Investment Casting

20030098004 Aeronautical Systems Div., Wright-Patterson AFB, OH, USA
Application of Structural Titanium Castings on the USAF F-22 Raptor
Gonzalez, Jorge F.; Perkins, Larry P.; Low Cost Composite Structures and Cost Effective Application of Titanium Alloys in Military Platforms; March 2003, pp. 5-1 - 5-8; In English; See also 20030097962; Original contains color and black and white illustrations; Copyright; Avail: CASI; C01, CD-ROM; A02, Hardcopy

The F-22 Raptor air superiority fighter, the USA Air Force replacement for the F-15 Eagle, is the newest and most advanced fighter aircraft ever built. However, the F-22 did not achieve such revolutionary performance overnight, as many cutting edge technological advancements were incorporated into the aircraft during development. One of these advances was the application of Titanium 6-4 Beta Annealed Structural Castings on primary structural members. The U.S. Air Force (USAF) and industry joined forces to further the development and implementation of this technology with the ultimate goal of decreasing the overall airframe cost and weight while maintaining stringent structural requirements associated with fracture critical structures. This paper summarizes the lessons learned regarding the technology transition of structural castings on the F-22 aircraft.
Author
Titanium; Airframes; F-22 Aircraft; Structural Members; Annealing; Castings

20030098006
Production Methods for Titanium Aircraft Components
VanDenBerghe, Guido; Low Cost Composite Structures and Cost Effective Application of Titanium Alloys in Military Platforms; March 2003, pp. 10-1 - 10-12; In English; See also 20030097962; Original contains color illustrations; Copyright; Avail: CASI; C01, CD-ROM; A03, Hardcopy

This paper gives an overview of production methods for Titanium aircraft components. The information contained in the paper is based on 20 years of experience in machining Titanium components for the aerospace industry. The purpose is to give the reader a practical view on the different aspects in machining of Titanium aircraft components. Asco has been founded as a family company in 1954 and started as a subcontractor for military armoured vehicles. As the military market collapsed, the company successfully diversified into the manufacturing of aircraft components. Up until 1995 Airbus was the sole aircraft customer but in 1995 Asco obtained a first contract with Boeing for 737 NG wing components. Today Asco is still a family owned company and is now a risk sharing partner for all Aircraft manufacturers like Boeing, Airbus, Embraer, Canadair, As from the beginning it has always been Asco's specialty to machine components in difficult materials as Titanium, Stainless Steel and hardened steels. It has been a strategic choice for Asco only to concentrate on the production/machining of these materials instead of the ease and higher production volumes of Aluminium.
Author
Aerospace Industry; Production Engineering; Titanium; Stainless Steels; Aluminum

20030098007 Italian Air Force Pratica di Mare, Rome, Italy
Mechanical Treatments Evaluation on Ti-6Al-4V Alloy by means of XRD Residual Stress Measurement Technique
DePaolis, F.; Caroselli, C.; Riscifuli, S.; Low Cost Composite Structures and Cost Effective Application of Titanium Alloys in Military Platforms; March 2003, pp. 11-1 - 11-10; In English; See also 20030097962; Original contains color illustrations; Copyright; Avail: CASI; C01, CD-ROM; A02, Hardcopy

Mechanical treatments optimization on Titanium parts undergone to fatigue stress must be considered as a strategic target for a Life-Cycle Costs reduction. Residual stresses, produced in the material surface and subsurface by different mechanical treatments, are one of the most important factor affecting mechanical properties of the metals and can be considered the driving force producing the range of fatigue life observed for differently finished components. The aim of this study was to investigate residual stress patterns introduced in Ti-6Al-4V alloy by shot peening using the XRD Residual Stress Determination Technique and to compare XRD results with mechanical fatigue tests. For this purpose, Ti-6Al-4V specimens were prepared and undergone to different shot peening processes and their resulting residual stress distributions were measured as a function of depth by means of an etching solution (HNO3 10% + HF 2%). The achieved results showed that changing peening

parameters strictly affect the residual stress distribution and then produce a variation of the mean fatigue life; in particular, some hard shot peening conditions, commonly used in manufacturing processes, have been found to produce excessive strains, dislocations and surface defects in the outer layers of the specimens, whose effect cause a material fatigue life decrease. Further tests are currently being carried out to evaluate, from the same viewpoint, other mechanical treatments (machining, cold working) performed on Ti-6Al-4V.
Author
Residual Stress; Titanium Alloys; Mechanical Properties; Fatigue Tests

20030098008 Prins Maurits Lab. TNO, Rijswijk, Netherlands
Ballistic Protection Against Armour Piercing Projectiles Using Titanium Base Armour
Diederen, A. M.; Broos, J. P. F.; vanTrigt, S. N.; Peijen, M. C. P.; Low Cost Composite Structures and Cost Effective Application of Titanium Alloys in Military Platforms; March 2003, pp. 12-1 - 12-17; In English; See also 20030097962; Original contains color illustrations; Copyright; Avail: CASI; C01, CD-ROM; A03, Hardcopy

This paper presents the experimentally established ballistic resistance of armour configurations with titanium base armour against 12.7 mm AP, 14.5 mm AP and 25 mm APDS projectiles. The target configurations consist of a very hard outer layer, a Ti-6Al-4V base armour and sometimes a polyethylene composite spall-liner. The ballistic limit velocity distribution according to the Kneubuehl method is established for 12.7 mm AP/ 14.5 mm AP ammunition (0 or 60 NATO impact angle). The areal density of the tested armour configurations can be compared with other modern (aluminium base) armour configurations using a single graph per stopping probability (e.g. 99%). The titanium-based targets are overmatched and perforated by 25 mm APDS projectiles. For this threat and for normal impact, the spall cone characteristics and the residual projectile penetration are established using metallic witness-packs. The hole-size distribution gives the cone angle and spall density distribution, the difference in hole-size distribution from the first (front) to the last witness plate indicates the penetration capacity distribution of the spall cloud. Different thicknesses of spall-liner backing the titanium armour are used to assess their effectiveness.
Author
Ballistics; Aluminum Alloys; Titanium; Projectiles; Armor

20030098054 Lawrence Livermore National Lab., Livermore, CA
Microstructural Evolution in the 2219 Aluminum Alloy During Severe Plastic Deformation
Kailbysehv, R. O.; Safarov, I. M.; Lesuer, D. R.; Mar. 29, 2000; 12 pp.; In English
Report No.(s): DE2003-238179; UCRL-ID-138466; No Copyright; Avail: Department of Energy Information Bridge

Numerous investigations have demonstrated that intense plastic deformation is an attractive procedure for producing an ultrafine grain size in metallic materials. Torsional deformation under high pressure and equal-channel angular extrusion are two techniques that can produce microstructures with grain sizes in the submicrometer and nanometer range. Materials with these microstructures have many attractive properties. The objective of the present work is to examine the microstructure evolution during severe plastic deformation of a 2219 aluminum alloy. Specific attention is given to the mechanism of ultrafine grain formation as a result of severe plastic deformation.
NTIS
Plastic Deformation; Aluminum Alloys; Microstructure

20030102203
The Repair of Single Crystal Nickel Superalloy Turbine Blades Using Laser Engineered Net Shape (LENS) Technology
Glavicic, Michael G.; Sargent, K. A.; Kobryn, P. A.; Semiatin, S. L.; Jan. 2003; 25 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F33615-00-C-5212; Proj-4347
Report No.(s): AD-A415694; AFRL-ML-WP-TR-2003-4103; No Copyright; Avail: CASI; A03, Hardcopy

A feasibility study to evaluate Laser Engineered Net Shape (LENS(TM)) technology as a general repair vehicle for single-crystal nickel superalloy turbine blades was conducted. A variety of deposition conditions at several locations were examined. The crystallographic orientation and microstructures of the deposits and substrates were examined using a scanning electron microscope (SEM) equipped to collect Electron-Back-Scatter-Diffraction (EBSD) data. The results of this study indicated that, for a variety of deposition conditions, it was possible to produce deposits that had the same crystallographic

orientation as the substrate. The main difficulties encountered were the development of cracks in the deposits and the unreliability of the LENS(TM)system used.
DTIC
Single Crystals; Turbine Blades; Heat Resistant Alloys

20030102220 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Effects of Forged Stock and Pure Aluminum Coating on Cryogenic Performance of Heat Treated Aluminum Mirrors
Toland, Ronald W.; Ohl, Raymond G.; Barthelmy, Michael P.; Zewari, S. Wahid; Greenhouse, Matthew A.; MacKenty, John W.; [2003]; 5 pp.; In English; SPIE Optical Science and Technology Annual Meeting, 3-8 Aug. 2003, San Diego, CA, USA; Copyright; Avail: CASI; A01, Hardcopy

We present the results of an on-going test program designed to empirically determine the effects of different stress relief procedures for aluminum mirrors. Earlier test results identified a preferred heat treatment for flat and spherical mirrors diamond turned from blanks cut out of Al 6061-T651 plate stock. Further tests have been performed on mirrors from forged stock and one set from plate stock coated with Alumiplate(trademark) aluminum coating to measure the effect of these variables on cryogenic performance. The mirrors are tested for figure error and radius of curvature at room temperature and at 80 K for three thermal cycles. We correlate the results of our optical testing with heat treatment and metallographic data. Author
Aluminum Coatings; Mirrors; Heat Treatment; Stress Relieving

20030105521 Aerospace Corp., El Segundo, CA
Tribology of Composite Au-MoS2 Films at Varying Contact Stresses
Lince, J. R.; Jun. 2003; 20 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F04701-00-C-0009
Report No.(s): AD-A416193; TR-2003(8565)-3; SMC-TR-03; No Copyright; Avail: CASI; A03, Hardcopy

Solid-lubricant coatings for sliding electrical contact applications like slip-ring assemblies have very different requirements from typical applications like ball bearings and cutting tools: they have significantly lower contact stresses and sliding speeds. We are optimizing the performance of sputter-deposited nanocomposite Au-MoS2 films for such low con tact stress applications. Higher contact stress pin-on-disk tests (S(sub m) = 730 MPa) showed that low Au-MoS2 films (i.e., 22 to 38 at% Au) outperformed those with higher Au content (i. e. greater or equal to 55 at% Au). In contrast, low contact stress disk-on-disk tests (S(sub m) ^ 0. 3 MPa) showed that higher Au-content films outperformed low Au- MoS2 films. These results, along with Auger Nanoprobe post- test analysis, indicate that Au provides structural integrity for the films in the high-contact-stress tests, while optimizing the MoS2 transfer rate in the low-contact-stress tests. The results are promising for sliding electrical contacts because high-Au films not only perform the best tribologically, but also exhibit the highest electrical conductivity.
DTIC
Stresses; Metal Films; Gold; Tribology; Sliding Friction

20030105642 Massachusetts Inst. of Tech., Cambridge, MA, USA
Textural Equilibria of Iron Sulfide Liquids in Partly Molten Silicate Aggregates and Their Relevance to Core Formation Scenarios
Holzheid, Astrid; Schmitz, Mark D.; Grove, Timothy L.; Journal of Geophysical Research; June 10, 2000; ISSN 0148-0227; Volume 105, No. B6, pp. 13,555-13,567; In English
Report No.(s): Paper-2000JB900046; Copyright; Avail: Other Sources

The influence of the coexistence of silicate and iron sulfide melts on the wetting of mantle olivine by iron sulfide melt is investigated. The dihedral angle between iron alloy and olivine is unaffected by the presence of silicate melt at 1.5 GPa and 1370-1410 C and is much greater than the maximum allowable dihedral angle for melt connectivity at low melt fractions. In experimental charges where silicate and sulfide melt occupy the same melt pocket, the sulfide melt adheres to olivine grain faces rather than forming discrete droplets. The relative interfacial energy between iron sulfide and basaltic silicate melt is lower than that of iron sulfide with olivine, but the contrast is not sufficient for basaltic silicate melt to wet FeS-olivine grain boundaries. This result implies that very large silicate melt fractions are necessary to mobilize iron sulfide melts in partially molten silicate phase assemblages. Therefore segregation of Fe-rich metallic melts by porous flow at low melt fraction is not a likely process for metal separation. The experiments also investigated the influence of the presence of a thermal gradient on sulfide melt migration. Although the sulfide melt can not migrate through the olivine network by porous flow, evidence in the

experiments indicates mobility of sulfide through the interconnected silicate melt network. The sulfide melt pools in contact with silicate melt at the hot, top part of the experimental charges grow over time at the expense of the silicate melt pools in the cooler part of the charge. This points to a diffusive transport mechanism for local sulfide redistribution. We review literature data on metal-olivine wetting angles and find that the metal composition has a dominant influence on the wetting behavior of a metallic liquid on an olivine matrix. Iron-rich metallic liquid compositions are characterized by large dihedral angles (less than 90 deg). The metal-olivine dihedral angle decreases with increasing amounts of dissolved light element (S, C, O). For light element contents in excess of approx. 59 at %, the dihedral angle approaches 60 deg., and the wetting behavior of a metallic liquid is similar to that of a silicate liquid.
Author
Iron; Sulfides; Iron Alloys; Liquids; Silicates

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NONMETALLIC MATERIALS

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

20030086326 Argonne National Lab., IL, USA
Metal Dusting Behavior of Coatings
Natesan, K.; Zeng, Z.; Soppet, W. K.; Rink, D. L.; Oct. 2002; In English
Report No.(s): DE2003-805260; No Copyright; Avail: National Technical Information Service (NTIS)

Surface modification by preoxidation and/or by coatings and alternative materials are being examined at ANL to alleviate the metal dusting problem. Oxide coatings have the advantage that they can minimize carbon-producing reactions (by reducing the availability of catalytic surface) and can also act as a barrier to minimize carbon ingress and pitting of the substrate alloy.
NTIS
Carbon; Protective Coatings

20030093547 NASA Glenn Research Center, Cleveland, OH, USA
Results of Mechanical Testing for Pyroceram(tm) Glass-Ceramic
Choi, Sung R.; Gyekenyesi, John P.; September 2003; 89 pp.; In English
Contract(s)/Grant(s): SAA3-298; WBS 22-708-31-07
Report No.(s): NASA/TM-2003-212487; E-14029; NAS 1.15:212487; No Copyright; Avail: CASI; A05, Hardcopy

Mechanical testing for Pyroceram (trademark) 9606 glass-ceramic fabricated by Corning was conducted to determine mechanical properties of the material including slow crack growth.Valid testing was not achieved in tension, compression, and shear testing due to inappropriate test specimen configurations provided and primarily due to the existence of fortified layer(in tension).
Author
Mechanical Properties; Pyroceram (Trademark)

20030093630 Embry-Riddle Aeronautical Univ., USA
Torque Limit for Bolted Joint for Composites, Part A, TTTC Properties of Laminated Composites
Zhao, Yi; The 2002 NASA Faculty Fellowship Program Research Reports; April 2003, pp. LIV-1 - LIV-5; In English; See also 20030093576
Contract(s)/Grant(s): NAG8-1859; No Copyright; Avail: CASI; C01, CD-ROM; A01, Hardcopy

The existing design code for torque limit of bolted joints for composites at Marshall Space Flight Center is MSFC-STD-486B, which was originally developed in 1960s for metallic materials. The theoretical basis for this code was a simplified mechanics analysis, which takes into account only the bolt, nut and washers, but not the structural members to be connected. The assumption was that metallic materials would not fail due to the bearing stress at the contact area between washer and the mechanical member. This is true for metallic materials; but for composite materials the results could be completely different. Unlike most metallic materials, laminated composite materials have superior mechanical properties (such as modulus and strength) in the in-plane direction, but not in the out-of-plane, or through-the-thickness (TTT) direction. During the torquing, TTT properties (particularly compressive modulus and compressive strength) play a dominant role in composite failure. Because of this concern, structural design engineers at Marshall are currently using a compromised empirical approach: using 50% of the torque value for composite members. Companies like Boeing is using a similar

approach. An initial study was conducted last summer on this topic to develop theoretical model(s) that takes into consideration of composite members. Two simplified models were developed based on stress failure criterion and strain failure criterion, respective. However, these models could not be used to predict the torque limit because of the unavailability of material data, specifically, through-the-thickness compression (TTTC) modulus and strength. Therefore, the task for this summer is to experimentally determine the TTTC properties. Due to the time limitation, only one material has been tested: IM7/8552 with [0 degrees,plus or minus 45 degrees, 90 degree] configuration. This report focuses the test results and their significance, while the experimentation will be described in a separate report by Mr. Kris Kostreva.
Author
Torque; Composite Materials; Laminates

20030098017
A Systematic Study of the Failure Wave Phenomenon in Brittle Materials
Kanel, G. I.; Bogatch, A. A.; Razorenov, S. V.; Savinykh, A. S.; Apr. 2003; 29 pp.; In English
Contract(s)/Grant(s): N62558-02-M-6020
Report No.(s): AD-A415847; No Copyright; Avail: CASI; A03, Hardcopy

Shock-wave experiments with four glasses of different hardness, two ceramics, quartz and silicon single crystals have been carried out with the goals to better understand in which materials the failure wave may occur under shock compression, which material properties control the formation and propagation, and what are the threshold conditions. Experiments with piles of thin sample plates confirm the appearance of the failure wave in elastically compressed fused quartz, K8 crown glass, and heavy flint glass, although the relationships between the Hugoniot elastic limits and the failure thresholds of these glasses are different. For softest heavy flint glass, the failure threshold is closest to the HEL. The failure waves were not recorded in single crystals and polycrystalline alumina and boron carbide ceramics. The results show that the propagation speed of the failure wave in glass slightly depends on the stress above the failure threshold, and does not depend on the propagation distance. The process becomes unstable and stops at stresses near the failure threshold. Longitudinal compressibility of comminuted glass has been found close to that of intact material. Preliminary results of computer simulations demonstrate the potential of the combustion-like model in simulating the evolution of failure wave.
DTIC
Thresholds; Shock Waves; Ceramics; Brittleness; Failure; Glass; Single Crystals

20030102211 Dayton Univ. Research Inst., OH
Ceramic Bar-on-Bar Impact Experiments
Brar, N. S.; May 2003; 26 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAAD19-01-1-0791
Report No.(s): AD-A415727; UDRI-TR-2003-00089; ARO-43000.1-EG; No Copyright; Avail: CASI; A03, Hardcopy

Ceramic bar-on-bar (uniaxial stress) experiments are performed to extend uniaxial strain deformation states imposed in flyer plate impact experiments. The major objective of these experiments is to generate a variety of multi axial deformation states for characterizing the failure mechanisms in ceramics and other brittle materials.
DTIC
Impact Tests; Ceramics; Brittle Materials

20030102213 Sytronics, Inc., Dayton, OH
Interlaboratory Study (ILS) For F 428-83, The Standard Test Method for Intensity of Scratches on Aerospace Glass Enclosures
Pinkus, Alan R; Hausmann, Martha A.; Jan. 2003; 48 pp.; In English
Contract(s)/Grant(s): F33615-98-D-6000; Proj-7184
Report No.(s): AD-A416229; No Copyright; Avail: CASI; A03, Hardcopy

Scratches exist on all glass surfaces. Usually cleaning procedures cause very fine scratches that are not visible when looking through the glass. Visible scratches may be distracting to an observer looking through a transparent aerospace enclosure. Therefore, a procedure to define scratches is useful. A visual comparison is made between a set of graded scratch standards and a scratch on the glass transparency to determine its relative intensity. A visual standard is used because it is not practical to measure the dimensions of the fine scratches.
DTIC
Glass; Aerospace Systems; Crack Propagation

20030105969 Texas A&M Univ., College Station, TX, USA
Transverse Coefficient of Thermal Expansion Measurements of Carbon Fibers Using ESEM at High Temperatures
Ochoa, O.; Jiang, J.; Putnam, D.; Lo, Z.; Ellis, A.; Effinger, Michael; [2003]; 1 pp.; In English; 27th Annual Conference on Composites, Materials and Structures, 27-31 Jan. 2003, Cocoa Beach, FL, USA
Contract(s)/Grant(s): NAG8-1882; No Copyright; Avail: Other Sources; Abstract Only

The transverse coefficient of thermal expansion (CTE) of single IM7, T1000, and P55 carbon fibers are measured at elevated temperatures. The specimens are prepared by press-fitting fiber tows into 0.7mm-diameter cavity in a graphite disk of 5mm in diameter and 3mm high. The specimens are placed on a crucible in an ESEM, and images of the fiber cross section are taken as the fibers are heated up to 800 C. Holding time, heating and cool down cycles are also introduced. The geometrical changes are measured using a graphics tablet. The change in area/perimeter is calculated to determine the strain and transverse CTE for each fiber. In a complimentary computational effort, displacements and stresses are calculated with finite element models.
Author
Carbon Fibers; Thermal Expansion; Scanning Electron Microscopy

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*.

20030098028 Lawrence Livermore National Lab., Livermore, CA
Isomer Research: Energy Release Validation, Production, and Applications
Becker, J. A.; Rundberg, B.; Apr. 10, 2003; 10 pp.; In English
Report No.(s): DE2003-15003919; UCRL-ID-152904; No Copyright; Avail: Department of Energy Information Bridge

The goal of this applied nuclear isomer research program is the search for, discovery of, and practical application of a new type of high energy density material (HEDM). Nuclear isomers could yield an energy source with a specific energy as much as a hundred thousand times as great as that of chemical fuels. There would be enormous payoffs to the Department of Energy and to the country as a whole if such energy sources could be identified and applied to a range of civilian and defense applications. Despite the potential payoff, efforts in applied isomer research have been rather limited and sporadic. Basic research on nuclear isomers dates back to their discovery in 1935 with occasional hints to tantalize interest in HEDM. In most cases, these hints were refuted following careful examination by other groups.
NTIS
Isomers; Nuclear Research; High Energy Fuels

20030099692 Lynntech, Inc., College Station, TX, USA, Lynntech Industries Ltd., College Station, TX, USA
Putting Fuel Cells to the Test
Spinoff 2003: 100 Years of Powered Flight; 2003, pp. 52-53; In English; See also 20030099639; Original contains color illustrations; No Copyright; Avail: National Technology Transfer Center (NTTC), Wheeling, WV

If research has its way, an electrochemical device capable of converting energy into electricity and heat will become the impetus behind the next generation of automobiles, superseding the internal combustible engine found under the hoods of vehicles that rule the road today. The thought of fuel cell technology being able to accomplish such a feat may be dismissed as too futuristic by some, but the truth is that fuel cells have been in play as a source of propulsion since the 1960s, when NASA first used them to generate power onboard the Gemini and Apollo spacecraft for extended space missions. Even more unknown is the fact that fuel cells were and continue to be a source of drinking water for astronauts in orbit, since they produce pure water as a by-product.
Derived from text
By-Products; Combustion; Fuel Cells; Combustion Chambers

20030105550 Sierra Engineering, Inc., Carson City, NV, USA
The Performance of Hydrocarbon Fuels with H2O2 in a Uni-element Combustor
Muss, Jeffrey A.; Johnson, Curtis W.; Kruse, William; Cohn, Richard K.; Jul. 2003; 11 pp.; In English
Report No.(s): AD-A416416; AFRL-PR-ED-TP-2003-142; No Copyright; Avail: CASI; A03, Hardcopy

A team from Sierra Engineering Inc, (Sierra), AFRL, and Northrop Grumman Corporation (NGC, formally TRW) tested several different hydrocarbon fuels in a uni-element, 1300 pound thrust hydrogen peroxidel hydrocarbon rocket combustor. Tests were conducted with a variety of hydrocarbon fuels, including JP-8, RP-I, JP-10, toluene, quadricyclane and turpentine, as well as several mixtures of these fields. The combustor used decomposed 90% hydrogen peroxide as the oxidizer. The water-cooled combustion chamber included significant fuel film cooling, with the overall mixture ratio (MR) ranging from 3.75 to 7.4. Testing was conducted at a chamber pressure of approximately 800 psia. Figures of merit presented in this paper include characteristic velocity (eta C*) and energy release efficiencies (ERE). Agreement was generally excellent, with eta C* and ERE agreeing to within 1 %. The experimental performance results were compared with theoretical performance computations. The exhaust plume was monitored during the tests with an infrared spectrometer. Results are shown for integrated band intensities, demonstrating the sensitivity of the plume radiance to variation in combustor operating conditions. In several instances, the variations of the plume intensity could be correlated with events occurring within the combustion chamber. However, the plume measurement was more sensitive than the direct measurements of chamber operating condition (such as pressure and temperature measurements).
DTIC
Hydrocarbons; Performance Prediction; Combustion Chambers; Liquid Rocket Propellants

29
SPACE PROCESSING

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

20030086717 Clarkson Univ., Potsdam, NY, USA
Detached Solidification in Microgravity: A Review, Appendix A
Regel, Liya L.; Wilcox, William R.; Microgravity Sci Technol. XI; 1998; Volume 4, pp. 152-166; In English
Contract(s)/Grant(s): NAG8-1482; Copyright; Avail: Other Sources

Directional solidification in microgravity has often led to ingots that grew with little or no contact with the ampoule wall. When this occurred, crystallographic perfection was usually greatly improved-often by several orders of magnitude. We summarize here the experiments that have produced such results. Mechanisms for detached solidification will be reviewed in a subsequent paper.
Author
Directional Solidification (Crystals); Microgravity; Ampoules; Crystallography

20030091420 Clarkson Univ., Potsdam, NY, USA
Influence of Contact Angle, Growth Angle and Melt Surface Tension on Detached Solidification of InSb
Wang, Yazhen; Regel, Liya L.; Wilcox, William R.; Journal of Crystal Growth; 2000; Volume 209, pp. 175-180; In English
Contract(s)/Grant(s): NAG8-1482; Copyright; Avail: Other Sources

We extended the previous analysis of detached solidification of InSb based on the moving meniscus model. We found that for steady detached solidification to occur in a sealed ampoule in zero gravity, it is necessary for the growth angle to exceed a critical value, the contact angle for the melt on the ampoule wall to exceed a critical value, and the melt-gas surface tension to be below a critical value. These critical values would depend on the material properties and the growth parameters. For the conditions examined here, the sum of the growth angle and the contact angle must exceed approximately 130, which is significantly less than required if both ends of the ampoule are open.
Author
Melts (Crystal Growth); Solidification; Interfacial Tension; Ampoules

20030105583 Clarkson Univ., Potsdam, NY, USA
Microgravity Effects on Materials Processing: A Review
Wilcox, William R.; Regel, Liya L.; [2001]; 9 pp.; In English; EUROMAT 2001, 10-14 Jul. 2001, Rimini, Italy
Contract(s)/Grant(s): NAG8-1266; NAG8-1482; NAG8-1703; Copyright; Avail: Other Sources

Materials processing in space has been studied both theoretically and experimentally for over 1/4 of a century. In the beginning, we naively spoke of zero gravity, elimination of convection, growth of perfect crystals, and eventual manufacturing in space. All of these appear to have fallen by the wayside. On the other hand, we have learned an unprecedented amount about

the influences of gravity on materials processing. We have had many surprises, and not all experimental results have yet been satisfactorily explained. Gravity was found to influence processes that were thought to be gravity-independent. One consequence is that materials processing on earth has often been improved. And it is difficult to imagine how the materials-processing industries could have flourished without the engineers and scientists who received their training by working on microgravity materials processing.
Author
Microgravity; Space Processing; Crystal Growth; Solidification; Gravitational Effects

31
ENGINEERING (GENERAL)

Includes general research topics related to engineering and applied physics, and particular areas of vacuum technology, industrial engineering, cryogenics, and fire prevention. For specific topics in engineering see *categories 32 through 39*.

20030093615 Alabama Agricultural and Mechanical Univ., Normal, AL, USA
Development of Processing Parameters for Organic Binders Using Selective Laser Sintering
Mobasher, Amir A.; The 2002 NASA Faculty Fellowship Program Research Reports; April 2003, pp. XXIX-1 - XXIX-5; In English; See also 20030093576
Contract(s)/Grant(s): NAG8-1859; No Copyright; Avail: CASI; C01, CD-ROM; A01, Hardcopy
This document describes rapid prototyping, its relation to Computer Aided Design (CAD), and the application of these techniques to choosing parameters for Selective Laser Sintering (SLS). The document reviews the parameters selected by its author for his project, the SLS machine used, and its software.
CASI
Laser Applications; Sintering; Binders (Materials)

20030093624 Florida Univ., FL, USA
Preliminary Design, Feasibility and Cost Evaluation of 1- to 15-Kilometer Height Steel Towers
Shanker, Ajay; The 2002 NASA Faculty Fellowship Program Research Reports; April 2003, pp. XLIII-1 - XLIII-5; In English; See also 20030093576
Contract(s)/Grant(s): NAG8-1859; No Copyright; Avail: CASI; C01, CD-ROM; A01, Hardcopy
Design and construction of tall towers is an on-going research program of NASA. The agency has already done preliminary review in this area and has determined that multi-kilometer height towers are technically and economically feasible. The proposed towers will provide high altitude launch platforms reaching above eighty percent of Earth's atmosphere and provide tremendous gains in the potential energy as well as substantial reduction in aerodynamic drag. NASA has also determined that a 15-KM tower will have many useful applications in: (i)Meteorology,(ii)Oceanography, (iii)Astronomy, (iv)High Altitude Launch, (v)Physics Drop Tower, (vi) Biosphere Research, (vii) Nanotechnology, (viii) Energy/Power, (ix)Broadband Wireless Technology, (x)Space Transportation and (xi)Space Tourism.
Derived from text
Feasibility Analysis; Towers; Steels; Structural Engineering; Scale Height; Fabrication

20030105900
The Design, Construction and Commissioning of a Magnetic Suspension and Balance System for the Princeton/ONR High Reynolds Number Testing Facility (HRTF)
Britcher, Colin p.; Gonzalez, Oscar; Gray, Steven; Jun. 30, 2003; 18 pp.; In English
Contract(s)/Grant(s): N00014-99-1-0298
Report No.(s): AD-A416684; No Copyright; Avail: CASI; A03, Hardcopy
Princeton University has constructed a specialized wind tunnel, the Princeton/ONR High Reynolds number Testing Facility (HRTF) to be used for aero/ hydrodynamic testing of submersible shapes. The facility is capable of operation at very high pressures, up to around 230 atmospheres, with relatively low test velocities. Old Dominion University is responsible for the design and commissioning of a Magnetic Suspension and Balance System (MSBS) for use with the HRTF. The design task encompasses configuration definition, detail design and documentation. Initial commissioning was undertaken at NASA Langley Research Center, with subsequent relocation to Princeton and installation in the HRTF.
DTIC
Construction; Design Analysis; Wind Tunnels; Test Facilities

32
COMMUNICATIONS AND RADAR

Includes radar; radio, wire, and optical communications; land and global communications; communications theory. For related information see also 04 Aircraft Communications and Navigation; and *17 Space Communications, Spacecraft Communications, Command and Tracking*; for search and rescue, see *03 Air Transportation and Safety*; and *16 Space Transportation and Safety*.

20030086323 National Telecommunications and Information Administration, Washington, DC
Measurements of Channel Transfer Functions and Capacity Calculations for a 16X16 BLAST Array over a Ground Plane
Papazian, P. B.; Lo, Y.; Lemmon, J. J.; Gans, M. J.; Jun. 2003; In English
Report No.(s): PB2003-107078; NTIA-TR-03-403; No Copyright; Avail: National Technical Information Service (NTIS)

Wideband channel transfer function measurements were made for a 16- element transmit and 16-element receive, multiple input, multiple output (MIMO) antenna array. The measurements were conducted using the National Institute of Standards and Technology (NIST) open area test site (OATS), allowing analytic calculations of the channel transfer functions. The H matrix for the BLAST array was then determined from measured data and the link capacity was calculated using information theory. The theoretical link capacity was then calculated and found to be 22.16 Bits/Hz/s for horizontally polarized antennas and 22.19 Bits/Hz/s for vertically polarized antennas. It was then found that the measured results agreed with the theoretical calculations with 5% error using horizontally polarized antennas and with <0.3% error for the vertically polarized case. The objective of this work was to verify that wideband measurements could be used to accurately measure H and predict the capacity of a MIMO channel.
NTIS
Antenna Arrays; Broadband; Channel Capacity

20030093499 Helsinki Univ. of Technology, Espoo, Finland
Design and Characterization of Downconversion Mixers and the On-Chip Calibration Techniques for Monolithic Direct Conversion Radio Receivers
Kivekaes, K.; Oct. 2002; In English
Report No.(s): PB2003-107232; REPT-34; No Copyright; Avail: National Technical Information Service (NTIS)

This thesis consists of eight publications and an overview of the research topic, which is also a summary of the work. The research described in this thesis is focused on the design of downconversion mixers and direct conversion radio receivers for UTRA/FDD WCDMA and GSM standards. The main interest of the work is in the 1-3 GHz frequency range and in the Silicon and Silicon-Germanium BiCMOS technologies. The RF front-end, and especially the mixer, limits the performance of direct conversion architecture. The most stringent problems are involved in the second-order distortion in mixers to which special attention has been given. The work introduces calibration techniques to overcome these problems. Some design considerations for front-end radio receivers are also given through a mixer-centric approach.
NTIS
Mixing Circuits; Radio Receivers; Energy Conversion

20030095824 Nippon Telegraph and Telephone Public Corp., Tsukuba, Japan
Aerial Optical Fiber Interconnection Method for Connecting Fibers of Different Carriers
Ando, Kimio; Aoyagi, Yuji; Awamori, Masashi; NTT Technical Review, Volume 1, No. 2; May 2003, pp. 71-74; In English; See also 20030095822; Original contains color illustrations; Copyright; Avail: Other Sources

In response to demands to interconnect optical fibers owned by different carriers, we have developed a simple optical fiber interconnection method. Each carrier uses our cord converter to terminate a fiber in a standard connector. These connectors can then be connected together simply, without either carrier working on or handling fibers belonging to another carrier. We have also designed an aerial optical closure that can be mounted on a utility pole to accommodate several such connectors. Author
Optical Fibers; Telecommunication

20030095833 Nippon Telegraph and Telephone Public Corp., Yokosuka, Japan
Development of an Economical Access Point and Peripheral Equipment for an Advanced Wireless Access System
Kagami, Osamu; Ohta, Atsushi; Hojo, Hiroshi; NTT Technical Review, Volume 1, No. 2; May 2003, pp. 79-82; In English; See also 20030095822; Original contains color illustrations; Copyright; Avail: Other Sources

NTT Access Network Service Systems Laboratories have developed an economical access point for the Advanced

Wireless Access system. We have also developed a mobile terminal capable of interoperation between equipment from different vendors.
Author
Peripheral Equipment (Computers); Wireless Communication; Communication Networks; Computer Networks

20030095835 Nippon Telegraph and Telephone Public Corp., Musashino, Japan
ATM Forum Activities and NTT's Contributions
Murakami, Tatsuro; NTT Technical Review, Volume 1, No. 2; May 2003, pp. 88-90; In English; See also 20030095822; Original contains color illustrations; Copyright; Avail: Other Sources

The ATM Forum was established in 1991 to specify de facto standards for the global communications market awareness and knowledge about technical and commercial developments utilizing ATM. The forum has three world-wide offices under its board of directors and it has greatly influenced the ATM market. NTT joined the forum in early 1993 and made many contributions to its efforts. This article summarizes the forum's accomplishments and NTT's contributions.
Author
Industries; Communication; Commerce; Organizations

20030098014
Global Positioning System Standard Positioning Service Performance Standard
Oct. 2001; In English
Report No.(s): PB2003-106680; No Copyright; Avail: National Technical Information Service (NTIS)

The Global Positioning System (GPS) is a space-based radionavigation system managed and operated by the USA (U.S.) Government. GPS was designed as a dual-use system with the primary purpose of enhancing the effectiveness of U.S. and allied military forces. The Standard Positioning Service (SPS) was originally designed to provide civil users with a less accurate positioning capability than PPS through the use of a technique known as Selective Availability (SA). On May 1, 2000, the President directed the U.S. Department of Defense (DoD) to discontinue the use of SA effective midnight May 1, 2000. This edition of the SPS Performance Standard establishes new performance standards that reflect the removal of SA.
NTIS
Global Positioning System; Radio Navigation; United States

20030099686 Decision Systems, Inc., USA
Keeping Communication Continuous
Spinoff 2003: 100 Years of Powered Flight; 2003, pp. 100; In English; See also 20030099639; Original contains color illustrations; No Copyright; Avail: National Technology Transfer Center (NTTC), Wheeling, WV

General Dynamics Decision Systems employees have played a role in supplying telemetry, tracking, and control (TT&C) and other communications systems to NASA and the U.S. Department of Defense for over 40 years. Providing integrated communication systems and subsystems for nearly all manned and unmanned U.S. space flights, the heritage of this Scottsdale, Arizona-based company includes S-band transceivers that enabled millions of Americans to see Neil Armstrong and hear his prophetic words from the Moon in 1969. More recently, Decision Systems has collaborated with NASA s Goddard Space Flight Center to develop transponders, wireless communications devices that pick up and automatically respond to an incoming signal, for NASA s Tracking and Data Relay Satellite System (TDRSS). Four generations of Decision Systems TDRSS transponders have been developed under Goddard s sponsorship. The company s Fourth Generation TDRSS User Transponder (TDRSS IV) allows low-Earth-orbiting spacecraft to communicate continuously with a single ground station at White Sands, New Mexico, through a constellation of geostationary relay satellites positioned at key locations around the Earth. In addition to the communications of forward link control commands and return link telemetry data, the TDRSS IV also supports spacecraft orbit tracking through coherent turn-around of a pseudo-noise ranging code and two-way Doppler tracking.When the NSBF adopted the use of global positioning system receivers for balloon position tracking, Decision Systems concluded that a simpler, noncoherent transceiver could provide the NSBF with the necessary TDRSS communications without the additional cost and complexity of a coherent transponder. The solution was to take the core design of the TDRSS IV Transponder, but remove the extra functionality that supported coherent turn-around. This would simplify the production effort, reduce the testing required, and result in a lower cost product with smaller size, weight, and power consumption. Once NSBF and Decision Systems agreed on a concept for this new product, known as the Multi-Mode

Transceiver (MMT), the NSBF approached Goddard for approval and funding.
Derived from text
Transponders; Transmitter Receivers

20030102121 Helsinki Univ. of Technology, Espoo
Experimental Analysis of Multidimensional Radio Channels
Kalliola, K.; Feb. 2002; In English
Report No.(s): PB2003-107337; REPT-S-251; No Copyright; Avail: National Technical Information Service (NTIS)

In this thesis new systems for radio channel measurements including space and polarization dimensions are developed for studying the radio propagation in wideband mobile communication systems. Multidimensional channel characterization is required for building channel models for new systems capable of exploiting the spatial nature of the channel. It also gives insight into the dominant propagation mechanisms in complex radio environments, where their prediction is difficult, such as urban and indoor environments. The measurement systems are based on the HUT/IDC wideband radio channel sounder, which was extended to enable real-time multiple output channel measurements at practical mobile speeds at frequencies up to 18 GHz. Two dual-polarized antenna arrays were constructed for 2 GHz, having suitable properties for characterizing the 3-D spatial radio channel at both ends of a mobile communication link. These implementations and their performance analysis are presented.
NTIS
Channels (Data Transmission); Radio Frequencies

20030102123
Bandpass Delta-Sigma Modulators for Radio Receivers
Salo, T.; Apr. 2003; In English
Report No.(s): PB2003-107348; REPT-36; No Copyright; Avail: National Technical Information Service (NTIS)

This thesis concerns discrete-time (DT) bandpass (BP) Delta Sigma modulators targeted for intermediate frequency (IF) analog-to-digital (A/D) conversion in radio receivers. The receiver architecture adopted has to be capable of operating with different radio frequencies, channel bandwidths, and modulation techniques. This is necessary in order to achieve an extensive operating area and the possibility of utilizing a local mobile phone standard or a standard suitable for a specific service. The digital IF receiver is a good choice for a multi-mode and multi-band mobile phone receiver, because the signal demodulation and channel filtering are performed in the digital domain. This increases the flexibility of the receiver and relieves the design of the baseband part, but an A/D conversion with high dynamic range and low power dissipation is required. BP Delta Sigma modulators are capable of converting a high-frequency narrow band signal and are therefore suitable for signal digitization in an IF receiver.
NTIS
Radio Receivers; Delta Modulation

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*.

20030093550 NASA Glenn Research Center, Cleveland, OH, USA
The Series Connected Buck Boost Regulator Concept for High Efficiency Light Weight DC Voltage Regulation
Birchenough, Arthur G.; September 2003; 11 pp.; In English; First International Energy Conversion Engineering Conference, 17-21 Aug. 2003, Portsmouth, VA, USA
Contract(s)/Grant(s): WBS 22-706-21-03
Report No.(s): NASA/TM-2003-212514; E-14074; NAS 1.15:212514; No Copyright; Avail: CASI; A03, Hardcopy

Improvements in the efficiency and size of DC-DC converters have resulted from advances in components, primarily semiconductors, and improved topologies. One topology, which has shown very high potential in limited applications, is the Series Connected Boost Unit (SCBU), wherein a small DC-DC converter output is connected in series with the input bus to provide an output voltage equal to or greater than the input voltage. Since the DC-DC converter switches only a fraction of the power throughput, the overall system efficiency is very high. But this technique is limited to applications where the output

is always greater than the input. The Series Connected Buck Boost Regulator (SCBBR) concept extends partial power processing technique used in the SCBU to operation when the desired output voltage is higher or lower than the input voltage, and the implementation described can even operate as a conventional buck converter to operate at very low output to input voltage ratios. This paper describes the operation and performance of an SCBBR configured as a bus voltage regulator providing 50 percent voltage regulation range, bus switching, and overload limiting, operating above 98 percent efficiency. The technique does not provide input-output isolation.
Author
Voltage Converters (Dc To Dc); Voltage Regulators; Regulators

20030093628 Vanderbilt Univ., TN, USA
Impedance-Based Structural Health Monitoring for Composite Laminates at Cryogenic Environments
Tseng, Kevin; The 2002 NASA Faculty Fellowship Program Research Reports; April 2003, pp. LI-1 - LI-5; In English; See also 20030093576
Contract(s)/Grant(s): NAG8-1859; No Copyright; Avail: CASI; C01, CD-ROM; A01, Hardcopy

One of the important ways of increasing the payload in a reusable launch vehicle (RLV) is to replace heavy metallic materials by lightweight composite laminates. Among various parts and systems of the RLV, this project focuses on tanks containing cryogenic fuel. Historically, aluminum alloys have been used as the materials to construct fuel tanks for launch vehicles. To replace aluminum alloys with composite laminates or honeycomb materials, engineers have to make sure that the composites are free of defects before, during, and after launch. In addition to robust design and manufacturing procedures, the performance of the composite structures needs to be monitored constantly.In recent years, the impedance-based health monitoring technique has shown its promise in many applications. This technique makes use of the special properties of smart piezoelectric materials to identify the change of material properties due to the nucleation and progression of damage. The piezoceramic patch serves as a sensor and an actuator simultaneously. The piezoelectric patch is bonded onto an existing structure or embedded into a new structure and electrically excited at high frequencies. The signature (impedance or admittance) is extracted as a function of the exciting frequency and is compared with the baseline signature of the healthy state. The damage is quantified using root mean square deviation (RMSD) in the impedance signatures with respect to the baseline signature. A major advantage of this technique is that the procedure is nondestructive in nature and does not perturb the properties and performance of the materials and structures. This project aims at applying the impedance-based nondestructive testing technique to the damage identification of composite laminates at cryogenic temperature.
Author
Laminates; Reusable Launch Vehicles; Piezoelectric Actuators

20030093725 QSS Group, Inc., Cleveland, OH, USA
Performance of the NASA Digitizing Core-Loss Instrumentation
Schwarze, Gene E., Technical Monitor; Niedra, Janis M.; August 2003; 13 pp.; In English; First International Energy Conversion Engineering Conference, 17-21 Aug. 2003, Portsmouth, VA, USA
Contract(s)/Grant(s): NAS3-00145; WBS 22-755-60-14
Report No.(s): NASA/CR-2003-212545; E-14111; NAS 1.26:212545; AIAA Paper 2003-5972; No Copyright; Avail: CASI; A03, Hardcopy

The standard method of magnetic core loss measurement was implemented on a high frequency digitizing oscilloscope in order to explore the limits to accuracy when characterizing high Q cores at frequencies up to 1 MHz. This method computes core loss from the cycle mean of the product of the exciting current in a primary winding and induced voltage in a separate flux sensing winding. It is pointed out that just 20 percent accuracy for a Q of 100 core material requires a phase angle accuracy of 0.1 between the voltage and current measurements. Experiment shows that at 1 MHz, even high quality, high frequency current sensing transformers can introduce phase errors of a degree or more. Due to the fact that the Q of some quasilinear core materials can exceed 300 at frequencies below 100 kHz, phase angle errors can be a problem even at 50 kHz. Hence great care is necessary with current sensing and ground loops when measuring high Q cores. Best high frequency current sensing accuracy was obtained from a fabricated 0.1-ohm coaxial resistor, differentially sensed. Sample high frequency core loss data taken with the setup for a permeability-14 MPP core is presented.
Author
NASA Programs; Magnetic Cores; Fabrication; Detection; Performance Tests; Measuring Instruments; Analog To Digital Converters

20030093747 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Total Ionizing Dose Results and Displacement Damage Results for Candidate Spacecraft Electronics for NASA
Cochran, Donna J.; Kniffin, Scott D.; LaBel, Kenneth A.; OBryan, Martha V.; Reed, Robert A.; Ladbury, Ray L.; Howard, James W., Jr.; Poivey, Christian; Buchner, Stephen P.; Marshall, Cheryl J., et al.; [2003]; 8 pp.; In English; Nuclear and Space Radiation Effects Conference 2003, 21-25 Jul. 2003, Monterey, CA, USA
Contract(s)/Grant(s): DTRA-IACRO-02-40391; Copyright; Avail: CASI; A02, Hardcopy

We present data on the vulnerability of a variety of candidate spacecraft electronics to total ionizing dose and displacement damage. Devices tested include optoelectronics, digital, analog, linear bipolar devices, hybrid devices, Analog-to-Digital Converters (ADCs), and Digital-to-Analog Converters (DACs), among others.
Author
Spacecraft Electronic Equipment; NASA Programs; Displacement; Ionizing Radiation; Electro-Optics; Proton Damage

20030093818 Naval Undersea Warfare Center, Newport, RI
Lightweight Underwater Acoustic Projector
Howarth, Thomas R., Inventor; Apr. 10, 2003; 18 pp.; In English
Patent Info.: Filed 11 May 2002; US-Patent-Appl-SN-10289900
Report No.(s): AD-D020074; No Copyright; Avail: Other Sources; , Microfiche

A compound electro-acoustic transducer for producing acoustic signals has a plurality of elements. Each element has a piezoelectric disk with electrically conductive plates fixed on the top and bottom sides of the piezoelectric disk. A stud is joined to an outer face of each plate. Conductors can be joined to each stud. The elements can be assembled on a resilient structure to form an array. Elements can be used in the array or individually accessed.
DTIC
Electroacoustic Transducers; Sound Transducers; Underwater Acoustics; Projectors; Piezoelectric Transducers

20030093825 Lawrence Livermore National Lab., Livermore, CA
ITER Model Coil Tests Overview: Nb3Sn Strand Properties in Cable-in-Conduit-Conductors
Martovetsky, N. N.; Apr. 14, 2003; 18 pp.; In English
Report No.(s): DE2003-15003852; UCRL-JC-152692; No Copyright; Avail: Department of Energy Information Bridge

During the ITER Model Coil Program two large coils and three Insert coils were built and tested. The test campaigns provided very valuable data on the Conductor in Conduit Cable (CICC) properties. The tests showed that the Nb3Sn strands in CICC behave differently than so-called witness strands, which underwent the same heat treatment. The paper describes Volt-temperature characteristics (VTC) and Volt-Ampere characteristics (VAC) measured in the tests, presents comparisons with the witness strands, and interprets the test results.
NTIS
Electric Current; Electric Coils; Niobium Alloys; Tin Alloys

20030095939 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Single Event Effects Testing of the Linfinity SG1525A Pulse Width Modulator Controller
Howard, J. W., Jr.; Carts, M. A.; LaBel, K. A.; Forney, J. D.; Irwin, T. L.; [2003]; 7 pp.; In English; Nuclear and Space Radiation Effects Conference, 21 Jul. 2003, Monterey, CA, USA; Copyright; Avail: CASI; A02, Hardcopy

Pulse Width Modulator (PWM) Controllers are the heart of switching power supply systems in development today. The PWMs considered here have the same integration advantages as many other controllers but it also includes the interface drivers for the follow-on power Field Effect Transistors (FET). Previous work on these types of devices looked into the required test methodologies [11 and the impact of radiation on the soft start and shutdown circuits of typically incorporated in the technology [2]. Taking advantage of this previous work this study was undertaken to determine the single event destructive and transient susceptibility of the Linfinity SG1525A Pulse Width Modulator Controller. The device was monitored for transient interruptions in the output signals and for destructive events induced by exposing it to a heavy ion beam at the Texas A&M University Cyclotron Single Event Effects Test Facility. After exposing these devices to the beam, a new upset mode has been identified that can lead to catastrophic power supply system failure if this event would occur while drive power FETs off the two device outputs. The devices and the test methods used will be described first. This will be followed by a brief description of the data collected to date (not all data can be presented with the length constraints of the summary) and a summary of the key results.
Author
Modulators; Integrated Circuits

20030095978 NASA Marshall Space Flight Center, Huntsville, AL, USA
Correlation of Radiation Dosage With Mechanical Properties of Thin Films
Newton, R. L.; August 2003; 70 pp.; In English
Report No.(s): NASA/TM-2003-212692; M-1088; NAS 1.15:212692; No Copyright; Avail: CASI; A04, Hardcopy

The objective of this investigation was to examine the relationship between irradiation level (proton dose), microstructure, and stress levels in chemical vapor deposited diamond and polysilicon film using crosssectioned specimens. However, the emphasis was placed on the diamond specimen because diamond holds much promise for use in advanced technologies. The use of protons allows not only the study of the charged particle that may cause the most microstructural damage in Earth-orbit microelectromechanical systems (MEMS) devices, but also allows the study of relatively deeply buried damage inside the diamond material. Using protons allows these studies without having to resort to megaelectronvolt implant energies that may create extensive damage due to the high energy that is needed for the implantation process. Since 1 MEMS devices operating in space will not have an opportunity to reverse radiation damage via annealing, only nonannealed specimens were investigated. The following three high spatial resolution techniques were used to examine these relationships: (I) Scanning electron microscopy, (2) micro-Raman spectroscopy, and (3) micro x-ray diffraction.
Author
Mechanical Properties; Microelectromechanical Systems; Radiation Dosage; Thin Films

20030098021 National Renewable Energy Lab., Golden, CO
Integration of Xantrex HY-100 Hybrid Inverter with an AC Induction Wind Turbine
Corbus, D.; Newcomb, C.; Friedly, S.; May 2003; In English
Report No.(s): DE2003-15003885; NREL/TP-500-33445; No Copyright; Avail: National Technical Information Service (NTIS)

Several issues must be addressed before solid-state inverters can be used in wind-diesel systems with larger wind turbines. This project addresses those issues by using a commercial hybrid inverter designed for PV-diesel systems and modifying the inverter for use with an AC induction wind turbine. Another approach would have entailed building an inverter specifically for use with an AC induction wind turbine, but that was beyond the scope of this project. The inverter chosen for this project was a Xantrex HY-100, an inverter designed for PV systems. The unit consists of an inverter/rectifier bridge, a generator interface contactor, a battery charge controller, a hybrid controller, and the associated control electronics. Details of the inverter may be found in Appendix A. A twofold approach was taken to integrating the existing inverter for use with an AC induction wind turbine: (1) development of a detailed model to model both steady-state and transient behavior of the system, and (2) modification and testing of the inverter with an induction wind turbine based on the modeling results. This report describes these two tasks.
NTIS
Inverters; Wind Turbines; Rectifiers

20030099644 Applied Nanotech, Inc., Austin, TX, USA
Creating With Carbon
Spinoff 2003: 100 Years of Powered Flight; 2003, pp. 94-95; In English; See also 20030099639; Original contains color illustrations; No Copyright; Avail: National Technology Transfer Center (NTTC), Wheeling, WV

A subsidiary of SI Diamond Technology, Inc., Applied Nanotech, of Austin, Texas, is creating a buzz among various technology firms and venture capital groups interested in the company s progressive research on carbon-related field emission devices, including carbon nanotubes, filaments of pure carbon less than one ten-thousandth the width of human hair. Since their discovery in 1991, carbon nanotubes have gained considerable attention due to their unique physical properties. For example, a single perfect carbon nanotube can range from 10 to 100 times stronger than steel, per unit weight. Recent studies also indicate that the nanotubes may be the best heat-conducting material in existence. These properties, combined with the ease of growing thin films or nanotubes by a variety of deposition techniques, make the carbon-based material one of the most desirable for cold field emission cathodes.
Author
Cold Cathodes; Carbon Nanotubes; Technology Utilization

20030099684 Omni Technologies, Inc., New Orleans, LA, USA
Remote Transmission at High Speed

Spinoff 2003: 100 Years of Powered Flight; 2003, pp. 87; In English; See also 20030099639; Original contains color illustrations; No Copyright; Avail: National Technology Transfer Center (NTTC), Wheeling, WV

Omni and NASA Test Operations at Stennis entered a Dual-Use Agreement to develop the FOTR-125, a 125 megabit-per-second fiber-optic transceiver that allows accurate digital recordings over a great distance. The transceiver s fiber-optic link can be as long as 25 kilometers. This makes it much longer than the standard coaxial link, which can be no longer than 50 meters.The FOTR-125 utilizes laser diode transmitter modules and integrated receivers for the optical interface. Two transmitters and two receivers are employed at each end of the link with automatic or manual switchover to maximize the reliability of the communications link. NASA uses the transceiver in Stennis High-Speed Data Acquisition System (HSDAS). The HSDAS consists of several identical systems installed on the Center s test stands to process all high-speed data related to its propulsion test programs. These transceivers allow the recorder and HSDAS controls to be located in the Test Control Center in a remote location while the digitizer is located on the test stand.
Derived from text
Transmitter Receivers; Fiber Optics

20030099690 GENVAC AeroSpace Corp., Cleveland, OH, USA
Multiplying Electrons With Diamond
Spinoff 2003: 100 Years of Powered Flight; 2003, pp. 84; In English; See also 20030099639; Original contains black and white illustrations; No Copyright; Avail: National Technology Transfer Center (NTTC), Wheeling, WV

As researchers in the Space Communications Division of NASA s Glenn Research Center in 1992, Dr. Gerald Mearini, Dr. Isay Krainsky, and Dr. James Dayton made a secondary electron emission discovery that became the foundation for Mearini s company, GENVAC AeroSpace Corporation. Even after Mearini departed Glenn, then known as Lewis Research Center, his contact with NASA remained strong as he was awarded Small Business Innovation Research (SBIR) contracts to further develop his work. Mearini s work for NASA began with the investigation of diamond as a material for the suppression of secondary electron emissions. The results of his research were the opposite of what was expected diamond proved to be an excellent emitter rather than absorber. Mearini, Krainsky, and Dayton discovered that laboratory-grown diamond films can produce up to 45 electrons from a single incident electron. Having built an electron multiplier prototype at NASA, Mearini decided to start his own company to develop diamond structures usable in electron beam devices.
Derived from text
Diamond Films; Electrons; Prototypes; Space Communication; Photomultiplier Tubes

20030100115 Air Force Research Lab., Wright-Patterson AFB, OH
AFRL/GaAsTek Heterojunction Bipolar Transistor (HBT) Process Development
Gillespie, James K.; Oct. 2001; 5 pp.; In English
Contract(s)/Grant(s): Proj-6096
Report No.(s): AD-A415646; AFRL-SN-WP-TM-2003-1089; No Copyright; Avail: CASI; A01, Hardcopy

A CRDA was established between Aerospace Components and Subsystem Division (AFRL/SND) and ITT GaAsTek to transfer the design, manufacture, and development of the Air Force's thermally shunted HBT (TSHBT) process to GaAsTek and to co-develop, design, and fabricate novel power amplifiers using GaAsTek's Process 5 MMIC foundry. GaAsTek was a well-known DoD MMIC foundry for high-power x-band amplifiers utilizing MESFET technology. AFRL/SND was known for developing a TSHBT capability for high power density devices. By working together, plans were made to transfer the TSHBT technology to GaAsTek. The Air Force was to benefit from this transfer by having a reputable DoD foundry be capable of manufacturing high-power amplifiers for Air Force system integration. Another added benefit would be having Air Force circuit designers work with a foundry to design and process novel power amplifiers for future Air Force system needs. GaAsTek was to benefit by gaining a new device capability, which could be used for commercial as well as military markets. DTIC
Heterojunction Devices; Bipolar Transistors

20030102142 Helsinki Univ. of Technology, Espoo, Finland
Modes in a Hard Surface Waveguide with Uniaxially Anisotropic Chiral Material Filling
Mahmoud, S. F.; Viitanen, A. J.; Sep. 2002; 24 pp.
Report No.(s): PB2003-107123; REPT-400; Copyright; Avail: National Technical Information Service (NTIS)

Propagation of waves in circular waveguide with the boundary condition of hard surface is considered. The waveguide is filled with uniaxial chiral material. This study is a generalization of previously studied cases with isotropic chiral or

anisotropic material filling. The eigenvalue equation is formed and the corresponding eigenmodes are presented. It is seen that the hard surface boundary condition simplifies the field analysis remarkably. While the eigenwaves in anisotropic waveguide were TE and TM fields in this more general case the eigenwaves are elliptically polarized hybrid fields. Since the eigenwaves are certain combinations of TE and TM fields and propagate with different propagation factors, uniaxial chiral medium can be used for polarization transformation. Reflection and transmission from uniaxial chiral section of a waveguide is analyzed with numerical examples.
NTIS
Waveguides; Chirality

20030102149 QSS Group, Inc., Cleveland, OH, USA
200 C Demonstration Transformer Operates Efficiently at 50 kHz
Niedra, Janis M.; Schwarze, Gene E., Technical Monitor; August 2003; 9 pp.; In English; First International Energy Conversion Engineering Conference, 17-21 Aug. 2003, Portsmouth, VA, USA
Contract(s)/Grant(s): NAS3-00145; WBS 22-755-60-14
Report No.(s): NASA/CR-2003-212524; AIAA Paper 2003-6004; E-14086; NAS 1.26:212524; No Copyright; Avail: CASI; A02, Hardcopy

A compact, high temperature demonstration transformer was constructed, using a moly permalloy powder core and Teflon -insulated copper wire. At 50 kHz and 200 C, this 1:2 ratio transformer is capable of 98 percent efficiency when operating at a specific power of 6.1 kW/kg at 4 kW. This roughly 7 cm diameter transformer has a mass of 0.65 kg. Although Teflon is unstable above 200 C, about the same electrical performance was seen at 250 C. A plot of winding loss versus frequency illustrates the need to control these losses at high frequency.
Author
Transformers; High Temperature; Fabrication; Magnetic Materials; Power Efficiency; Temperature Measurement; Electrical Engineering

20030102193 Michigan State Univ., East Lansing, MI
Technology-Independent, Multicomponent Synthesis Environment
Chung, Moon-Jung; Dec. 2001; 53 pp.; In English
Contract(s)/Grant(s): F33615-92-C-1029; Proj-6096
Report No.(s): AD-A416230; AFRL-IF-WP-TR-2002-1525; No Copyright; Avail: CASI; A04, Hardcopy

As the complexity of the microelectronics systems and the tools involved increases, design process becomes the key issue in improving productivity. In this project, we report a novel scheme of managing design process to increase the productivity and improve the quality of design. The framework provides the following facilities: 1) coordination of activities, 2) modular approach to customizing and reconfiguring processes, 3) sharing of data and processes, and 4) reuse of data and processes. The framework is based on process grammar, a formal representation of design process. The strong theoretical foundation of our approach allows users to analyze and predict the behavior of a particular process. The abstraction of process is separated from the execution environment, proving a natural way of browsing process repository, and allowing process reuse and improvement. The execution environment determines an individual organization's requirements, mapping them to the most suitable tools and process. Individuals may, if necessary, modify the flow to match an organization's particular needs. The execution environment coordinates the activities (invoking tools, workflow, etc.) with the correct data at the right time. The framework guides the designer toward a design that meets diverse criteria such as performance, cost, design time, and safety.
DTIC
Electrical Engineering; Computer Aided Design; Functional Design Specifications; Microelectronics

20030102206 Air Force Inst. of Tech., Wright-Patterson AFB, OH, USA
The Effects of Ionizing Radiation on Microelectromechanical Systems (MEMS) Actuators: Electrostatic, Electrothermal, and Residual Stress
Caffey, Jared R.; Mar. 25, 2003; 217 pp.; In English; Original contains color illustrations
Report No.(s): AD-A415708; AFIT/GE/ENG/03-05; No Copyright; Avail: CASI; A10, Hardcopy

The effects of ionizing radiation on the operation of polysilicon mmicroelectromechanical system (MEMS) electrostatic actuators, electrothermal actuators, and residual stress cantilevers were examined. Pre-irradiation, in-situ, and post-irradiation measurements were taken for the electrosatic and electrothermal actuators. The residual stress cantilevers were characterized before and after irradiation. All devices were irradiated to a total ionizing does of 1 megarad(Si) using both the Air Force

Research Laboratory's low energy X-ray source and Co-60 gamma source.
DTIC
Actuators; Ionizing Radiation; Microelectromechanical Systems

20030105559 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Scaling and Single Event Effects (SEE) Sensitivity
Oldham, Timothy R.; [2003]; 67 pp.; In English; IEEE Nuclear and Space Radiation Effects Conference, 21 Jul. 2003, Monterey, CA, USA; No Copyright; Avail: CASI; A04, Hardcopy

This paper begins by discussing the potential for scaling down transistors and other components to fit more of them on chips in order to increasing computer processing speed. It also addresses technical challenges to further scaling. Components have been scaled down enough to allow single particles to have an effect, known as a Single Event Effect (SEE). This paper explores the relationship between scaling and the following SEEs: Single Event Upsets (SEU) on DRAMs and SRAMs, Latch-up, Snap-back, Single Event Burnout (SEB), Single Event Gate Rupture (SEGR), and Ion-induced soft breakdown (SBD).
CASI
Chips (Electronics); Transistors; Sensitivity; Scale Effect

20030105569 Aerospace Corp., El Segundo, CA, USA
TID Effects of High-Z Material Spot Shields on FPGA Using MPTB Data
Hardage, Donna, Technical Monitor; Crain, S. H.; Mazur, J. E.; Looper, M. D.; August 2003; 22 pp.; In English
Contract(s)/Grant(s): NASA Order H-32489-D
Report No.(s): NASA/CR-2003-212638; M-1085; NAS 1.26:212638; No Copyright; Avail: CASI; A03, Hardcopy

An experiment on the Microelectronics and Photonics Test Bed (MPTB) was testing lield programmable gate arrays using spot shields to extend the life of some of the devices being tested. It was expected that the unshielded parts would fail from a total ionizing dose (TID) and yet the opposite occurred. The data show that the devices failing from the TID effects are those with the spot shields attached. This effort is to determine the mechanism by which the environment is interacting with the high-Z material to enhance the TID in these field programmable gate arrays.
Author
Field-Programmable Gate Arrays; Microelectronics; Photonics; Ionization

20030105833 Veridian, Brooks AFB, TX, USA
An Evaluation of the Electrical Properties and Bio-Behavioral Effects of Four Commercially Available Tasers and the JAYCOR Sticky Shocker
Sherry, Clifford; Brown, Carroll; Beason, Charles; Dayton, Thomas; Ross, James; Jun. 2003; 32 pp.; In English
Contract(s)/Grant(s): F41624-96-C-9009; Proj-7757
Report No.(s): AD-A416553; AFRL-HE-BR-TR-2003-0089; No Copyright; Avail: CASI; A03, Hardcopy

The TASER is a device that propels two darts into a subject and transmits short pulses of electric current through wires, causing involuntary muscle contractions that incapacitate. Four commercially available TASERs (Tasertron's Model TE86 and Model 95HP; TASER International's Model 34000 'Air TASER' and Model 44000 M26 'Advanced TASER') and a prototype self-contained TASER-like device (Jaycor's 'Sticky Shocker') were tested for effectiveness. The output voltage of each was obtained using four different voltage divider dummy loads: 100, 1,000, 5,000, and 10,000 ohms. Eleven minipigs (Sus scrofa) were exposed to the output of each device for 15 sec, with a minimum rest period of 45 hrs between succeeding exposures. All of the devices caused most animals to run in circles. These swine were able to maintain posture and to jump. Rhythmic contractions of the thorax and abdominal muscles were also observed. Only one device, the TASER International Model 44000 M26 advanced TASER, caused a loss of posture (7 of 11 animals). Two of the 7 were able to regain posture while being tasered. The relative effectiveness of the various devices appeared to be related to total charge flux, with the M26 Advanced TASER having the largest value by far. maximizing the total charge flux output from a TASER should be the basis for any program designed to increase the device's effectiveness.
DTIC
Electrical Properties; Evaluation; Biological Effects; Exposure; Muscles; Posture

20030105837 Rensselaer Polytechnic Inst., Troy, NY

SiGe HBT BiCMOS for 2-160 Gb/s Next Generation Internet (NGI)

McDonald, John F.; May 2003; 92 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): F30602-01-1-0533; AF Proj. K212; DARPA Order K212

Report No.(s): AD-A416571; AFRL-IF-RS-TR-2003-124; No Copyright; Avail: CASI; A05, Hardcopy

This Final Report describes the research related to high speed serial communication circuits implemented in SiGe HBT technology at Rensselaer Polytechnic Institute. Serializer/Deserializer (SERDES) circuits are crucial in keeping pace with the rapidly advancing needs for high-speed data transmission in both short distance and long distance scenarios. Research was undertaken to make better use of existing long-haul infrastructure such as fiber optic networks, as well as for improving communication over much smaller scales such as those distances found on a typical PCB. Designs pushing the fundamental limits of the available manufacturing processes provide a fertile ground for developing innovative circuits in both the analog and digital realms. Work rapidly changes focus to the circuitry responsible for the most recently encountered bottleneck, be it in amplification, digital sampling, oscillators, or elsewhere. To date we have created two complete prototype designs, which were fabricated. A third design would capture 80% of the device fT as a bit rate. For IBM 5HP with an fT of 50 GHz this would be 40 Gb/s, but for a 210 GHz ft in IBM 8HP this would become 160 Gb/s. The challenge is to achieve unprecedented symmetry in the SERDES circuit and layout, as well as development of extremely low jitter VCOfs.

DTIC

Telecommunication; Central Processing Units; Silicon Alloys; Germanium; Cmos; Internets

20030105840 Rockwell Collins, Inc., Cedar Rapids, IA, USA

Ultra Wideband Electromagnetic Interference Test Report. AN/ASN-163 and AN-PSN-11 GPS Receivers. Rockwell Collins GPS Test Report

Jul. 10, 2003; 86 pp.; In English

Report No.(s): AD-A416592; No Copyright; Avail: CASI; A05, Hardcopy

The goal of the Networking in Extreme Environments (NETEX) Program is to create a wireless networking technology that enables robust connectivity in harsh environments and support its integration into new and emerging sensor and Navigation receivers. The NETEX program is focused on the development of an improved physical layer for networked Navigations based on a family of new ultra-wideband UWB devices. UWB devices have the potential to perform a number of useful military Navigation and sensing functions that make them very appealing for war-fighter applications. This report is one of a series of NETEX sponsored electromagnetic interference (EMI) test reports that detail the effects of interference from UWB transmissions on legacy military receivers. The purpose of this report is to document the results of EMI testing performed on the AN/ASN-163 and AN/PSN- 11 GPS Navigation Receivers using an UWB signal generator as the potential interfering source. The AN/ASN-163 GPS Navigation Receiver is a five channel Miniaturized Airborne GPS Receiver. The AN/PSN-11 GPS Navigation Receiver is a five channel handheld GPS receiver. The report provides detailed descriptions of the UWB signal source and AN/ASN-163 and AN/PSN-11 operating modes, identifies the test methodology and test procedures and presents the results of the test events. The intent of these tests was to determine the relative susceptibility with respect to a standard RF interference signal of the AN/ASN-163 and AN/PSN-11 receivers for several of the primary operating modes of the receivers. Accordingly, a set of thirteen test waveforms were designed and injected into the receivers in order to be able to measure the interference effects. The results of the tests are presented in relative susceptibility plots and summarized in a data table.

DTIC

Global Positioning System; Radio Receivers; Electromagnetic Interference; Signal Generators

20030105873 Arkansas Univ., Fayetteville, AR

Direct Cooling of Propulsion Drives for High Power Density and Low Volume

Balda, Juan C.; Barlow, Fred D.; Selvam, Panneer; Elshabini, Aicha; Jul. 2003; 23 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): N00014-01-1-0634; Proj-01PR07524-00

Report No.(s): AD-A416748; No Copyright; Avail: CASI; A03, Hardcopy

This Second Annual Report summarizes the activities performed on this grant from July 1, 2002, through June 30, 2003. The main technical activities during this time period were the following: (1) Understanding of direct cooling methods for power semiconductors; (2) Thermal simulation of spray-cooled power modules (3) Design of a spray-cool test bed for power modules; (4) Design of experiments for thermal test die; (5 Analysis of selected inverter topologies for high- power motor

drives for ship propulsion; and (6) In-depth analysis of a simple method for series connection of IGBTs.
DTIC
Density; Marine Propulsion; Density (Mass/Volume); Semiconductors (Materials); Thermal Simulation; Cooling Systems

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*.

20030086329 Kansas State Univ., Manhattan, KS, USA
Molecular Simulations of Complex Fluids in Confined Geometries
Gehrke, S. H.; Aug. 22, 2002; 12 pp.; In English
Report No.(s): DE2003-807873; No Copyright; Avail: Department of Energy Information Bridge

This award supports collaborative research between Kansas State University and Sandia National Laboratories. The objectives of this work are to develop new methodologies for fast and accurate simulations and apply simulations to various problems of interest to DOE. The success of this work will address several deficiencies in the Sandia's capabilities in the area of molecular simulations. In addition, it provides educational opportunities for students and will enhance the science and technology capabilities at Kansas through partnership with the national laboratories.
NTIS
Molecular Structure; Fluids; Simulation

20030093614 Maine Univ., ME, USA
Concentration and Velocity Gradients in Fluidized Beds
McClymer, James P.; The 2002 NASA Faculty Fellowship Program Research Reports; April 2003, pp. XXVIII-1 - XVIII-6; In English; See also 20030093576
Contract(s)/Grant(s): NAG8-1859; No Copyright; Avail: CASI; C01, CD-ROM; A02, Hardcopy

In this work we focus on the height dependence of particle concentration, average velocity components, fluctuations in these velocities and, with the flow turned off, the sedimentation velocity. The latter quantities are measured using Particle Imaging Velocimetry (PIV). The PIV technique uses a 1-megapixel camera to capture two time-displaced images of particles in the bed. The depth of field of the imaging system is approximately 0.5 cm. The camera images a region with characteristic length of 2.6 cm for the small particles and 4.7 cm. for the large particles. The local direction of particle flow is determined by calculating the correlation function for sub-regions of 32 x 32 pixels. The velocity vector map is created from this correlation function using the time between images (we use 15 to 30 ms). The software is sensitive variations of 1/64th of a pixel. We produce velocity maps at various heights, each consisting of 3844 velocities. We break this map into three vertical zones for increased height information. The concentration profile is measured using an expanded (1 cm diameter) linearly polarized HeNe Laser incident on the fluidized bed. A COHU camera (gamma=1, AGC off) with a lens and a polarizer images the transmitted linearly polarized light to minimize the effects of multiply scattered light. The intensity profile (640 X 480 pixels) is well described by a Gaussian fit and the height of the Gaussian is used to characterize the concentration. This value is compared to the heights found for known concentrations. The sedimentation velocity is estimated using by imaging a region near the bottom of the bed and using PIV to measure the velocity as a function of time. With a nearly uniform concentration profile, the time can be converted to height information. The stable fluidized beds are made from large pseudo-monodisperse particles (silica spheres with radii (250-300) microns and (425-500) microns) dispersed in a glycerin/water mix. The Peclet number is sufficiently large that Brownian motion of the particles can be ignored and the Reynolds number sufficiently small that particle inertia is negligible. A packed particle bed is used to randomize and disperse the flowing fluid introduced by a peristaltic pump. The bed itself is a rectangular glass cell 8 cm wide (x), 0.8 cm deep and a height of 30.5 cm (z). The depth of field of the camera is approximately 0.5 cm so depth information is averaged. Over flow fluid is returned to the reservoir making a closed loop system. In these experiments the particles form a sediment approximately 5.7 cm high with the pump off and expand to 22 cm with the pump on. For the smaller particles the pump velocity is .5 millimeters per second and 1.1 millimeters per second for the large particles. At this concentration the bed has a very well defined top where particle concentration rapidly drops to zero.
Derived from text
Fluidized Bed Processors; Velocity Distribution; Concentration (Composition); Sediments; Particle Image Velocimetry; Scale Height

20030099654 New York Univ., NY, USA, ANSYS, Inc., USA

Faster Aerodynamic Simulation With Cart3D

Spinoff 2003: 100 Years of Powered Flight; 2003, pp. 56; In English; See also 20030099639; Original contains color illustrations; No Copyright; Avail: National Technology Transfer Center (NTTC), Wheeling, WV

A NASA-developed aerodynamic simulation tool is ensuring the safety of future space operations while providing designers and engineers with an automated, highly accurate computer simulation suite. Cart3D, co-winner of NASA's 2002 Software of the Year award, is the result of over 10 years of research and software development conducted by Michael Aftosmis and Dr. John Melton of Ames Research Center and Professor Marsha Berger of the Courant Institute at New York University. Cart3D offers a revolutionary approach to computational fluid dynamics (CFD), the computer simulation of how fluids and gases flow around an object of a particular design. By fusing technological advancements in diverse fields such as mineralogy, computer graphics, computational geometry, and fluid dynamics, the software provides a new industrial geometry processing and fluid analysis capability with unsurpassed automation and efficiency.

Derived from text

Computational Fluid Dynamics; Computerized Simulation; Software Engineering; Aerodynamics; Automation

20030099655 Energy Science Labs., Inc., San Diego, CA, USA

Conducting the Heat

Spinoff 2003: 100 Years of Powered Flight; 2003, pp. 85; In English; See also 20030099639; Original contains color illustrations; No Copyright; Avail: National Technology Transfer Center (NTTC), Wheeling, WV

Heat conduction plays an important role in the efficiency and life span of electronic components. To keep electronic components running efficiently and at a proper temperature, thermal management systems transfer heat generated from the components to thermal surfaces such as heat sinks, heat pipes, radiators, or heat spreaders. Thermal surfaces absorb the heat from the electrical components and dissipate it into the environment, preventing overheating. To ensure the best contact between electrical components and thermal surfaces, thermal interface materials are applied. In addition to having high conductivity, ideal thermal interface materials should be compliant to conform to the components, increasing the surface contact. While many different types of interface materials exist for varying purposes, Energy Science Laboratories, Inc. (ESLI), of San Diego, California, proposed using carbon velvets as thermal interface materials for general aerospace and electronics applications. NASA s Johnson Space Center granted ESLI a Small Business Innovation Research (SBIR) contract to develop thermal interface materials that are lightweight and compliant, and demonstrate high thermal conductance even for nonflat surfaces. Through Phase II SBIR work, ESLI created Vel-Therm for the commercial market. Vel-Therm is a soft, carbon fiber velvet consisting of numerous high thermal conductivity carbon fibers anchored in a thin layer of adhesive. The velvets are fabricated by precision cutting continuous carbon fiber tows and electrostatically flocking the fibers into uncured adhesive, using proprietary techniques.

Derived from text

Fabrication; Conductive Heat Transfer; Aerospace Engineering; Electronics; Carbon Fibers

20030099664 Boulder Imaging, Inc., Louisville, CO, USA

Image Acquisition in Real Time

Spinoff 2003: 100 Years of Powered Flight; 2003, pp. 64-65; In English; See also 20030099639; Original contains color and black and white illustrations; No Copyright; Avail: National Technology Transfer Center (NTTC), Wheeling, WV

In 1995, Carlos Jorquera left NASA s Jet Propulsion Laboratory (JPL) to focus on erasing the growing void between high-performance cameras and the requisite software to capture and process the resulting digital images. Since his departure from NASA, Jorquera s efforts have not only satisfied the private industry's cravings for faster, more flexible, and more favorable software applications, but have blossomed into a successful entrepreneurship that is making its mark with improvements in fields such as medicine, weather forecasting, and X-ray inspection. Formerly a JPL engineer who constructed imaging systems for spacecraft and ground-based astronomy projects, Jorquera is the founder and president of the three-person firm, Boulder Imaging Inc., based in Louisville, Colorado. Joining Jorquera to round out the Boulder Imaging staff are Chief Operations Engineer Susan Downey, who also gained experience at JPL working on space-bound projects including Galileo and the Hubble Space Telescope, and Vice President of Engineering and Machine Vision Specialist Jie Zhu Kulbida, who has extensive industrial and research and development experience within the private sector.

Derived from text

Imaging Techniques; Real Time Operation; Computer Vision

20030099680 Sydney Univ., Australia

Monte Carlo Methodology Serves Up a Software Success

Spinoff 2003: 100 Years of Powered Flight; 2003, pp. 70-71; In English; See also 20030099639; Original contains color illustrations; No Copyright; Avail: National Technology Transfer Center (NTTC), Wheeling, WV

Widely used for the modeling of gas flows through the computation of the motion and collisions of representative molecules, the Direct Simulation Monte Carlo method has become the gold standard for producing research and engineering predictions in the field of rarefied gas dynamics. Direct Simulation Monte Carlo was first introduced in the early 1960s by Dr. Graeme Bird, a professor at the University of Sydney, Australia. It has since proved to be a valuable tool to the aerospace and defense industries in providing design and operational support data, as well as flight data analysis. In 2002, NASA brought to the forefront a software product that maintains the same basic physics formulation of Dr. Bird's method, but provides effective modeling of complex, three-dimensional, real vehicle simulations and parallel processing capabilities to handle additional computational requirements, especially in areas where computational fluid dynamics (CFD) is not applicable. NASA's Direct Simulation Monte Carlo Analysis Code (DAC) software package is now considered the Agency s premier high-fidelity simulation tool for predicting vehicle aerodynamics and aerothermodynamic environments in rarified, or low-density, gas flows.

Derived from text

Monte Carlo Method; Computational Fluid Dynamics; Methodology; Direct Numerical Simulation; Software Engineering; Aerothermodynamics

20030102134 Argonne National Lab., IL, Coventry Univ., Coventry

Modelling of Liquid Metal Duct and Free-Surface Flows using CFX

Aleksandrova, S.; Molokov, S.; Reed, C. B.; Jun. 2002; In English

Report No.(s): DE2003-43822; ANL/TD/TM02-30; No Copyright; Avail: National Technical Information Service (NTIS)

Liquid metal free-surface flows provide an option of a renewable surface for heat absorption, removal of impurities, and eliminating the problems of erosion and thermal stresses. In a tokamak liquid metal flows through a strong magnetic field, which results in a magnetohydrodynamic (MHD) interaction. For a free-surface flow the MHD interaction may be even more important than for the duct flows in blankets, because the electromagnetic forces may significantly deform the free-surface and thus make it unfavourable for heat extraction. The MHD-related problems for the free-surface flows have been reviewed in. Among the most important ones are the effects of nonuniform magnetic fields, inertia, surface tension, wettability and roughness of walls on both the jet/drop shape and trajectory. For modelling ordinary hydrodynamic flows several commercial codes are available, such as CFX, FLUENT, FLOW-3D, etc. Although most of them do not model MHD flows automatically, they can be modified using user-defined subroutines to include the body forces, such as the Lorentz force, and couple the momentum equations with the other MHD equations. The aims of this report are: to summarise the first steps in the development of the extension of CFX for modelling MHD flows, to present the results of testing the code on several benchmark problems, and to present the description of the code for further reference.

NTIS

Liquid Metals; Tokamak Devices; Magnetohydrodynamic Flow; Surface Reactions

20030102186 Massachusetts Inst. of Tech., Cambridge, MA

Forces and Moments Due to Unsteady Motion of an Underwater Vehicle

Oller, Erik D.; Jun. 2003; 101 pp.; In English

Report No.(s): AD-A415688; No Copyright; Avail: CASI; A06, Hardcopy

Unmanned Underwater Vehicles (UUV's) perform many of their missions in shallow water environments subject to the forces of ocean waves and the proximity to the ocean floor. Under these conditions, accurate vertical position control is necessary to prevent broaching or hitting the ocean floor. Accurate horizontal position control is necessary to enable the UUV to conduct its mission with accuracy and return to a predetermined recovery point. Shallow water position control is made more difficult by ocean waves. In deep water the effects of these waves are negligible, but the effects in shallow water are significant. Important shallow water missions include pollution monitoring, marine life sampling, bottom contour mapping, and mine location. Currently, UUV's are controlled in shallow water by altering empirical control parameters for better shallow water performance and by establishing empirically based operating depth limits on the UUV operations. These operating depth limits are based upon wave conditions. With a thorough understanding of the dynamics of UUV's in shallow water and the forces and moments on vehicles due to sea waves in these waters, improved control systems and vehicle designs can be achieved to allow the UUV to operate in shallower water and in larger waves than is commonly done. This will allow

the UUV to be more effectively perform its missions. This thesis explores the effects of variation in water depth and vehicle submergence on added mass, damping, and restoring forces.
DTIC
Ocean Surface; Underwater Vehicles; Marine Environments; Unsteady Flow; Drone Vehicles

20030102192 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Low Frequency High Amplitude Temperature Oscillations in Loop Heat Pipe Operation
Ku, Jentung; Rodriguez, Jose; [2003]; 32 pp.; In English; International Two-Phase Thermal Control Technology Workshop 2003, 15-17 Sep. 2003, Noordwijk, Netherlands; No Copyright; Avail: CASI; A03, Hardcopy

This paper presents viewgraphs on the low frequency high amplitude temperature oscillations observed in loop heat pipe operations. The topics include: 1) Proposed Theory; 2) Test Loop and Test Results; and 3) Effects of Various Parameters. The author also presents a short summary on the conditiions that must be met in order to sustain a low frequency high amplitude temperature oscillation.
CASI
Heat Pipes; High Temperature; Low Frequencies; Oscillations

20030102200
Development of Robust Boundary Layer Controllers
Speyer, Jason L.; Kim, John; Nov. 29, 2002; 124 pp.; In English
Contract(s)/Grant(s): F49620-00-1-0166
Report No.(s): AD-A416220; AFRL-SR-AR-TR-03-0248; No Copyright; Avail: CASI; A06, Hardcopy

In this study, control system analysis and design techniques were developed to control turbulent and convective boundary layers. The design was dependant solely on the linearized governing equations of a channel flow and a layer of heated fluid. The three-dimensional Navier-Stokes equations of channel flow, linearized about a Poisueille profile, and Oberbeck-Boussinesq equations of a layer of fluid, linearized about the no motion state, were decomposed by a spectral decomposition involving a two-dimensional Fourier expansion and a Chebyshev Calcrkin projection. The resulting temporal state space model, composed of the coefficients of this decomposition, allowed for a multivariable feedback design combining an array of sensors to an array of actuators. In particular, this spectral decomposition decouples the dynamical equations into a parallel architecture, where each wave number pair sub-system could he handled individually Linear Quadratic Guassian (LQC) multivariable synthesis and model reduction techniques are applied to a few select wave number pair sub-systems, reducing the required computational bandwidth. Controller performance was tested on direct numerical simulations. Even with a limited number of controlled wave number pairs and a drastic reduction in state space size, the controllers have proven remarkably effective.
DTIC
Turbulent Boundary Layer; Robustness (Mathematics); Control Systems Design

35
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*.

20030091469 Johns Hopkins Univ., Baltimore, MD, USA
High Resolution Imaging from the Stratosphere: Atmospheric Seeing and Tether Dynamics
Ford, Holland; [2003]; 18 pp.; In English
Contract(s)/Grant(s): NAG5-8826; No Copyright; Avail: CASI; A03, Hardcopy

A balloon-borne telescope that is capable of imaging planets orbiting nearby stars requires that the flatness and tilt of the wavefront of the light entering that telescope meet certain stringent conditions. The atmosphere through which the light propagates distorts the wavefront due to turbulence in the atmosphere and due to the disturbances caused by the balloon itself The magnitude of these effects may be estimated, but no direct measurements have been made at the level of precision necessary for designing a telescope as demanding as we envision. Therefore, under this grant we carried out a study of

techniques that could be used to make an in situ measurement of the distortion of the optical wavefront.
Derived from text
Telescopes; Balloon-Borne Instruments; Imaging Techniques; Tethering

20030091492 Scripps Institution of Oceanography, La Jolla, CA, USA
A Numerical Climate Observing Network Design Study
Stammer, Detlef; September 24, 2003; 46 pp.; In English
Contract(s)/Grant(s): NAG5-8623; ONR-N00014-99-1-1049; No Copyright; Avail: CASI; A03, Hardcopy

This project was concerned with three related questions of an optimal design of a climate observing system: 1. The spatial sampling characteristics required from an ARGO system. 2. The degree to which surface observations from ARGO can be used to calibrate and test satellite remote sensing observations of sea surface salinity (SSS) as it is anticipated now. 3. The more general design of an climate observing system as it is required in the near future for CLIVAR in the Atlantic. An important question in implementing an observing system is that of the sampling density required to observe climate-related variations in the ocean. For that purpose this project was concerned with the sampling requirements for the ARGO float system, but investigated also other elements of a climate observing system. As part of this project we studied the horizontal and vertical sampling characteristics of a global ARGO system which is required to make it fully complementary to altimeter data with the goal to capture climate related variations on large spatial scales (less thanAttachment: 1000 km). We addressed this question in the framework of a numerical model study in the North Atlantic with an 1/6 horizontal resolution. The advantage of a numerical design study is the knowledge of the full model state. Sampled by a synthetic float array, model results will therefore allow to test and improve existing deployment strategies with the goal to make the system as optimal and cost-efficient as possible. Attachment: 'Optimal observations for variational data assimilation'
Author
Numerical Analysis; Climate; Mathematical Models; Ocean Surface; Altimeters

20030093592 Austin Peay State Univ., Clarksville, TN, USA
Phase Retrieval Using a Genetic Algorithm on the Systematic Image-Based Optical Alignment Testbed
Taylor, Jaime R.; The 2002 NASA Faculty Fellowship Program Research Reports; April 2003, pp. XLIX-1 - XLIX-5; In English; See also 20030093576
Contract(s)/Grant(s): NAG8-1859; No Copyright; Avail: CASI; C01, CD-ROM; A01, Hardcopy

NASA s Marshall Space Flight Center s Systematic Image-Based Optical Alignment (SIBOA) Testbed was developed to test phase retrieval algorithms and hardware techniques. Individuals working with the facility developed the idea of implementing phase retrieval by breaking the determination of the tip/tilt of each mirror apart from the piston motion (or translation) of each mirror. Presented in this report is an algorithm that determines the optimal phase correction associated only with the piston motion of the mirrors. A description of the Phase Retrieval problem is first presented. The Systematic Image-Based Optical Alignment (SIBOA) Testbeb is then described. A Discrete Fourier Transform (DFT) is necessary to transfer the incoming wavefront (or estimate of phase error) into the spatial frequency domain to compare it with the image. A method for reducing the DFT to seven scalar/matrix multiplications is presented. A genetic algorithm is then used to search for the phase error. The results of this new algorithm on a test problem are presented.
Author
Mirrors; Optical Equipment; Phase Error

20030093636 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Implicit Spacecraft Gyro Calibration
Harman, Richard; Bar-Itzhack, Itzhack Y.; [2003]; 21 pp.; In English; 2003 AAS/AIAA Astrodynamics Specialist Conference Meeting, 3-7 Aug. 2003, Big Sky, MT
Report No.(s): AAS-03-604; No Copyright; Avail: CASI; A03, Hardcopy

This paper presents an implicit algorithm for spacecraft onboard instrument calibration, particularly to onboard gyro calibration. This work is an extension of previous work that was done where an explicit gyro calibration algorithm was applied to the AQUA spacecraft gyros. The algorithm presented in this paper was tested using simulated data and real data that were downloaded from the Microwave Anisotropy Probe (MAP) spacecraft. The calibration tests gave very good results. A comparison between the use of the implicit calibration algorithm used here with the explicit algorithm used for AQUA

spacecraft indicates that both provide an excellent estimation of the gyro calibration parameters with similar accuracies.
Author
Algorithms; Calibrating; Gyroscopes; Spacecraft Instruments; Onboard Equipment

20030093637 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Progress on Passive Sensor for Ultra-Precise Measurement of C02
Heaps, William S.; Kawa, S. Randolph; Georgieva, Elena; Wilson, Emily; June 2003; 3 pp.; In English; International Symposium on Tropospheric Profiling: Needs and Technologies, 14-20 Sep. 2003, Leipzig,, Germany; Copyright; Avail: CASI; A01, Hardcopy

We will present results from a novel instrument employing a Fabry-Perot interferometer to measure column carbon dioxide with great precision. These measurements are very important for improving our understanding of the global warming phenomenon. The instrument technique can be extended to a number of other important trace gases in the atmosphere.
Author
Carbon Dioxide; Carbon Cycle; Fabry-Perot Interferometers; Atmospheric Composition

20030093730 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Detecting Protostellar Jets with the Goddard Fabry-Perot Coronagraph, and Modification for Adaptive Optics
Woodgate, Bruce E.; Bowers, Charles W.; Grady, Carol A.; Wassell, Edward J.; Palunas, Povilas; [2003]; 1 pp.; In English; AMOS Conference, 7-12 Sep. 2003, Maui, HI, USA; No Copyright; Avail: Other Sources; Abstract Only

The Goddard Fabry-Perot has been used at the Apache Point Observatory 3.5-m telescope to diagnose jets from young Herbig Ae (HD163296) and T Tauri stars (DL Tau and CW Tau), detected by the Space Telescope Imaging Spectrograph coronagraph on the Hubble Space Telescope. The additional spectral discrimination of the Fabry-Perot allows these faint jets to be detected from the ground, to obtain velocities and densities, and to find further extensions. In order to plan what measurements require space coronagraphs, we need to explore the extent to which coronagraphic detections can be made from the ground, including using adaptive optics. Modifications to the Fabry-Perot tunable narrow band coronagraph for possible use with the AEOS 3.65-m telescope will be described.
Author
Coronagraphs; Hubble Space Telescope

20030093733 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Development of a 1K x 1K GaAs QWIP Far IR Imaging Array
Jhabvala, M.; Choi, K.; Goldberg, A.; La, A.; Gunapala, S.; [2003]; 11 pp.; In English; No Copyright; Avail: CASI; A03, Hardcopy

In the on-going evolution of GaAs Quantum Well Infrared Photodetectors (QWIPs) we have developed a 1,024 x 1,024 (1K x1K), 8.4-9 microns infrared focal plane array (FPA). This 1 megapixel detector array is a hybrid using the Rockwell TCM 8050 silicon readout integrated circuit (ROIC) bump bonded to a GaAs QWIP array fabricated jointly by engineers at the Goddard Space Flight Center (GSFC) and the Army Research Laboratory (ARL). The finished hybrid is thinned at the Jet Propulsion Lab. Prior to this development the largest format array was a 512 x 640 FPA. We have integrated the 1K x 1K array into an imaging camera system and performed tests over the 40K-90K temperature range achieving BLIP performance at an operating temperature of 76K (f/2 camera system). The GaAs array is relatively easy to fabricate once the superlattice structure of the quantum wells has been defined and grown. The overall arrays costs are currently dominated by the costs associated with the silicon readout since the GaAs array fabrication is based on high yield, well-established GaAs processing capabilities. In this paper we will present the first results of our 1K x 1K QWIP array development including fabrication methodology, test data and our imaging results.
Author
Gallium Arsenides; Quantum Wells; Infrared Detectors; Infrared Imagery; Fabrication

20030093734 NASA Goddard Space Flight Center, Greenbelt, MD, USA
A Precision Metrology System for the Hubble Space Telescope Wide Field Camera 3 Instrument
Toland, Ronald W.; [2003]; 12 pp.; In English; SPIE Optical Science and Technology Annual Meeting, 3-8 Aug. 2003, San Diego, CA, USA; No Copyright; Avail: CASI; A03, Hardcopy

The Wide Field Camera 3 (WFC3) instrument for the Hubble Space Telescope (HST) will replace the current Wide Field and Planetary Camera 2 (WFPC2). By providing higher throughput and sensitivity than WFPC2, and operating from the

near-IR to the near-UV, WFC3 will once again bring the performance of HST above that from ground-based observatories. Crucial to the integration of the WFC3 optical bench is a pair of 2-axis cathetometers used to view targets which cannot be seen by other means when the bench is loaded into its enclosure. The setup and calibration of these cathetometers is described, along with results from a comparison of the cathetometer system with other metrology techniques.
Author
Hubble Space Telescope; Cameras; Cathetometers

20030093736 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Active and Passive Sensing from Geosynchronous and Libration Orbits
Schoeberl, Mark; Raymond, Carol; Hildebrand, Peter; [2003]; 6 pp.; In English; IGARSS 2003, 21-25 Jul. 2003, Toulouse, France; No Copyright; Avail: CASI; A02, Hardcopy

The development of the LEO (EOS) missions has led the way to new technologies and new science discoveries. However, LEO measurements alone cannot cost effectively produce high time resolution measurements needed to move the science to the next level. Both GEO and the Lagrange points, L1 and L2, provide vantage points that will allow higher time resolution measurements. GEO is currently being exploited by weather satellites, but the sensors currently operating at GEO do not provide the spatial or spectral resolution needed for atmospheric trace gas, ocean or land surface measurements. It is also may be possible to place active sensors in geostationary orbit. It seems clear, that the next era in earth observation and discovery will be opened by sensor systems operating beyond near earth orbit.
Derived from text
Geosynchronous Orbits; Spectral Resolution

20030095960 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Energy Scales in X-ray Microcalorimeters
Tillotson, W. A.; Boyce, K. R.; Brown, G. V.; Figueroa, E.; Kelley, R. L.; Porter, F. S.; Stahle, C. K.; Cottam, J.; [2003]; 1 pp.; In English; LTD-10, 7-11 Jul. 2003, Genoa,, Italy; No Copyright; Avail: Other Sources; Abstract Only

Microcalorimeter pulse shape characteristics, such as pulse height, decay time and rise time, are dependent on the detector temperature and bias as well as the photon energy and flux. We examine the nature of the temperature dependency by illuminating the ASTRO-E2 X-ray Spectrometer (XRS) microcalorimeter array with X-rays generated by electron impact on a range of foil targets. The resulting pulses are collected for a range of detector temperatures. We observe and model the temperature dependence of the pulse shape characteristics by fitting the data with non-linear pulse models. Our aim is to determine a robust method for correcting the energy scale obtained in ground calibration for slight differences in the operating conditions while in orbit.
Author
Calorimeters; X Ray Spectrometers; Energy Spectra; Photons

20030095965 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Applications of Gas Imaging Micro-Well Detectors to an Advanced Compton Telescope
Bloser, P. F.; Hunter, S. D.; Ryan, J. M.; McConnell, M. L.; Miller, R. S.; Jackson, T. N.; Bai, B.; Jung, S.; [2003]; 6 pp.; In English; No Copyright; Avail: CASI; A02, Hardcopy

We present a concept for an Advanced Compton Telescope (ACT) based on the use of pixelized gas micro-well detectors to form a three-dimensional electron track imager. A micro-well detector consists of an array of individual micro-patterned proportional counters opposite a planar drift electrode. When combined with thin film transistor array readouts, large gas volumes may be imaged with very good spatial and energy resolution at reasonable cost. The third dimension is determined by timing the drift of the ionization electrons. The primary advantage of this approach is the excellent tracking of the Compton recoil electron that is possible in a gas volume. Such good electron tracking allows us to reduce the point spread function of a single incident photon dramatically, greatly improving the imaging capability and sensitivity. The polarization sensitivity, which relies on events with large Compton scattering angles, is particularly enhanced. We describe a possible ACT implementation of this technique, in which the gas tracking volume is surrounded by a CsI calorimeter, and present our plans to build and test a small prototype over the next three years.
Author
Imaging Techniques; Image Resolution; Gas Detectors; Three Dimensional Motion

20030095994 NASA Goddard Space Flight Center, Greenbelt, MD, USA
High-Sensitivity X-ray Polarimetry with Amorphous Silicon Active-Matrix Pixel Proportional Counters
Black, J. K.; Deines-Jones, P.; Jahoda, K.; Ready, S. E.; Street, R. A.; [2003]; 8 pp.; In English; SPIE Conference, 3-8 Aug. 2003, San Diego, CA, USA
Contract(s)/Grant(s): NRA-01-01-HEA-021; Copyright; Avail: CASI; A02, Hardcopy

Photoelectric X-ray polarimeters based on pixel micropattern gas detectors (MPGDs) offer order-of-magnitude improvement in sensitivity over more traditional techniques based on X-ray scattering. This new technique places some of the most interesting astronomical observations within reach of even a small, dedicated mission. The most sensitive instrument would be a photoelectric polarimeter at the focus of 2 a very large mirror, such as the planned XEUS. Our efforts are focused on a smaller pathfinder mission, which would achieve its greatest sensitivity with large-area, low-background, collimated polarimeters. We have recently demonstrated a MPGD polarimeter using amorphous silicon thin-film transistor (TFT) readout suitable for the focal plane of an X-ray telescope. All the technologies used in the demonstration polarimeter are scalable to the areas required for a high-sensitivity collimated polarimeter. Leywords: X-ray polarimetry, particle tracking, proportional counter, GEM, pixel readout
Author
Polarimeters; X Ray Telescopes; Gas Detectors; Sensitivity

20030098035 NASA Goddard Space Flight Center, Greenbelt, MD, USA
A Laboratory-Based Microwave Radio-Interferometry Testbed
Moriarity, M.; Simon, N.; Leach, K.; Piepmeier, J. R.; May 02, 2003; 3 pp.; In English; 2003 International Geoscience and Remote Sensing Symposium
Contract(s)/Grant(s): 292-03-73
Report No.(s): IGARSS2003-03.1737; Copyright; Avail: CASI; A01, Hardcopy

The Goddard Radio lnterferometry Testbed (GRIT) is an adaptable platform for laboratory testing of Synthetic Thinned Array Radiometers (STAR). Using this testbed, we demonstrate that the Doppler radiometer can image a point source in an observed scene.
Author
Radiometers; Synthetic Arrays

20030099652 Boulder Nonlinear Systems, Inc., Lafayette, CO, USA, Look Dynamics, Longmont, CO, USA
Processing at the Speed of Light
Spinoff 2003: 100 Years of Powered Flight; 2003, pp. 98-99; In English; See also 20030099639; Original contains color and black and white illustrations; No Copyright; Avail: National Technology Transfer Center (NTTC), Wheeling, WV

Spatial Light Modulators (SLMs) are critical elements in optical processing systems used for imaging, displaying, data storage, communications, and other applications. By taking advantage of the natural properties of light beams, the devices process information at speeds unattainable by human operators and most machines, with high-resolution results.Boulder Nonlinear Systems, Inc., is one of the world s foremost SLM manufacturers. Applications of this technology are briefly described.
Derived from text
Light Modulators; Imaging Techniques

20030099653 Digital Interface Systems, Inc., North Olmsted, OH, USA
Designing It Smart With SIV
Spinoff 2003: 100 Years of Powered Flight; 2003, pp. 101; In English; See also 20030099639; Original contains color illustrations; No Copyright; Avail: National Technology Transfer Center (NTTC), Wheeling, WV

When research staff at NASA s Glenn Research Center developed and patented Stereo Imaging Velocimetry (SIV), the world s first three-dimensional (3-D), full-field quantitative and qualitative analysis tool to investigate flow velocities, experiments that were previously impossible became a reality. Seizing the opportunity to commercialize NASA s breakthrough invention, Digital Interface Systems (DIS), Inc., of North Olmsted, Ohio, acquired an exclusive license to market SIV, which has a range of applications from improving the aerodynamics of aircraft and automobiles to avoiding ‘no flow’ regions in artificial hearts.
Derived from text
Flow Velocity; Imaging Techniques; Qualitative Analysis; Quantitative Analysis; Velocity Measurement

20030099656 Radatec, LLC, Atlanta, GA, USA
New Sensor Gaining Interest on Industry Radar Screen
Spinoff 2003: 100 Years of Powered Flight; 2003, pp. 90-91; In English; See also 20030099639; Original contains color illustrations; No Copyright; Avail: National Technology Transfer Center (NTTC), Wheeling, WV

While radar is typically used to track large objects that are relatively far away, an Atlanta, Georgia-based start-up company is using the technology in a counter-intuitive way to track very small changes in displacement at close proximity. Radatec, Inc., a designer, manufacturer, and implementer of sensor systems for monitoring combustion-zone components in turbine engines, was formed in 2001 to commercialize the patented radio frequency vibrometer technology from the Georgia Institute of Technology (Georgia Tech). In readying the technology for the commercial market, Radatec received assistance from NASA s Dryden Flight Research Center.
Derived from text
Sensors; Combustion; Displacement; Vibration Meters

20030099665 Brimrose Corp. of America, Baltimore, MD, USA
A Closer Look at Quality Control
Spinoff 2003: 100 Years of Powered Flight; 2003, pp. 86; In English; See also 20030099639; Original contains color illustrations; No Copyright; Avail: National Technology Transfer Center (NTTC), Wheeling, WV

Spectrometers, which are durable, lightweight, and compact instruments, are a requirement for NASA deep space science missions, especially as NASA strives to conduct these missions with smaller spacecraft. NASA s Jet Propulsion Laboratory (JPL) awarded the Brimrose Corporation of America a Small Business Innovation Research (SBIR) contract to develop a compact, rugged, near-infrared spectrometer for possible future missions. Spectrometers are of particular importance on NASA missions because they help scientists to identify the make-up of a planet s surface and analyze the molecules in the atmosphere. Minerals and molecules emit light of various colors. The light, identified as spectra, is difficult to see, and spectrometers, which are essentially special cameras that collect the separate colors of light in an object, allow scientists to identify the different materials. For example, spectrometers can help scientists determine whether soil was created from lava flows or from meteorites.
Derived from text
Spectrometers; Cameras; Quality Control

20030099666 Micro Control, Inc., West Bloomfield, MI, USA
Sensing the Tension
Spinoff 2003: 100 Years of Powered Flight; 2003, pp. 92-93; In English; See also 20030099639; Original contains color illustrations; No Copyright; Avail: National Technology Transfer Center (NTTC), Wheeling, WV

Spanning over 4 decades, NASA's bolt tension monitoring technology has benefited automakers, airplane builders, and other major manufacturers that rely on the devices to evaluate the performance of computerized torque wrenches and other assembly line mechanisms. In recent years, the advancement of ultrasonic sensors has drastically eased this process for users, ensuring that proper tension and torque are being applied to bolts and fasteners, with less time needed for data analysis. Langley Research Center s Nondestructive Evaluation Branch is one of the latest NASA programs to incorporate ultrasonic sensors within a bolt tension measurement instrument. As a multi-disciplined research group focused on spacecraft and aerospace transportation safety, one of the branch s many commitments includes transferring problem solutions to industry. In 1998, the branch carried out this obligation in a licensing agreement with Micro Control, Inc., of West Bloomfield, Michigan. Micro Control, an automotive inspection company, obtained the licenses to two Langley patents to provide an improved-but-inexpensive means of ultrasonic tension measurement.
Derived from text
Ultrasonic Scanners; Sensors; Nondestructive Tests

20030099670 ThermTech Services, Inc., Stuart, FL, USA
Thermographic Inspections Save Skins and Prevent Blackouts
Spinoff 2003: 100 Years of Powered Flight; 2003, pp. 96; In English; See also 20030099639; Original contains color illustrations; No Copyright; Avail: National Technology Transfer Center (NTTC), Wheeling, WV

Scanning thermography involves heating a component s surface and subsequently measuring the surface temperature, using an infrared camera to identify structural defects such as corrosion and disbonding. It is a completely noninvasive and noncontacting process. Scans can detect defects in conventional metals and plastics, as well as in bonded aluminum

composites, plastic- and resinbased composites, and laminated structures. The apparatus used for scanning is highly portable and can cover the surface of a test material up to six times faster than conventional thermography. NASA scientists affirm that the technology is an invaluable asset to the airlines, detecting potential defects that can cause structural failure.In 1996, ThermTech Services, Inc., of Stuart, Florida, approached NASA in an effort to evaluate the technology for application in the power and process industries, where corrosion is of serious concern. ThermTech Services proceeded to develop the application for inspecting boiler waterwall tubing at fossil-fueled electric-generating stations. In 1999, ThermTech purchased the rights to NASA s patented technology and developed the specialized equipment required to apply the inspecting method to power plant components. The ThermTech robotic system using NASA technology has proved to be extremely successful and cost effective in performing detailed inspections of large structures such as boiler waterwalls and aboveground chemical storage tanks. It is capable of inspecting a waterwall, tank-wall, or other large surfaces at a rate of approximately 10 square feet per minute or faster.
Author
Thermography; Structural Failure; Cracking (Fracturing)

20030099671 MetroLaser, USA, 4D Technology Corp., Tuscon, AZ, USA
Precise Measurement for Manufacturing
Spinoff 2003: 100 Years of Powered Flight; 2003, pp. 97; In English; See also 20030099639; Original contains color illustrations; No Copyright; Avail: National Technology Transfer Center (NTTC), Wheeling, WV

A metrology instrument known as PhaseCam supports a wide range of applications, from testing large optics to controlling factory production processes. This dynamic interferometer system enables precise measurement of three-dimensional surfaces in the manufacturing industry, delivering speed and high-resolution accuracy in even the most challenging environments.Compact and reliable, PhaseCam enables users to make interferometric measurements right on the factory floor. The system can be configured for many different applications, including mirror phasing, vacuum/cryogenic testing, motion/modal analysis, and flow visualization.
Derived from text
Interferometers; Metrology

20030099685 Exergen Corp., Watertown, MA, USA
Going Places No Infrared Temperature Devices Have Gone Before
Spinoff 2003: 100 Years of Powered Flight; 2003, pp. 88-89; In English; See also 20030099639; Original contains color illustrations; No Copyright; Avail: National Technology Transfer Center (NTTC), Wheeling, WV

Exergen's IRt/c is a self-powered sensor that matches a thermocouple within specified temperature ranges and provides a predictable and repeatable signal outside of this specified range. Possessing an extremely fast time constant, the infrared technology allows users to measure product temperature without touching the product. The IRt/c uses a device called a thermopile to measure temperature and generate current. Traditionally, these devices are not available in a size that would be compatible with the Exergen IRt/c, based on NASA s quarterinch specifications. After going through five circuit designs to find a thermopile that would suit the IRt/c design and match the signal needed for output, Exergen maintains that it developed a model that totaled just 20 percent of the volume of the previous smallest detector in the world. Following completion of the project with Glenn, Exergen continued development of the IRt/c for other customers, spinning off a new product line called the micro IRt/c. This latest development has broadened applications for industries that previously could not use infrared thermometers due to size constraints. The first commercial use of the micro IRt/c involved an original equipment manufacturer that makes laminating machinery consisting of heated rollers in very tight spots. Accurate temperature measurement for this application requires close proximity to the heated rollers. With the micro IRt/c s 50-millisecond time constant, the manufacturer is able to gain closer access to the intended temperature targets for exact readings, thereby increasing productivity and staying ahead of competition.In a separate application, the infrared temperature sensor is being utilized for avalanche warnings in Switzerland. The IRt/c is mounted about 5 meters above the ground to measure the snow cover throughout the mountainous regions of the country.
Derived from text
Thermocouples; Thermopiles

20030102194 NASA Goddard Space Flight Center, Greenbelt, MD, USA
The MODIS Aerosol Algorithm, Products and Validation
Remer, L. A.; Kaufman, Y. J.; Tanre, D.; Mattoo, S.; Chu, D. A.; Martins, J. V.; Li, R.-R.; Ichoku, C.; Levy, R. C.; Kleidman, R. G., et al.; [2003]; 68 pp.; In English; Copyright; Avail: CASI; A04, Hardcopy

The MODerate resolution Imaging Spectroradiometer (MODIS) aboard both NASA's Terra and Aqua satellites is making near global daily observations of the earth in a wide spectral range. These measurements are used to derive spectral aerosol optical thickness and aerosol size parameters over both land and ocean. The aerosol products available over land include aerosol optical thickness at three visible wavelengths, a measure of the fraction of aerosol optical thickness attributed to the fine mode and several derived parameters including reflected spectral solar flux at top of atmosphere. Over ocean, the aerosol optical thickness is provided in seven wavelengths from 0.47 microns to 2.13 microns. In addition, quantitative aerosol size information includes effective radius of the aerosol and quantitative fraction of optical thickness attributed to the fine mode. Spectral aerosol flux, mass concentration and number of cloud condensation nuclei round out the list of available aerosol products over the ocean. The spectral optical thickness and effective radius of the aerosol over the ocean are validated by comparison with two years of AERONET data gleaned from 133 AERONET stations. 8000 MODIS aerosol retrievals colocated with AERONET measurements confirm that one-standard deviation of MODIS optical thickness retrievals fall within the predicted uncertainty of delta tauapproximately equal to plus or minus 0.03 plus or minus 0.05 tau over ocean and delta tay equal to plus or minus 0.05 plus or minus 0.15 tau over land. 271 MODIS aerosol retrievals co-located with AERONET inversions at island and coastal sites suggest that one-standard deviation of MODIS effective radius retrievals falls within delta r_eff approximately equal to 0.11 microns. The accuracy of the MODIS retrievals suggests that the product can be used to help narrow the uncertainties associated with aerosol radiative forcing of global climate.
Author
Aerosols; Modis (Radiometry); Spectroradiometers; Algorithms

20030105592 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Design of a Resonant Edge-Slot Waveguide Array for the Lightweight Rainfall Radiometer (LRR)
Gosselin, R. B.; Seufert, S. E.; Dod, L. R.; [2003]; 3 pp.; In English; International Geoscience and Remote Sensing Symposium, 21-25 Jul. 2003, Toulouse, France; No Copyright; Avail: CASI; A01, Hardcopy

Several X-band resonant edge-slot waveguide arrays were designed and fabricated for the passive X-band radiometer being flown on the NASA Lightweight Rainfall Radiometer (LRR) aircraft mission. The advantage of this antenna for aperture synthesis between adjacent linear arrays is described along with detailed description of a modern technique for designing resonant edge-slot waveguide arrays. What made this achievement most noteworthy was this historically difficult design was accomplished at very low cost without manufacturing any hardware prototypes and the antenna was very well-optimized. This paper will summarize the development effort, and present engineering design curves used to create this low-sidelobe antenna design and data measured from the radiometer antenna.
Author
Fabrication; Microwave Radiometers; Rain; Slots; Waveguides; Antenna Design; Linear Arrays

20030105593 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Investigation of Space Interferometer Control Using Imaging Sensor Output Feedback
Leitner, Jesse A.; Cheng, Victor H. L.; April 28, 2003; 30 pp.; In English; AIAA Guidance, Navigation, and Control Conference, 11-13 Aug. 2003, Austin, TX, USA
Contract(s)/Grant(s): NAS5-01184; No Copyright; Avail: CASI; A03, Hardcopy

Numerous space interferometry missions are planned for the next decade to verify different enabling technologies towards very-long-baseline interferometry to achieve high-resolution imaging and high-precision measurements. These objectives will require coordinated formations of spacecraft separately carrying optical elements comprising the interferometer. High-precision sensing and control of the spacecraft and the interferometer-component payloads are necessary to deliver sub-wavelength accuracy to achieve the scientific objectives. For these missions, the primary scientific product of interferometer measurements may be the only source of data available at the precision required to maintain the spacecraft and interferometer-component formation. A concept is studied for detecting the interferometer's optical configuration errors based on information extracted from the interferometer sensor output. It enables precision control of the optical components, and, in cases of space interferometers requiring formation flight of spacecraft that comprise the elements of a distributed instrument, it enables the control of the formation-flying vehicles because independent navigation or ranging sensors cannot deliver the high-precision metrology over the entire required geometry. Since the concept can act on the quality of the interferometer output directly, it can detect errors outside the capability of traditional metrology instruments, and provide the means needed to augment the traditional instrumentation to enable enhanced performance. Specific analyses performed in this study include the application of signal-processing and image-processing techniques to solve the problems of interferometer

aperture baseline control, interferometer pointing, and orientation of multiple interferometer aperture pairs.
Author
Feedback; Imaging Techniques; Interferometers; Detection; Telescopes; Spacecraft Control; Apertures

20030105597 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Carrier Plus: A Sensor Payload for Living With a Star Space Environment Testbed (LWS/SET)
Marshall, Cheryl; Moss, Steven; Howard, Regan; LaBel, Kenneth; Grycewicz, Tom; Barth, Janet; Brewer, Dana; [2003]; 8 pp.; In English; International Society for Optical Engineering Conference, 6 Aug. 2003, San Diego, CA, USA
Report No.(s): SPIE-5167; No Copyright; Avail: CASI; A02, Hardcopy

The paper discusses the following: 1. Living with a Star (LWS) program: space environment testbed (SET); natural space environment. 2. Carrier plus: goals and benefits. 3. ON-orbit sensor measurements. 4. Carrier plus architecture. 5. Participation in carrier plus.
CASI
Payloads; Sensors

20030105664 NASA Goddard Space Flight Center, Greenbelt, MD, USA
A Concept for a High-Energy Gamma-ray Polarimeter
Bloser, P. F.; Hunter, S. D.; Depaola, G. O.; Longo, F.; [2003]; 9 pp.; In English; Copyright; Avail: CASI; A02, Hardcopy

We present a concept for an imaging gamma-ray polarimeter operating from approx. 50 MeV to approx. 1 GeV. Such an instrument would be valuable for the study of high-energy pulsars, active galactic nuclei, supernova remnants, and gamma-ray bursts. The concept makes use of pixelized gas micro-well detectors, under development at Goddard Space Flight Center, to record the electron-positron tracks from pair-production events in a large gas volume. Pixelized micro-well detectors have the potential to form large-volume 3-D track imagers with approx. 100 micron (rms) position resolution at moderate cost. The combination of high spatial resolution and a continuous low-density gas medium permits many thousands of measurements per radiation length, allowing the particle tracks to be imaged accurately before multiple scattering masks their original directions. The polarization of the incoming radiation may then be determined from the azimuthal distribution of the electron-positron pairs. We have performed Geant4 simulations of these processes to estimate the polarization sensitivity as a function of instrument parameters and event selection criteria.
Author
Gamma Ray Astronomy; Polarimeters; Gas Detectors

20030105726 Naval Research Lab., Washington, DC
Phase I: FY01 Investigative Study for the Advanced Volume Sensor
Rose-Pehrsson, Susan L.; Owrutsky, Jeffrey C.; Gottuk, Daniel T.; Geiman, Justin A.; Williams, Frederick W.; Jun. 30, 2003; 28 pp.; In English
Report No.(s): AD-A416547; NRL/MR/6110--03-8688; No Copyright; Avail: CASI; A03, Hardcopy

This report presents an overview of relevant research and commercially available products as of FY01 that utilize spatial and spectral methods for fire detection systems. New capabilities are desired that can monitor damage control events in an entire space at a minimal cost. Optical detection methods are being investigated because this technology offers an effective means to monitor the entire space or volume without relying on diffusion of effluents to point sensors. Pattern recognition methods of video camera images (machine vision: spatially resolved) and spectrally resolved detection methods are being investigated for a volume sensor. Acoustic detection methods are also being considered and would be attractive for events such as flooding or pipe rupture. This is the first phase of the Advanced Volume Sensor task in the Future Naval Capabilities ONR program Advanced Damage Countermeasures. Several technologies are identified as having potential in the volume sensor development effort. The resulting system is expected to provide sensitive and selective detection of damage control events including fire.
DTIC
Detection; Fire Control; Optical Measurement

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*.

20030093652 Lawrence Livermore National Lab., Livermore, CA
Modeling of High-Energy Pulsed Laser Interactions with Coupons
Boley, C. D.; Rubenchik, A. M.; Feb. 06, 2003; 28 pp.; In English
Report No.(s): DE2003-15003837; UCRL-ID-151857; No Copyright; Avail: Department of Energy Information Bridge

We describe a computational model of laser-materials interactions in the regime accessed by the solid state heat capacity lasers (SSHCLs) built at LLNL. We show that its predictions compare quite favorably with coupon experiments by the 10 kW SSHCL at LLNL.
NTIS
Pulsed Lasers; Laser Target Interactions

20030102238 California Univ., Berkeley, CA
Soft X-Ray Microscopy and Metrology
Attwood, David; Oct. 2001; 47 pp.; In English
Contract(s)/Grant(s): FDF49620-96-1-0153
Report No.(s): AD-A416265; No Copyright; Avail: CASI; A03, Hardcopy

This AFOSR grant has been used to support graduate students in the areas of coherence and microscopy at soft X-ray wavelengths. Techniques were developed for characterizing the spatial coherence of undulator radiation, table top soft X-ray lasers, and high harmonic generation of femtosecond pulses at short wavelengths, all in the 1-50 nm wavelength regime. With varying additional attributes, all three sources provide radiation exhibiting a high degree of spatial coherence. In the area of high resolution soft X-ray microscopy, a spatial resolution of 23 nanometers has been demonstrated using new, best-in-the-world, Fresnel zone plate lenses, special nanometer test patterns, and bending magnet radiation in the 1- 4 nm region. State-of-the-art images have been obtained of magnetic recording materials with sub-5O nm domains, cryo- prepared biological samples showing detailed views of cells and sub-cellular structures, and modern nanochip interconnects. A new text has been published: D. Attwood, 'Soft X-rays and Extreme Ultraviolet Radiation: Principles and Applications' (Cambridge Univ. Press, UK 2000). Several reprints are attached: 'Soft X-ray Microscopy to 25 nm with Applications to Biology and Magnetic Materials' (NIM A, v467-468, p841-844, 2001); 'Spatial Coherence and Properties of Undulator Radiation Based on Thompson-Wolf Two-pinhole Measurement' (NIM A, v467-468, p913-916, 2001); 'Spatial Coherence Characterization of Undulator Radiation' (Optics Communications, v182, p25-34, 2000); 'Achievement of Essentially Full Spatial Coherence in a High-Average-Power Soft X-ray Laser' (Phys. Rev. A, v63 n3, p33802-1 to 33802-5, 2001); 'Nanofabrication and Diffractive Optics for High- Resolution X-ray Applications' (J. Vac. Sci. Technol. B, v18 n6, p2970-2975, Nov-Dec 2000); 'High-Resolution Soft X-ray Microscopy' (Proc. of SPIE reprint, v4146, p171-175, 2000); 'Experimental Analysis of High-Resolution Soft X-ray Microscopy' (Proc. of SPIE Reprint, v4499, p134-141, 2001).
DTIC
Microscopy; X Ray Lasers; Magnetic Recording; Harmonic Generations; Spatial Resolution

20030105603 Old Dominion Univ., Norfolk, VA
Diagnostic Systems for Pulsed Electric Field Studies
Schoenbach, Karl H.; Apr. 2003; 14 pp.; In English
Contract(s)/Grant(s): F49620-02-1-0227
Report No.(s): AD-A416485; ODURF-221031; AFRL-SR-AR-TR-03-0299; No Copyright; Avail: CASI; A03, Hardcopy

Experimental and modeling studies have shown that nanosecond electric fields allow us to affect internal structures of biological cells. Electrical diagnostics work with temporal resolution in the sub-nanosecond range is critical for evaluation of such ultrafast pulses for the extension of this new bioelectric technique from presently used electrode application in cell suspensions and tissues, to electromagnetic field interactions using antennas. Experiments are ongoing using the 4 GHz bandwidth oscilloscope purchased by this grant for studies on pulsed electron heating in plasmas and electrical breakdown of liquids. Another purchase in support of bioelectrics research is a Time Domain Dielectric Spectroscopy (TDDS) system. It allows us to measure the complex dielectric constant of biological suspensions, and via modeling, get information on cell membrane resistivities and capacitances. A TDDS-system, developed specifically for biological studies, has been purchased

from IDC expertise LDC, and has recently generated the first results on the temporal development of the electrical parameters of HL6O cells in pulsed electric fields.
DTIC
Electric Fields; Dielectric Properties; Cells (Biology); Diagnosis

20030105836 Stanford Univ., Stanford, CA
Portable Diode Laser Diagnostic System for Collaborative Research on Air-Breathing Combustion
Hanson, Ronald K.; Jul. 2003; 5 pp.; In English
Contract(s)/Grant(s): F49620-02-1-0286; Proj-3484
Report No.(s): AD-A416567; AFRL-SR-AR-TR-03-0289; No Copyright; Avail: CASI; A01, Hardcopy

This equipment grant focused on four areas: (1) portable diode laser sensors with new fiber-coupled diode lasers and the support equipment to provide higher power with extended wavelength tuning range and speed; (2) agile wavelength tuning to cover a broader wavelength region; (3) new wavelength sources for the ultraviolet to expand the wavelengths available for sensor strategy research; and (4) portable data acquisition and laser control electronics.
DTIC
Lasers; Laser Spectroscopy; Portable Equipment; Diodes

20030105955 Hampton Univ., VA
High Resolution Laser Spectroscopy of Novel Photonic Materials
Hommerich, Uwe; Nov. 11, 2002; 12 pp.; In English
Contract(s)/Grant(s): F49620-01-1-0528
Report No.(s): AD-A415895; No Copyright; Avail: CASI; A03, Hardcopy

A narrow-band and widely tunable Optical Parametric Oscillator laser system has been acquired and installed during the performance period of this HBCU-infrastructure award. The laser system has been incorporated in the development of a new high-resolution photoluminescence excitation setup. Initial spectroscopic studies of several novel photonic materials have been carried out (GaN:Er and GaN:Eu). The initial results have been presented at several conferences and a first manuscript of research results is in preparation. The new instrumentation has been incorporated in the training of undergraduate and graduate students seeking B.S., M.S., and Ph.D. degrees in physics and related disciplines. In addition, the instrumentation has been implemented in research projects for students participating in summer outreach programs.
DTIC
Materials; Photonics; Laser Spectroscopy

37
MECHANICAL ENGINEERING

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

20030093576 Alabama Univ., Tuscaloosa, AL, USA, Alabama Univ., Huntsville, AL, USA
The 2002 NASA Faculty Fellowship Program Research Reports
Bland, J., Compiler; April 2003; In English; See also 20030093577 - 20030093630; Original contains color and black and white illustrations
Contract(s)/Grant(s): NAG8-1859
Report No.(s): NASA/CR-2003-212397; M-1074; NAS 1.26:212397; No Copyright; Avail: CASI; C01, CD-ROM

Contents include the following: System Identification of X-33. Neural Network Advanced Ceramic Technology for Space Applications at NASA MSFC. Developing a MATLAB-Based Tool for Visualization and Transformation. Subsurface Stress Fields in Single Crystal (Anisotropic). Contacts Our Space Future: A Challenge to the Conceptual Artist Concept Art for Presentation and Education. Identification and Characterization of Extremophile Microorganisms. Significant to Astrobiology. Mathematical Investigation of Gamma Ray and Neutron. Absorption Grid Patterns for Homeland Defense-Related Fourier Imaging Systems. The Potential of Microwave Radiation for Processing Martian Soil. Fuzzy Logic Trajectory Design and Guidance for Terminal Area.
Derived from text
Active Control; Combustion Chambers; Cylindrical Bodies; Data Processing; Design To Cost

20030093590 Pittsburg State Univ., Pittsburg, KS, USA
Manufacturing Development for 100-kW Thermonuclear Simulator
Rosmait, Russell L.; The 2002 NASA Faculty Fellowship Program Research Reports; April 2003; 1 pp.; In English; See also 20030093576
Contract(s)/Grant(s): NAG8-1859; No Copyright; Avail: Other Sources
No abstract available
Manufacturing; Simulators

20030093591 Christian Brothers Univ., Memphis, TN, USA
Comparative Study of Two Kinematics and Dynamics Analysis Tools for Multi-body Systems
Shiue, Yeu-Sheng Paul; The 2002 NASA Faculty Fellowship Program Research Reports; April 2003; 1 pp.; In English; See also 20030093576
Contract(s)/Grant(s): NAG8-1859; No Copyright; Avail: CASI; C01, CD-ROM; A01, Hardcopy
No abstract available
Dynamic Characteristics; Body Kinematics

20030093597 Florida Univ., Gainesville, FL, USA
Subsurface Stress Fields in Single Crystal (Anisotropic) Contacts
Arakere, Nagaraj K.; The 2002 NASA Faculty Fellowship Program Research Reports; April 2003, pp. IV-1 - IV-5; In English; See also 20030093576; Original contains color illustrations
Contract(s)/Grant(s): NAG8-1859; No Copyright; Avail: CASI; C01, CD-ROM; A01, Hardcopy
Single crystal superalloy turbine blades used in high pressure turbomachinery are subject to conditions of high temperature, triaxial steady and fatigue stresses, fretting stresses in the blade attachment and damper contact locations, and exposure to high-pressure hydrogen. The blades are also subjected to extreme variations in temperature during start-up and shutdown transients. The most prevalent HCF failure modes observed in these blades during operation include crystallographic crack initiation/propagation on octahedral planes, and noncrystallographic initiation with crystallographic growth. Numerous cases of crack initiation and crack propagation at the blade leading edge tip, blade attachment regions, and damper contact locations have been documented. Understanding crack initiation/propagation under mixed-mode loading conditions is critical for establishing a systematic procedure for evaluating HCF life of single crystal turbine blades. Techniques for evaluating two and three dimensional subsurface stress fields in anisotropic contacts are presented in this report. Figure 1 shows typical damper contact locations in a turbine blade. The subsurface stress results are used for evaluating contact fatigue life at damper contacts and dovetail attachment regions in single crystal nickel-base superalloy turbine blades. Author
Blade Tips; Crack Initiation; Crack Propagation; Crystallography; Stress Distribution; Turbine Blades

20030093601 Southern Univ., Baton Rouge, LA, USA
Investigation of Friction Stir Welding of Al Metal Matrix Composite Materials
Diwan, Ravinder M.; The 2002 NASA Faculty Fellowship Program Research Reports; April 2003, pp. XIV-1 - XIV-5; In English; See also 20030093576
Contract(s)/Grant(s): NAG8-1859; No Copyright; Avail: CASI; C01, CD-ROM; A01, Hardcopy
The innovative process of Friction Stir Welding (FSW) has generated tremendous interest since its inception about a decade or so ago since the first patent in 1991 by TWI of Cambridge, England. This interest has been seen in many recent international conferences and publications on the subject and relevant published literature. Still the process needs both intensive basic study of deformation mechanisms during this FSW process and analysis and feasibility study to evaluate production methods that will yield high quality strong welds from the stirring action of the appropriate pin tool into the weld plate materials. Development of production processes is a complex task that involves effects of material thickness, materials weldability, pin tool design, pin height, and pin shoulder diameter and related control conditions. The frictional heating with rotational speeds of the pin tool as it plunges into the material and the ensuing plastic flow arising during the traverse of the welding faying surfaces provide the known special advantages of the FSW process in the area of this new advanced joining technology.
Derived from text
Friction Stir Welding; Production Engineering; Weldability; Thickness; Feasibility

20030093619 Auburn Univ., AL, USA

Metal Cutting Theory and Friction Stir Welding Tool Design

Payton, Lewis N.; The 2002 NASA Faculty Fellowship Program Research Reports; April 2003, pp. XXXIV-1 - XXXIV-5; In English; See also 20030093576; Original contains color and black and white illustrations

Contract(s)/Grant(s): NAG8-1859; No Copyright; Avail: CASI; C01, CD-ROM; A01, Hardcopy

Friction Stir Welding (FSW) is a relatively new industrial process that was invented at The Weld Institute (TWI, UK) and patented in 1992 under research funded by in part by the National Aeronautics and Space Administration (NASA). Often quoted advantages of the process include good strength and ductility along with minimization of residual stress and distortion. Less well advertised are the beneficial effects of this solid state welding process in the field of occupational and environmental safety. It produces superior weld products in difficult to weld materials without producing any toxic fumes or solid waste that must be controlled as hazardous waste. In fact, it reduces noise pollution in the workspace as well. In the early days of FSW, most welding was performed on modified machine tools, in particular on milling machines with modified milling cutters. In spite of the obvious milling heritage of the process, the techniques and lessons learned from almost 250 years of successful metalworking with milling machines have not been applied in the field of modern Friction Stir Welding. The goal of the current research was to study currently successful FSW tools and parameterize the process in such a way that the design of new tools for new materials could be accelerated. Along the way, several successful new tooling designs were developed for current issues at the Marshall Space Flight Center with accompanying patent disclosures

Derived from text

Friction Stir Welding; Milling (Machining); Metal Cutting; Metal Working

20030093743 NASA Goddard Space Flight Center, Greenbelt, MD, USA

A Compact, Continuous Adiabatic Demagnetization Refrigerator with High Heat Sink Temperature

Shirron, P. J.; Canavan, E. R.; DiPirro, M. J.; Jackson, M.; Tuttle, J. G.; [2003]; 5 pp.; In English; 10th International Low-Temperature Detector Workshop, 7-11 Jul. 2003, Genoa, Italy; No Copyright; Avail: CASI; A01, Hardcopy

In the continuous adiabatic demagnetization refrigerator (ADR), the existence of a constant temperature stage attached to the load breaks the link between the requirements of the load (usually a detector array) and the operation of the ADR. This allows the ADR to be cycled much faster, which yields more than an order of magnitude improvement in cooling power density over single-shot ADRs. Recent effort has focused on developing compact, efficient higher temperature stages. An important part of this work has been the development of passive gas-gap heat switches that transition (from conductive to insulating) at temperatures around 1 K and 4 K without the use of an actively heated getter. We have found that by carefully adjusting available surface area and the number of He-3 monolayers, gas-gap switches can be made to operate passively. Passive operation greatly reduces switching time and eliminates an important parasitic heat load. The current four stage ADR provides 6 micro W of cooling at 50 mK (21 micro W at 100 mK) and weighs less than 8 kg. It operates from a 4.2 K heat sink, which can be provided by an unpumped He bath or many commercially available mechanical cryocoolers. Reduction in critical current with temperature in our fourth stage NbTi magnet presently limits the maximum temperature of our system to approx. 5 K. We are developing compact, low-current Nb3Sn magnets that will raise the maximum heat sink temperature to over 10 K.

Author

Adiabatic Conditions; Demagnetization; Refrigerators; High Temperature; Critical Current

20030097966 Profile Composites, Inc., Sidney, British Columbia, Canada

Design and Certification of a Vacuum-Assisted Resin Transfer Moulded Composite Seaplane Float

Wood, Geoff; Petrescue, Laura; Johnston, Andrew; Low Cost Composite Structures and Cost Effective Application of Titanium Alloys in Military Platforms; March 2003, pp. 4-1 - 4-10; In English; See also 20030097962; Original contains color illustrations; Copyright; Avail: CASI; C01, CD-ROM; A02, Hardcopy

Vacuum assisted resin transfer moulding (VARTM) has been used for many years in the marine and transportation industries. More recently it has become an accepted process for the production of aircraft components. It is currently possible to produce high quality, low cost aircraft parts by carefully designing the VARTM process. Features incorporated into the design of the component can enhance the effectiveness of VARTM and make it a very cost effective method for producing large scale, complex parts. The criteria for designing the part and process include certification standards as defined by the Federal Aviation Administration (FAA). These standards were used in the design and evaluation of a composite aircraft float targetted at the deHavilland Beaver aircraft market and fabricated using VARTM. Profile Composites developed the float for Seaflight Industries with the assistance of the NRC s Industrial Research and Assistance Program (IRAP) and Institute for Aerospace Research (IAR). One factor affecting the final quality of the part was the inability of the room temperature cured

infusion resin system used to withstand the hot, wet conditioning tests required for aircraft certification. However, the VARTM process specifications and the design features of the part are applicable to a wide range of aircraft and high performance marine structures.
Author
Composite Materials; Aircraft Parts; Resin Transfer Molding

20030097979 European Aeronautic Defence and Space Co., Munich, Germany
Cold Forming of Beta Titanium Sheet
Lang, Roland; Hofmann, Klaus; Gese, Helmut; Low Cost Composite Structures and Cost Effective Application of Titanium Alloys in Military Platforms; March 2003, pp. 7-1 - 7-8; In English; See also 20030097962; Original contains color illustrations; Copyright; Avail: CASI; C01, CD-ROM; A02, Hardcopy

For cost efficient cold forming of high strength titanium sheet the beta alloy Ti15-3-3-3 was selected. The development was driven by FEM simulation for the deep drawing process. In a first step, a simulation tool was selected and adapted to the specific properties of the alloy. The required material properties for the simulation were determined and the test methods are described. Test parts with simple geometries were manufactured to derive failure criteria and to improve the quality of simulation. With this experience we selected an aircraft component which was slightly modified for this project. Simulation was used for example to design the die, to predict process parameters and finally, to calculate the deviations from the nominal shape caused by distortion and spring-back. The component was successfully deep drawn according to the predictions, heat treated and cut to final shape. The simulation has increased overall efficiency for the development of such parts. The manufacturing process leads to cost efficient high quality parts suitable for aerospace applications.
Author
Cold Working; Titanium; Metal Sheets; Manufacturing

20030097984 European Aeronautic Defence and Space Co., Munich, Germany
Increasing Productivity in Composite Manufacturing
Bauer, J.; Low Cost Composite Structures and Cost Effective Application of Titanium Alloys in Military Platforms; March 2003, pp. 6-1 - 6-11; In English; See also 20030097962; Original contains color illustrations; Copyright; Avail: CASI; C01, CD-ROM; A03, Hardcopy

The manufacturing effort of the integrally stiffened fuselage skin of the Eurofighter is dominated by the internal substructure. Focussing on this kind of structural parts a new technological approach was developed governed by the aim to reduce the manufacturing costs considerably. The approach is based on textile preforms in combination with resin infiltration techniques. New textile materials have been investigated and techniques were developped to create textile preforms. An innovative approach, called VAP (Vacuum Assisted Process), is currently in development suitable for the out-of-autoclave processing and applicable for the manufacturing of aircraft structural parts.
Author
Aircraft Structures; Composite Materials; Carbon Fibers; Resin Transfer Molding

20030097985 Stabilimento Agust, Anagmi, Italy
Manufacture of an Helicopter Structure with Resin Transfer Moulding
Anamateros, E.; Leone, A.; Severoni, R.; Cioeta, M.; Marchetti, M.; Low Cost Composite Structures and Cost Effective Application of Titanium Alloys in Military Platforms; March 2003, pp. 7-1 - 7-12; In English; See also 20030097962; Original contains color illustrations; Copyright; Avail: CASI; C01, CD-ROM; A03, Hardcopy

Based on the engineering requirements, the strength-stiffness behaviour of a secondary structure component was analysed with F.E.M. technique, behind this, the manufacture of an item with Resin Injection under Flexible Tool technique was designed and completed. RIFT is a variant of Resin Transfer Moulding (RTM) and it is considered a low cost technique to produce components like the chosen, notwithstanding the needs of a complete validation of all the manufacturing phase. The obtained components were fully analysed both non-destructive and destructive tests.
Author
Resin Transfer Molding; Optimization

20030097991 NASA Langley Research Center, Hampton, VA, USA

Composite Structures and Materials Research at NASA Langley Research Center

Starnes, James H., Jr.; Dexter, H. Benson; Johnston, Norman J.; Ambur, Damodar R.; Cano, roberto J.; Low Cost Composite Structures and Cost Effective Application of Titanium Alloys in Military Platforms; March 2003, pp. 17-1 - 17-11; In English; See also 20030097962; Original contains color and black and white illustrations; Copyright; Avail: CASI; C01, CD-ROM; A03, Hardcopy

A summary of recent composite structures and materials research at NASA Langley Research Center is presented. Fabrication research to develop low-cost automated robotic fabrication procedures for thermosetting and thermoplastic composite materials, and low-cost liquid molding processes for preformed textile materials is described. Robotic fabrication procedures discussed include ply-by-ply, cure-on-the-fly heated placement head and out-of-autoclave electron-beam cure methods for tow and tape thermosetting and thermoplastic materials. Liquid molding fabrication processes described include Resin Film Infusion (RFI), Resin Transfer Molding (RTM) and Vacuum-Assisted Resin Transfer Molding (VARTM). Results for a full-scale composite wing box are summarized to identify the performance of materials and structures fabricated with these low-cost fabrication methods.

Author

Resin Transfer Molding; Thermoplastic Resins; Thermosetting Resins; Composite Structures; Resin Film Infusion

20030097992 Katholieke Univ. te Leuven, Belgium

Study of the Deepdrawing Process of Technical Textile Reinforced Thermoplastics

Bogaerts, L.; Lossie, M.; Vandepitte, D.; Low Cost Composite Structures and Cost Effective Application of Titanium Alloys in Military Platforms; March 2003, pp. 18-1 - 18-8; In English; See also 20030097962; Original contains color illustrations; Copyright; Avail: CASI; C01, CD-ROM; A02, Hardcopy

Technical textile reinforced thermoplastics have recently emerged as promising engineering materials for shell-like structures. They combine the load bearing capacity of technical textiles with the damage tolerance and thermoformability of thermoplastic matrices. Thermoforming processes like matched-metal die forming, rubber stamping and diaphragm forming are typical production processes to form 3D shell structures. This research focuses on deepdrawing as an alternative to thermoforming. It is a feasibility study of the deepdrawing process for Twintex woven fabrics. During deepdrawing, undesired wrinkling can occur. To investigate the mechanism of wrinkle formation, an experimental process parameter study has been run. Throughout the experimentation, visual inspection is used as quality evaluator for the deepdrawn cups. Wrinkle formation during fabric shear has shown to be strongly dependent on drawing velocity, temperature of the sheet and blankholder forces. Maintained product quality up to a high deepdrawing velocity (200 300 mm/s) opens perspectives with respect to short cycle times

Author

Thermoplastic Resins; Woven Composites; Glass Fiber Reinforced Plastics; Forming Techniques

20030097993 European Aeronautic Defence and Space Co., Munich, Germany

Advanced Textile Technologies for the Cost Effective Manufacturing of High Performance Composites

Brandt, Juergen; Drechsler, Klaus; Filsinger, Juergen; Low Cost Composite Structures and Cost Effective Application of Titanium Alloys in Military Platforms; March 2003, pp. 20-1 - 20-7; In English; See also 20030097962; Original contains black and white illustrations; Copyright; Avail: CASI; C01, CD-ROM; A02, Hardcopy

For some decades the aerospace industry has applied composite materials, in particular CFRP, because of their high weight-specific stiffness and strength as well as their excellent fatigue performance. However, the time-consuming and therefore expensive manufacturing process prevented these materials from wide spread use in other industrial sectors. In recent years techniques were developed for processing advanced textile preforms offering both a potential for reducing manufacturing costs and for improving the damage tolerance of these materials compared to conventional prepreg technology. Processes such as 2D and 3D weaving, 2D and 3D braiding, warp-knitting, tailored fibre placement and stitching, for instance, allow the production of integral preforms which help to reduce the manual work and hence the processing time. This paper will give a general overview of major research activities and development trends in textile preforming with focus to new stitching technologies. An evaluation of these techniques for various application fields and some results of preform development activities will be presented.

Author

Textiles; Woven Composites

20030097994 Dayton Univ. Research Inst., OH, USA

Simulation Based Low-Cost Composite Process Development at the US Air Force Research Laboratory

Rice, Brian P.; Lee, C. William; Curliss, David B.; Low Cost Composite Structures and Cost Effective Application of Titanium Alloys in Military Platforms; March 2003, pp. 22-1 - 22-13; In English; See also 20030097962; Original contains color illustrations

Contract(s)/Grant(s): F33615-95-D-5029; NCCW-0076; Copyright; Avail: CASI; C01, CD-ROM; A03, Hardcopy

Low-cost composite research in the US Air Force Research Laboratory, Materials and Manufacturing Directorate, Organic Matrix Composites Branch has focused on the theme of affordable performance. Practically, this means that we use a very broad view when considering the affordability of composites. Factors such as material costs, labor costs, recurring and nonrecurring manufacturing costs are balanced against performance to arrive at the relative affordability vs. performance measure of merit. The research efforts discussed here are two projects focused on affordable processing of composites. The first topic is the use of a neural network scheme to model cure reaction kinetics, then utilize the kinetics coupled with simple heat transport models to predict, in real-time, future exotherms and control them. The neural network scheme is demonstrated to be very robust and a much more efficient method that mechanistic cure modeling approach. This enables very practical low-cost processing of thick composite parts. The second project is liquid composite molding (LCM) process simulation. LCM processing of large 3D integrated composite parts has been demonstrated to be a very cost effective way to produce large integrated aerospace components specific examples of LCM processes are resin transfer molding (RTM), vacuum assisted resin transfer molding (VARTM), and other similar approaches. LCM process simulation is a critical part of developing an LCM process approach. Flow simulation enables the development of the most robust approach to introducing resin into complex preforms. Furthermore, LCM simulation can be used in conjunction with flow front sensors to control the LCM process in real-time to account for preform or resin variability.

Author

Resin Transfer Molding; Composite Materials

20030097995 European Aeronautic Defence and Space Co., Suresnes, France

Thermoplastic Tape Placement and Continuous Consolidation

Lang, Didier; Barre, Sylvie; Coiffier-Colas, Carole; Sibois, Helene; Low Cost Composite Structures and Cost Effective Application of Titanium Alloys in Military Platforms; March 2003, pp. 23-1 - 23-5; In English; See also 20030097962; Original contains color illustrations; Copyright; Avail: CASI; C01, CD-ROM; A01, Hardcopy

Tomorrow s aircraft parts (such as fuselage) will have to meet increasingly optimized performance requirements and cost reduction objectives. The use of composite materials associated with the development of new industrial scenarios should enable both these objectives to be achieved. For the last three years, a thermoplastic composite process called in-situ consolidation has been under evaluation within the framework of a research project associating EADS, EUROCOPTER and DASSAULT AVIATION. This process consists in continuously laying up and consolidating the skins and assembling the previously made sub-structure to them by thermoplastic diffusion welding. Due to the promising results obtained, the 3 partners decided in 1999 to buy a thermoplastic prepreg with carbon fiber placement machine built at Automated Dynamics (USA) under partners specifications. This paper describes features of the machine available in the consortium and the latest works performed in order to improve the process.

Author

Peek; Carbon Fiber Reinforced Plastics

20030098003

Fatigue Evaluation of Titanium Investment Casting

Ciprandi, M.; Turri, A.; Low Cost Composite Structures and Cost Effective Application of Titanium Alloys in Military Platforms; March 2003, pp. 4-1 - 4-13; In English; See also 20030097962; Original contains color illustrations; Copyright; Avail: CASI; C01, CD-ROM; A03, Hardcopy

The present study takes into account some technological aspects related to the titanium investment casting process: for example more than one foundry was tested, the specimens were cast in more batches, the surfaces were pickled in the same way as actual parts, the shape of specimens was studied to include the typical feature of real castings, welding repairs were also evaluated and finally full size components were tested. All the investment casting specimens were tested to determine the fatigue behaviour of titanium alloy Ti6Al4V annealed. The obtained fatigue data are reported and compared with similar data related to specimens cut from forging. In spite of the intrinsic better fatigue resistance of the forging, which was observed also in this case, it was possible to demonstrate that, because of the local stress concentration areas found on the real parts, the performances of investment castings is almost equivalent to an average quality annealed forging. A comparison of final costs

including machining could make this technology interesting also for non-aerospace applications.
Author
Aluminum Alloys; Titanium Alloys; Vanadium Alloys; Investment Casting; Forging

20030099683 Sanders Design International, Wilton, NH, USA
Prompt and Precise Prototyping
Spinoff 2003: 100 Years of Powered Flight; 2003, pp. 82-83; In English; See also 20030099639; Original contains color illustrations; No Copyright; Avail: National Technology Transfer Center (NTTC), Wheeling, WV

For Sanders Design International, Inc., of Wilton, New Hampshire, every passing second between the concept and realization of a product is essential to succeed in the rapid prototyping industry where amongst heavy competition, faster time-to-market means more business. To separate itself from its rivals, Sanders Design aligned with NASA's Marshall Space Flight Center to develop what it considers to be the most accurate rapid prototyping machine for fabrication of extremely precise tooling prototypes. The company's Rapid ToolMaker System has revolutionized production of high quality, small-to-medium sized prototype patterns and tooling molds with an exactness that surpasses that of computer numerically-controlled (CNC) machining devices. Created with funding and support from Marshall under a Small Business Innovation Research (SBIR) contract, the Rapid ToolMaker is a dual-use technology with applications in both commercial and military aerospace fields. The advanced technology provides cost savings in the design and manufacturing of automotive, electronic, and medical parts, as well as in other areas of consumer interest, such as jewelry and toys. For aerospace applications, the Rapid ToolMaker enables fabrication of high-quality turbine and compressor blades for jet engines on unmanned air vehicles, aircraft, and missiles.
Derived from text
Aerospace Engineering; Fabrication; Rapid Prototyping; Numerical Control; Mechanical Devices

20030105596 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Practical Design and Use of Drill Template Jigs in Spacecraft Manufacturing
Robinson, David W.; [2003]; 8 pp.; In English; ASME International Mechanical Engineering Congress and Exposition, 15-21 Nov. 2003, Washington, DC, USA
Report No.(s): IMECE2003-41125; Copyright; Avail: CASI; A02, Hardcopy

Drill templates are used frequently in the fabrication and assembly of scientific spacecraft at NASA Goddard Space Flight Center. They are used to provide precision location of a hole pattern for mating parts and assemblies, from small parts to multi-million dollar space telescopes. Typically these interfaces are one of a kind and crucial to the success of the space mission. Although proper geometric dimensioning and tolerancing for CNC machining can often be relied upon, there are many situations where either it is too difficult to achieve the required tolerances, too difficult to inspect, or too uncertain. Once the decision is made to use a drill template at a critical interface, there are several key design considerations including how to hold the piece to be drilled, how to properly and repeatably align the template to the part, and how to step through the drilling process. In addition to these considerations, there are a remarkable number of tips and techniques used by the people on the shop floor to make the process work well. This paper includes many of these tips gathered from technicians and engineers from around NASA Goddard.
Author
Drilling; Design Analysis; Templates; Machine Tools; Jigs

38
QUALITY ASSURANCE AND RELIABILITY

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

20030093551 NASA Glenn Research Center, Cleveland, OH, USA
Microstructural and Defect Characterization in Ceramic Composites Using an Ultrasonic Guided Wave Scan System
Roth, D. J.; Cosgriff, L. M.; Martin, R. E.; Verrilli, M. J.; Bhatt, R. T.; September 2003; 14 pp.; In English; 30th Annual Review of Quantitative Nondestructive Evaluation, 27 Jul. - 1 Aug. 2003, Green Bay, WI, USA
Contract(s)/Grant(s): WBS 22-714-04-17
Report No.(s): NASA/TM-2003-212518; E-14080; NAS 1.15:212518; No Copyright; Avail: CASI; A03, Hardcopy

In this study, an ultrasonic guided wave scan system was used to characterize various microstructural and flaw conditions in two types of ceramic matrix composites, SiC/SiC and C/SiC. Rather than attempting to isolate specific lamb wave modes

to use for characterization (as is desired for many types of guided wave inspection problems), the guided wave scan system utilizes the total (multi-mode) ultrasonic response in its inspection analysis. Several time and frequency-domain parameters are calculated from the ultrasonic guided wave signal at each scan location to form images. Microstructural and defect conditions examined include delamination, density variation, cracking, and pre/ post-infiltration. Results are compared with thermographic imaging methods. Although the guided wave technique is commonly used so scanning can be eliminated, applying the technique in the scanning mode allows a more precise characterization of defect conditions.
Author
Microstructure; Ceramic Matrix Composites; Defects; Ultrasonic Scanners; Nondestructive Tests

39
STRUCTURAL MECHANICS

Includes structural element design, analysis and testing; dynamic responses of structures; weight analysis; fatigue and other structural properties; and mechanical and thermal stresses in structures. For applications see *05 Aircraft Design, Testing and Performance*; and *18 Spacecraft Design, Testing and Performance*.

20030093532 NASA Glenn Research Center, Cleveland, OH, USA
Determination of Rolling-Element Fatigue Life From Computer Generated Bearing Tests
Vlcek, Brian L.; Hendricks, Robert C.; Zaretsky, Erwin V.; August 2003; 28 pp.; In English; 2003 Annual Meeting and Exhibition, 28 Apr. - 1 May 2003, New York City, NY, USA
Contract(s)/Grant(s): WBS 22-323-71-00
Report No.(s): NASA/TM-2003-212186; E-13789; NAS 1.15:212186; No Copyright; Avail: CASI; A03, Hardcopy

Two types of rolling-element bearings representing radial loaded and thrust loaded bearings were used for this study. Three hundred forty (340) virtual bearing sets totaling 31400 bearings were randomly assembled and tested by Monte Carlo (random) number generation. The Monte Carlo results were compared with endurance data from 51 bearing sets comprising 5321 bearings. A simple algebraic relation was established for the upper and lower L(sub 10) life limits as function of number of bearings failed for any bearing geometry. There is a fifty percent (50 percent) probability that the resultant bearing life will be less than that calculated. The maximum and minimum variation between the bearing resultant life and the calculated life correlate with the 90-percent confidence limits for a Weibull slope of 1.5. The calculated lives for bearings using a load-life exponent p of 4 for ball bearings and 5 for roller bearings correlated with the Monte Carlo generated bearing lives and the bearing data. STLE life factors for bearing steel and processing provide a reasonable accounting for differences between bearing life data and calculated life. Variations in Weibull slope from the Monte Carlo testing and bearing data correlated. There was excellent agreement between percent of individual components failed from Monte Carlo simulation and that predicted.
Author
Ball Bearings; Roller Bearings; Monte Carlo Method; Thrust Bearings; Fatigue Life; Fatigue Tests; Simulation

20030093554 Akron Univ., Akron, OH, USA
FLAPS (Fatigue Life Analysis Programs): Computer Programs to Predict Cyclic Life Using the Total Strain Version of Strainrange Partitioning and Other Life Prediction Methods
Arya, Vinod K.; Halford, Gary R., Technical Monitor; August 2003; 85 pp.; In English
Contract(s)/Grant(s): NCC3-768
Report No.(s): NASA/CR-2003-212530; E-14092; NAS 1.26:212530; No Copyright; Avail: CASI; A05, Hardcopy

This manual presents computer programs FLAPS for characterizing and predicting fatigue and creep-fatigue resistance of metallic materials in the high-temperature, long-life regime for isothermal and nonisothermal fatigue. The programs use the Total Strain version of Strainrange Partitioning (TS-SRP), and several other life prediction methods described in this manual. The user should be thoroughly familiar with the TS-SRP and these life prediction methods before attempting to use any of these programs. Improper understanding can lead to incorrect use of the method and erroneous life predictions. An extensive database has also been developed in a parallel effort. The database is probably the largest source of high-temperature, creep-fatigue test data available in the public domain and can be used with other life-prediction methods as well. This users' manual, software, and database are all in the public domain and can be obtained by contacting the author. The Compact Disk (CD) accompanying this manual contains an executable file for the FLAPS program, two datasets required for the example

problems in the manual, and the creep-fatigue data in a format compatible with these programs.
Author
Fatigue Life; User Manuals (Computer Programs); Strain Measurement; Creep Analysis; Mechanical Properties; Metal Fatigue

20030093579 Lipscomb Univ., Nashville, TN, USA
Investigation of Methods for Supporting Tall, Slender Structures for Free-Free Modal Testing
Gwinn, A. Fort, Jr.; The 2002 NASA Faculty Fellowship Program Research Reports; April 2003; 1 pp.; In English; See also 20030093576
Contract(s)/Grant(s): NAG8-1859; No Copyright; Avail: CASI; C01, CD-ROM; A01, Hardcopy
No abstract available
Structural Members; Structural Engineering; Modal Response

20030093588 Mississippi State Univ., MS, USA
Fatigue and Fracture Analyses of Cracks in Ductile Materials
Newman, James C., Jr.; The 2002 NASA Faculty Fellowship Program Research Reports; April 2003; 2 pp.; In English; See also 20030093576
Contract(s)/Grant(s): NAG8-1859; No Copyright; Avail: CASI; C01, CD-ROM; A01, Hardcopy
No abstract available
Cracks; Fatigue (Materials); Fractures (Materials)

20030093622 Mississippi State Univ., MS, USA
Thermo-Mechanical Processing in Friction Stir Welds
Schneider, Judy; The 2002 NASA Faculty Fellowship Program Research Reports; April 2003, pp. XLI-1 - XLI-6; In English; See also 20030093576
Contract(s)/Grant(s): NAG8-1859; No Copyright; Avail: CASI; C01, CD-ROM; A02, Hardcopy
Friction stir welding is a solid-phase joining, or welding process that was invented in 1991 at The Welding Institute (TWI). The process is potentially capable of joining a wide variety of aluminum alloys that are traditionally difficult to fusion weld. The friction stir welding (FSW) process produces welds by moving a non-consumable rotating pin tool along a seam between work pieces that are firmly clamped to an anvil. At the start of the process, the rotating pin is plunged into the material to a pre-determined load. The required heat is produced by a combination of frictional and deformation heating. The shape of the tool shoulder and supporting anvil promotes a high hydrostatic pressure along the joint line as the tool shears and literally stirs the metal together. To produce a defect free weld, process variables (RPM, transverse speed, and downward force) and tool pin design must be chosen carefully. An accurate model of the material flow during the process is necessary to guide process variable selection. At MSFC a plastic slip line model of the process has been synthesized based on macroscopic images of the resulting weld material. Although this model appears to have captured the main features of the process, material specific interactions are not understood. The objective of the present research was to develop a basic understanding of the evolution of the microstructure to be able to relate it to the deformation process variables of strain, strain rate, and temperature.
Author
Friction Stir Welding; Solid Phases; Thermodynamics; Mechanical Properties; Microstructure

20030097986 Patras Univ., Greece
A Heavy Duty Composite Bridge Made of Glass/Polyester Pultruded Box Beams
Kostropoulos, V.; Markopoulos, Y. P.; Vlachos, D. E.; Galiotis, C.; Melanitis, N. E.; Low Cost Composite Structures and Cost Effective Application of Titanium Alloys in Military Platforms; March 2003, pp. 9-1 - 9-12; In English; See also 20030097962; Original contains color illustrations
Contract(s)/Grant(s): GSRT-97EKVAN2-43; Copyright; Avail: CASI; C01, CD-ROM; A03, Hardcopy
The present work deals with the design and construction of a vehicle bridge made of glass reinforced polyester pultruded box beams. The bridge is of 12 m span and 4m width and represents a single strip-loading lane. The load bearing capacity of the bridge is 300 kN and an overall design factor of 3 has been used. The composite bridge is consisted by a 3-D truss structure made of two layer one-shot, thick wall FRP longitudinal box elements of hollow square cross section, which are bridged together with box-beams of the same geometry. A continuous monitoring of the structural integrity of the composite

bridge has been scheduled by using vibration analysis techniques and periodic Acoustic Emission monitoring. The total weight of the composite bridge does not exceed the 135 kN while its expected service life is 50 years.
Author
Box Beams; Bridges (Structures); Glass Fiber Reinforced Plastics; Polyesters; Pultrusion; Manufacturing

42
GEOSCIENCES (GENERAL)

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

20030105646 Massachusetts Inst. of Tech., Cambridge, MA, USA
Sulfur Saturation Limits in Silicate Melts and their Implications for Core Formation Scenarios for Terrestrial Planets
Holzheid, Astrid; Grove, Timothy L.; American Mineralogist; January 2003; ISSN 0003-004X; Volume 87, pp. 227-237; In English
Contract(s)/Grant(s): NAG5-4768; Copyright; Avail: Other Sources

This study explores the controls of temperature, pressure, and silicate melt composition on S solubility in silicate liquids. The solubility of S in FeO-containing silicate melts in equilibrium with metal sulfide increases significantly with increasing temperature but decreases with increasing pressure. The silicate melt structure also exercises a control on S solubility. Increasing the degree of polymerization of the silicate melt structure lowers the S solubility in the silicate liquid. The new set of experimental data is used to expand the model of Mavrogenes and O Neill (1999) for S solubility in silicate liquids by incorporating the influence of the silicate melt structure. The expected S solubility in the ascending magma is calculated using the expanded model. Because the negative pressure dependence of S solubility is more influential than the positive temperature dependence, decompression and adiabatic ascent of a formerly S-saturated silicate magma will lead to S undersaturation. A primitive magma that is S-saturated in its source region will, therefore, become S-undersaturated as it ascends to shallower depth. In order to precipitate magmatic sulfides, the magma must first cool and undergo fractional crystallization to reach S saturation. The S content in a metallic liquid that is in equilibrium with a magma ocean that contains -200 ppm S (Le., Earth s bulk mantle S content) ranges from 5.5 to 12 wt% S. This range of S values encompasses the amount of S (9 to 12 wt%) that would be present in the outer core if S is the light element. Thus, the Earth s proto-mantle could be in equilibrium (in terms of the preserved S abundance) with a core-forming metallic phase.
Author
Silicates; Terrestrial Planets; Sulfur; Solubility

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*.

20030093574 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Evidence for Three-Dimensional Radiative Effects in MODIS Cloud Optical Depths Retrieved at Back Scattering View Angles
Varnai, Tamas; Marshak, Alexander; [2003]; 25 pp.; In English; Original contains black and white illustrations; No Copyright; Avail: CASI; A03, Hardcopy

This study addresses the question whether 1D radiative transfer theory describes well the angular distribution of shortwave cloud reflection. The statistical analysis of a large set of MODIS observations indicates that in oblique backward scattering directions, cloud reflection is stronger than 1D theory would predict. After considering a variety of possible causes, the paper concludes that the most likely reason for the increase lies in 3D radiative interactions. The results' main implication is that cloud optical depths retrieved at back scattering view angles larger than about 50 degrees tend to be overestimated and should be used only with great caution.
Author
Backscattering; Optical Thickness; Modis (Radiometry); Three Dimensional Models; Clouds (Meteorology); Remote Sensing; Radiative Transfer

20030093575 NASA Goddard Space Flight Center, Greenbelt, MD, USA

A Fast Implementation of the ISOCLUS Algorithm

Memarsadeghi, Nargess; Mount, David M.; Netanyahu, Nathan S.; LeMoigne, Jacqueline; [2003]; 3 pp.; In English; IEEE 2003 International Geoscience and Remote Sensing Symposium, 21-25 Jul. 2003, Toulouse, France; No Copyright; Avail: CASI; A01, Hardcopy

Unsupervised clustering is a fundamental tool in numerous image processing and remote sensing applications. For example, unsupervised clustering is often used to obtain vegetation maps of an area of interest. This approach is useful when reliable training data are either scarce or expensive, and when relatively little a priori information about the data is available. Unsupervised clustering methods play a significant role in the pursuit of unsupervised classification. One of the most popular and widely used clustering schemes for remote sensing applications is the ISOCLUS algorithm, which is based on the ISODATA method. The algorithm is given a set of n data points (or samples) in d-dimensional space, an integer k indicating the initial number of clusters, and a number of additional parameters. The general goal is to compute a set of cluster centers in d-space. Although there is no specific optimization criterion, the algorithm is similar in spirit to the well known k-means clustering method in which the objective is to minimize the average squared distance of each point to its nearest center, called the average distortion. One significant feature of ISOCLUS over k-means is that clusters may be merged or split, and so the final number of clusters may be different from the number k supplied as part of the input. This algorithm will be described in later in this paper. The ISOCLUS algorithm can run very slowly, particularly on large data sets. Given its wide use in remote sensing, its efficient computation is an important goal. We have developed a fast implementation of the ISOCLUS algorithm. Our improvement is based on a recent acceleration to the k-means algorithm, the filtering algorithm, by Kanungo et al.. They showed that, by storing the data in a kd-tree, it was possible to significantly reduce the running time of k-means. We have adapted this method for the ISOCLUS algorithm. For technical reasons, which are explained later, it is necessary to make a minor modification to the ISOCLUS specification. We provide empirical evidence, on both synthetic and Landsat image data sets, that our algorithm's performance is essentially the same as that of ISOCLUS, but with significantly lower running times. We show that our algorithm runs from 3 to 30 times faster than a straightforward implementation of ISOCLUS. Our adaptation of the filtering algorithm involves the efficient computation of a number of cluster statistics that are needed for ISOCLUS, but not for k-means.

Author

Image Processing; Algorithms; Cluster Analysis; Remote Sensing

20030093587 Alabama Agricultural and Mechanical Univ., Normal, AL, USA

The Land Use and Land Cover Dichotomy: A Comparison of Two Land Classification Systems in Support of Urban Earth Science Applications

McAllister, William K.; The 2002 NASA Faculty Fellowship Program Research Reports; April 2003, pp. XXVII-1 - XXVII-5; In English; See also 20030093576

Contract(s)/Grant(s): NAG8-1859; No Copyright; Avail: CASI; C01, CD-ROM; A01, Hardcopy

One is likely to read the terms 'land use' and 'land cover' in the same sentence, yet these concepts have different origins and different applications. Land cover is typically analyzed by earth scientists working with remotely sensed images. Land use is typically studied by urban planners who must prescribe solutions that could prevent future problems. This apparent dichotomy has led to different classification systems for land-based data. The works of earth scientists and urban planning practitioners are beginning to come together in the field of spatial analysis and in their common use of new spatial analysis technology. In this context, the technology can stimulate a common 'language' that allows a broader sharing of ideas. The increasing amount of land use and land cover change challenges the various efforts to classify in ways that are efficient, effective, and agreeable to all groups of users. If land cover and land uses can be identified by remote methods using aerial photography and satellites, then these ways are more efficient than field surveys of the same area. New technology, such as high-resolution satellite sensors, and new methods, such as more refined algorithms for image interpretation, are providing refined data to better identify the actual cover and apparent use of land, thus effectiveness is improved. However, the closer together and the more vertical the land uses are, the more difficult the task of identification is, and the greater is the need to supplement remotely sensed data with field study (in situ). Thus, a number of land classification methods were developed in order to organize the greatly expanding volume of data on land characteristics in ways useful to different groups. This paper distinguishes two land based classification systems, one developed primarily for remotely sensed data, and the other, a more comprehensive system requiring in situ collection methods. The intent is to look at how the two systems developed and how they can work together so that land based information can be shared among different users and compared over time.

Author

Land Use; Classifications; Remote Sensing

20030093719 NASA Goddard Space Flight Center, Greenbelt, MD, USA

New Examination of the Raman Lidar Technique for Water Vapor and Aerosols, Paper 1, Evaluating the Temperature Dependent Lidar Equations

Whiteman, David N.; [2003]; 63 pp.; In English; No Copyright; Avail: CASI; A04, Hardcopy

The intent of this paper and its companion is to compile together the essential information required for the analysis of Raman lidar water vapor and aerosol data acquired using a single laser wavelength. In this first paper several details concerning the evaluation of the lidar equation when measuring Raman scattering are considered. These details include the influence of the temperature dependence of both pure rotational and vibrational-rotational Raman scattering on the lidar profile. These are evaluated for the first time using a new form of the lidar equation. The results indicate that, for the range of temperatures encountered in the troposphere, the magnitude of the temperature dependent effect can reach 10% or more for narrowband Raman water vapor measurements. Also the calculation of atmospheric transmission is examined carefully including the effects of depolarization. Different formulations of Rayleigh cross section determination commonly used in the lidar field are compared revealing differences up to 5% among the formulations. The influence of multiple scattering on the measurement of aerosol extinction using the Raman lidar technique is considered as are several photon pulse-pileup correction techniques.

Author

Optical Radar; Raman Spectra; Water Vapor; Aerosols

20030093739 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Earth Science Imagery Registration

LeMoigne, Jacqueline; Morisette, Jeffrey; Cole-Rhodes, Arlene; Johnson, Kisha; Netanyahu, Nathan S.; Eastman, Roger; Stone, Harold; Zavorin, Ilya; [2003]; 3 pp.; In English; IGARSS 2003, 21-25 Jul. 2003, Toulouse, France; Copyright; Avail: CASI; A01, Hardcopy

The study of global environmental changes involves the comparison, fusion, and integration of multiple types of remotely-sensed data at various temporal, radiometric, and spatial resolutions. Results of this integration may be utilized for global change analysis, as well as for the validation of new instruments or for new data analysis. Furthermore, future multiple satellite missions will include many different sensors carried on separate platforms, and the amount of remote sensing data to be combined is increasing tremendously. For all of these applications, the first required step is fast and automatic image registration, and as this need for automating registration techniques is being recognized, it becomes necessary to survey all the registration methods which may be applicable to Earth and space science problems and to evaluate their performances on a large variety of existing remote sensing data as well as on simulated data of soon-to-be-flown instruments. In this paper we present one of the first steps toward such an exhaustive quantitative evaluation. First, the different components of image registration algorithms are reviewed, and different choices for each of these components are described. Then, the results of the evaluation of the corresponding algorithms combining these components are presented o n several datasets. The algorithms are based on gray levels or wavelet features and compute rigid transformations (including scale, rotation, and shifts). Test datasets include synthetic data as well as data acquired over several EOS Land Validation Core Sites with the IKONOS and the Landsat-7 sensors.

Author

Earth Sciences; Image Processing; Remote Sensing; Algorithms; Multisensor Applications

20030093742 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Optical Reflectance and Fluorescence for Detecting Nitrogen Needs in Zea mays L.

McMurtrey, J. E.; Middleton, E. M.; Corp. L. A.; Campbell, P. K. Entcheva; Butcher, L. M.; Daughtry, C. S. T.; [2003]; 1 pp.; In English; IGARSS 2003 (International Geoscience and RemoteSensing Symposium), 21-25 Jul. 2003, Toulouse, France; No Copyright; Avail: CASI; A01, Hardcopy

Nitrogen (N) status in field grown corn (Zea mays L.) was assessed using spectral techniques. Passive reflectance remote sensing and, both passive and active fluorescence sensing methods were investigated. Reflectance and fluorescence methods are reported to detect changes in the primary plant pigments (chlorophylls a and b; carotenoids) in higher plant species. As a general rule, foliar chlorophyll a (Chl a) and chlorophyll b (Chl b) usually exist in approx.3:l ratio. In plants under stress, Chl b content is affected before Chl a reductions occur. For reflectance, a version of the chlorophyll absorption in reflectance index (CARI) method was tested with narrow bands from the Airborne Imaging Spectroradiometer for Applications (ASIA). CARI minimizes the effects of soil background on the signal from green canopies. A modified CARI (MCARI) was used to track total Chl a levels in the red dip of the spectrum from the corn canopy. A second MCARI was used to track the auxiliary plant pigments (Chl b and the carotenoids) in the yellow/orange/red edge part of the reflectance spectrum. The difference

between these two MCARI indices detected variations in N levels across the field plot canopies using ASIA data. At the leaf level, ratios of fluorescence emissions in the blue, green, red and far-red wavelengths sensed responses that were associated with the plant pigments, and were indicative of energy transfer in the photosynthetic process. N stressed corn stands could be distinguish from those with optimally applied N with fluorescence emission spectra obtained from individual corn leaves. Both reflectance and fluorescence methods are sensitive in detecting corn N needs and may be especially powerful in monitoring crop conditions if both types of information can be combined.
Author
Reflectance; Optical Reflection; Nitrogen; Chlorophylls

20030093752 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Experiences with Testing the Largest Ground System NASA Has Ever Built
Lehtonen, Ken; Messerly, Robert; May 15, 2003; 8 pp.; In English; Space Mission Challenger for Information Technology, 13-16 Jul. 2003, Pasadena, CA, USA; No Copyright; Avail: CASI; A02, Hardcopy

In the 1980s, the National Aeronautics and Space Administration (NASA) embarked upon a major Earth-focused program called Mission to Planet Earth. The Goddard Space Flight Center (GSFC) was selected to manage and develop a key component - the Earth Observing System (EOS). The EOS consisted of four major missions designed to monitor the Earth. The missions included 4 spacecraft. Terra (launched December 1999), Aqua (launched May 2002), ICESat (Ice, Cloud, and Land Elevation Satellite, launched January 2003), and Aura (scheduled for launch January 2004). The purpose of these missions was to provide support for NASA s long-term research effort for determining how human-induced and natural changes affect our global environment. The EOS Data and Information System (EOSDIS), a globally distributed, large-scale scientific system, was built to support EOS. Its primary function is to capture, collect, process, and distribute the most voluminous set of remotely sensed scientific data to date estimated to be 350 Gbytes per day. The EOSDIS is composed of a diverse set of elements with functional capabilities that require the implementation of a complex set of computers, high-speed networks, mission-unique equipment, and associated Information Technology (IT) software along with mission-specific software. All missions are constrained by schedule, budget, and staffing resources, and rigorous testing has been shown to be critical to the success of each mission. This paper addresses the challenges associated with the planning, test definition. resource scheduling, execution, and discrepancy reporting involved in the mission readiness testing of a ground system on the scale of EOSDIS. The size and complexity of the mission systems supporting the Aqua flight operations, for example, combined with the limited resources available, prompted the project to challenge the prevailing testing culture. The resulting success of the Aqua Mission Readiness Testing (MRT) program was due in no small measure to re-structuring the traditional programmatic and technical approach to a more efficient and robust program. Programmatically, it meant gaining the endorsement, commitment, and cooperation of the numerous subsystem element managers and other stakeholder organizations. Technically, it required an MRT program that was agile, could rapidly adapt to requirements changes, and was flexible in its overall approach. Furthermore, this paper addresses the following questions: 1. What are the key ingredients (e.g., test tools, organization) needed to conduct a successful MRT program? 2. What distinguishes EOS MRT from the traditional system testing approach? 3. Where should the focus of testing be since it is infeasible to test every element or subsystem? 4. How can MRT be applied effectively to other systems or missions? To provide answers to these questions, this paper relies heavily on real-life, hands-on experiences (‘lessons learned’) gained during mission readiness testing of the Terra ground system and, most recently, the Aqua and ICESat missions. Moreover, this paper explores how lessons learned were turned into lessons applied for the upcoming Aura mission. Although derived from the EOS missions, MRT techniques and strategies can be applied to enhance the testing of other missions.
Author
Eos Data And Information System; Ice, Cloud And Land Elevation Satellite; Mission To Planet Earth

20030095915 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Low-Power Radio-Frequency SiGe Analog-to-Digital Converter
Thompson, Willie L, II; Hall, Wesley G.; Piepmeier, Jeffrey R.; Johnson-Bey, Charles T.; May 02, 2003; 3 pp.; In English
Contract(s)/Grant(s): 258-70-20
Report No.(s): IGARSS2003-03.1309; Copyright; Avail: CASI; A01, Hardcopy

A low-power, radio-frequency analog-to-digital converter (RF-ADC) for soil moisture remote sensing was designed and fabricated. The RF-ADC is the fundamental component used in a direct-sampling digital radiometer, which is proposed to minimize the power dissipation and system complexity for synthetic thinned array radiometer. The circuit was implemented

using 0.8 micron 35-GHz silicon germanium BiCMOS technology. The total power dissipation was 222 mW.
Author
Analog To Digital Converters; Radio Frequencies; Silicon; Germanium; Frequency Converters

20030096002 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Sea Ice Surface Temperature Product from the Moderate Resolution Imaging Spectroradiometer (MODIS)
Hall, Dorothy K.; Key, Jeffrey R.; Casey, Kimberly A.; Riggs, George A.; Cavalieri, Donald J.; [2003]; 22 pp.; In English; Copyright; Avail: CASI; A03, Hardcopy

Global sea ice products are produced from the Earth Observing System (EOS) Moderate Resolution Imaging Spectroradiometer (MODIS) on board both the Terra and Aqua satellites. Daily sea ice extent and ice-surface temperature (IST) products are available at 1- and 4-km resolution. Validation activities have been undertaken to assess the accuracy of the MODIS IST product at the South Pole station in Antarctica and in the Arctic Ocean using near-surface air-temperature data from a meteorological station and drifting buoys. Results from the study areas show that under clear skies, the MODIS ISTs are very close to those of the near-surface air temperatures with a bias of -1.1 and -1.2 K, and an uncertainty of 1.6 and 1.7 K, respectively. It is shown that the uncertainties would be reduced if the actual temperature of the ice surface were reported instead of the near-surface air temperature. It is not possible to get an accurate IST from MODIS in the presence of even very thin clouds or fog, however using both the Advanced Microwave Scanning Radiometer-EOS (AMSR-E) and the MODIS on the Aqua satellite, it may be possible to develop a relationship between MODIS-derived IST and ice temperature derived from the AMSR-E. Since the AMSR-E measurements are generally unaffected by cloud cover, they may be used to complement the MODIS IST measurements.
Author
Sea Ice; Surface Temperature; Microwave Radiometers

20030096008 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Radio Frequency Survey of the 21-cm Wavelength(l.4 GHz) Allocation for Passive Microwave Observing
Piepmeier, J. R.; Midon, M.; Caroglanian, A.; Ugweje, O. C.; May 02, 2003; 3 pp.; In English; 2003 International Geoscience and Remote Sensing Symposium, USA
Report No.(s): IGARSS2003-03.0522; Copyright; Avail: CASI; A01, Hardcopy

Because of the need to develop 1.4-GHz radiometers, a set of RF surveys was conducted in and around our laboratories. In this paper, a measurement campaign and analysis of radio frequency interference (RFI) in the 21 cm wavelength allocation for passive microwave observing, was undertaken. The experimental setup and measurement procedure are outlined and measured data are interpreted. Significant signals were discovered within and surrounding the allocated spectrum at 1.4 GHz. Some implications for remote sensing are discussed.
Author
Radio Frequencies; Remote Sensing; Microwave Radiometers; Radio Frequency Interference

20030102190 Goodwin (R. Christopher) and Associates, Inc., New Orleans, LA
Cultural Resources Study Supporting Supplement I to the Final Environmental Impact Statement, Mississippi River Main Line Levee
George, David; Saucier, Roger; Smith, Susan B.; Pincoske, Jeremy; Hayden, William; Oct. 2000; 369 pp.; In English
Contract(s)/Grant(s): DACW29-97-D-0018
Report No.(s): AD-A416222; No Copyright; Avail: CASI; A16, Hardcopy

This document presents the results of a comprehensive literature and records review that supports the Supplement I to the Final Environmental Impact Statement, Mississippi River and Tributaries, Mississippi River Levees and Channel Improvement. That document was filed with the Council on Environmental Quality in 1976. This records review was completed on behalf of the U.S. Army Corps of Engineers, New Orleans District, and it included preliminary investigations of 11 levee-related project items throughout southeastern Louisiana. These project items include the Fifth Louisiana District Levee Enlargement; the Baton Rouge Front Levee; the Reveille to Point Pleasant Levee Enlargement; the Carville to Marchand Levee Enlargement and Concrete Slope Pavement; the Hohen-Solms to Modesto Levee Enlargement; the Carrollton Levee Enlargement; the Alhambra to Hohen-Solms Concrete Slope Paving Project; the Jefferson Heights Concrete Slope Paving Project; the New Orleans District Floodwall; the Gap Closures West Bank Concrete Slope Paving Project; and the Gap Closures East Bank Concrete Slope Paving Project. These structures were constructed as part of the Mississippi River and Tributaries Project, authorized by Congress through the Flood Control Act of 1928. The current study was designed to identify

all previously conducted cultural resources surveys, as well as previously recorded archeological sites, standing structures, and historic cemeteries located within the 2- kilometer (1.2 mile) wide area of potential effect associated with each of the 11 proposed project items. The records review identified 45 cultural resources investigations that have been conducted within the overall study area. These studies have resulted in the identification of 47 archeological sites, 142 standing structures, and 6 historic cemeteries. In addition, 4 historic districts lie within the overall study corridor.
DTIC
Architecture; Histories; Documentation; Archaeology; Environmental Surveys

20030102219 Army Command and General Staff Coll., Fort Leavenworth, KS
Reserve Component Contribution to Imagery Intelligence
Stafford, Ann E.; May 22, 2003; 73 pp.; In English
Report No.(s): AD-A416241; No Copyright; Avail: CASI; A04, Hardcopy

One of six primary intelligence disciplines, IMINT traditionally has accounted for the lion's share of intelligence-derived information since World War II. Because raw imagery has limited value until it has been exploited, the increased volume of raw imagery demands an enhanced ability for combatant commanders and the National Imagery and Mapping Agency (NIMA) to effectively manage imagery exploitation assets in support of combatant commanders strategic and operational intelligence requirements. A shortage of imagery analysts (IA) relative to the amount of raw imagery needing exploitation has drawn national-level attention to IMINT. This monograph offers a model that the intelligence community may use to determine the most effective operational employment of reserve component (RC) intelligence elements in support of combatant commanders strategic and operational intelligence requirements. In terms of scope, RC forces account for approximately 40 percent of intelligence production in support of the combatant commands. More than 90 percent of all RC imagery analysts have deployed in the 18 months following the 11 September 2001 terrorist attacks. The model will show how optimal use of imagery analysts whether active or reserve, military or civilian will maximize combatant commanders analytical power, and therefore improve their ability to fulfill their strategic and operational intelligence requirements. To define the issues associated with RC contribution to IMINT and geospatial information requirements, the author surveyed the combatant commanders intelligence leadership at the Joint Intelligence Centers (JIC). The study structure identifies and links the major players involved in RC contribution to combatant commanders IMINT and geospatial information needs.
DTIC
Images; Mapping; Intelligence; Armed Forces; Deployment

20030102222 NASA Goddard Space Flight Center, Greenbelt, MD, USA
MODIS NDVI Response Following Fires in Siberia
Ranson, K. Jon; Sun, G.; Kovacs, K.; Kharuk, V. I.; [2003]; 3 pp.; In English; International Geoscience and Remote Sensing Symposium, 21-25 Jul. 2003, Toulouse,, France; Copyright; Avail: CASI; A01, Hardcopy

The Siberian boreal forest is considered a carbon sink but may become an important source of carbon dioxide if climatic warming predictions are correct. The forest is continually changing through various disturbance mechanisms such as insects, logging, mineral exploitation, and especially fires. Patterns of disturbance and forest recovery processes are important factors regulating carbon flux in this area. NASA's Terra MODIS provides useful information for assessing location of fires and post fire changes in forests. MODIS fire (MOD14), and NDVI (MOD13) products were used to examine fire occurrence and post fire variability in vegetation cover as indicated by NDVI. Results were interpreted for various post fire outcomes, such as decreased NDVI after fire, no change in NDVI after fire and positive NDVI change after fire. The fire frequency data were also evaluated in terms of proximity to population centers, and transportation networks.
Author
Modis (Radiometry); Forest Fires; Forests

20030102223 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Multi-Sensor Approach for Assessing the Taiga-Tundra Boundary
Ranson, K. J.; Sun, G.; Kharuk, V. I.; Kovacs, K.; [2003]; 3 pp.; In English; International Geoscience and Remote Sensing Symposium, 21-25 Jul. 2003, Toulouse,, France; Copyright; Avail: CASI; A01, Hardcopy

Monitoring the dynamics of the tundra-taiga boundary is critical for our understanding of the causes and consequences of the changes in this area. Because of its inaccessibility, remote sensing data will play an important role. In this study we examined the use of several remote sensing techniques for identifying the existing tundra-taiga ecotone. These include Landsat, MISR and RADARSAT data. High-resolution IKONOS images were used for local ground truth. It was found that

on Landsat ETM+ summer images, reflectance from tundra and taiga at band 4 (NIR) is similar, but different at other bands such as red, and MIR bands. When the incidence angle is small, C-band HH-pol backscattering coefficients from both tundra and taiga are relatively high. The backscattering from tundra targets decreases faster than taiga targets when the incidence angle increases, because the tundra targets look smoother than taiga. Because of the shading effect of the vegetation, the MISR data, both multi-spectral data at nadir looking and multi-angle data at red and NIR bands, clearly show the transition zone. Author

Satellite Imagery; Tundra; Forests; Multisensor Applications; Landsat Satellites; Radarsat; Radar Imagery

20030102234 NASA Goddard Space Flight Center, Greenbelt, MD, USA

The Economical Microbolometer-Based Environmental Radiometer Satellite (EMBERSAT) Designed for Forest Fire Detection and Monitoring

Lancaster, Redgie S.; Skillman, David R.; Welch, Wayne; Spinhirne, James D.; Manizade, Kathrine F.; Beecken, Brian P.; [2003]; 4 pp.; In English; International Workshop on Thermal Detectors, 19-20 Jun. 2003, Washington, DC, USA; Copyright; Avail: CASI; A01, Hardcopy

Thermal infrared imagery from several satellite instruments, such as the NOAA AVHRR and the NASA MODIS, is presently used to detect and map forest fires. But while these radiometers can identify fires they are designed and optimized for cloud detection, providing relatively low spatial resolution and quickly saturating even for small fires. Efforts to detect and monitor forest fires from space would benefit from the development of single-sensor satellites designed specifically for this purpose. With the advent of uncooled thermal detectors, and thus the absence of aggressive cooling, the possibility of developing small satellites for the purpose of fire detection and monitoring becomes practical and cost-effective. Thus is the case with the Economical Microbolometer Based Environmental Radiometer Satellite (EMBERSat) program. The objective of this program is to develop a single, prototype satellite that will provide multiband thermal imagery with a spatial resolution of 250m and a dynamic range of 300-1000K. The thermal imaging payload has flight heritage in the Infrared Spectral Imaging Radiometer that flew aboard mission STS-85 and the spacecraft is a variant of the SimpleSat bus launched from the shuttle Columbia as part of STS-109. The EMBERSat program is a technology demonstration initiative with the eventual goal of providing high-resolution thermal imagery to both the scientific community and the public.
Author

Bolometers; Radiometers; Satellite-Borne Instruments; Forest Fire Detection; Microsatellites; Infrared Imagery

20030105652 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Use of Multi-Resolution Wavelet Feature Pyramids for Automatic Registration of Multi-Sensor Imagery

Zavorin, Ilya; LeMoigne, Jacqueline; [2003]; 30 pp.; In English

Contract(s)/Grant(s): NAS2-37143; No Copyright; Avail: CASI; A03, Hardcopy

The problem of image registration, or alignment of two or more images representing the same scene or object, has to be addressed in various disciplines that employ digital imaging. In the area of remote sensing, just like in medical imaging or computer vision, it is necessary to design robust, fast and widely applicable algorithms that would allow automatic registration of images generated by various imaging platforms at the same or different times, and that would provide sub-pixel accuracy. One of the main issues that needs to be addressed when developing a registration algorithm is what type of information should be extracted from the images being registered, to be used in the search for the geometric transformation that best aligns them. The main objective of this paper is to evaluate several wavelet pyramids that may be used both for invariant feature extraction and for representing images at multiple spatial resolutions to accelerate registration. We find that the band-pass wavelets obtained from the Steerable Pyramid due to Simoncelli perform better than two types of low-pass pyramids when the images being registered have relatively small amount of nonlinear radiometric variations between them. Based on these findings, we propose a modification of a gradient-based registration algorithm that has recently been developed for medical data. We test the modified algorithm on several sets of real and synthetic satellite imagery.
Author

Multisensor Applications; Wavelet Analysis; Automatic Control; Remote Sensing; Satellite Imagery; Algorithms; Pattern Registration

20030105707 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Remote Sensing of Liquid Water and Ice Cloud Optical Thickness and Effective Radius in the Arctic: Application of Airborne Multispectral MAS Data

King, Michael D.; Platnick, Steven; Yang, Ping; Arnold, G. Thomas; Gray, Mark A.; Riedi, Jerome C.; Ackerman, Steven A.; Liou, Kuo-Nan; [2003]; 48 pp.; In English

Contract(s)/Grant(s): NAG5-31367; NAG5-6160; Copyright; Avail: CASI; A03, Hardcopy

A multispectral scanning spectrometer was used to obtain measurements of the reflection function and brightness temperature of clouds, sea ice, snow, and tundra surfaces at 50 discrete wavelengths between 0.47 and 14.0 microns. These observations were obtained from the NASA ER-2 aircraft as part of the FIRE Arctic Clouds Experiment, conducted over a 1600 x 500 km region of the north slope of Alaska and surrounding Beaufort and Chukchi Seas between 18 May and 6 June 1998. Multispectral images of the reflection function and brightness temperature in 11 distinct bands of the MODIS Airborne Simulator (MAS) were used to derive a confidence in clear sky (or alternatively the probability of cloud), shadow, and heavy aerosol over five different ecosystems. Based on the results of individual tests run as part of the cloud mask, an algorithm was developed to estimate the phase of the clouds (water, ice, or undetermined phase). Finally, the cloud optical thickness and effective radius were derived for both water and ice clouds that were detected during one flight line on 4 June. This analysis shows that the cloud mask developed for operational use on MODIS, and tested using MAS data in Alaska, is quite capable of distinguishing clouds from bright sea ice surfaces during daytime conditions in the high Arctic. Results of individual tests, however, make it difficult to distinguish ice clouds over snow and sea ice surfaces, so additional tests were added to enhance the confidence in the thermodynamic phase of clouds over the Beaufort Sea. The cloud optical thickness and effective radius retrievals used 3 distinct bands of the MAS, with the newly developed 1.62 and 2.13 micron bands being used quite successfully over snow and sea ice surfaces. These results are contrasted with a MODIS-based algorithm that relies on spectral reflectance at 0.87 and 2.13 micron.

Author

Remote Sensing; Ice Clouds; Optical Thickness; Multispectral Band Scanners; Sea Ice; Snow; Tundra

20030105839 Geo-Marine, Inc., Las Vegas, NV, USA

Hill Air Force Base: Archaeological Monitoring of Target and Access Road Development for the TS-5-2 Target Area, Utah Test and Training Range, Tooele County, Utah

Duke, Daron; Jun. 2002; 45 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DACA63-99-D-0010

Report No.(s): AD-A416577; No Copyright; Avail: CASI; A03, Hardcopy

The U.S. Army Corps of Engineers, Fort Worth District, contracted with Geo-Marine, Inc. to conduct archaeological monitoring for a U.S. Air Force Air Combat Command (ACC) project on the Utah Test and Training Range, which is located in Tooele County, western Utah. Monitoring of ground-disturbing activities associated with ACC development of Target TS-5-2 and a 2.5-mile dirt access road on the TS-5 (Wild Isle) area of UTTR was undertaken in January 2001. Additional target and access road development monitoring was conducted in July and August of 2001, and the results of this work are included as an addendum to this volume. The TS-5-2 project area consisted of the target complex and the access road, both of which required construction. The removal of vegetation and a thin layer of soil, less than 2-to-3 feet below the surface, by a bulldozer was to be the primary impact. Previous archaeological surveys of the entire TS-5 area had documented numerous sites and had identified the area as possessing potential for containing important buried cultural deposits beneath the sand dunes. Based on these surveys, the road and target area were designed to avoid known sites, but the road route passed adjacent to several recorded sites. The monitoring objective was to assure that known sites were avoided and to verify that the nearby sites did not extend into the proposed roadway. Other monitoring considerations included heavy equipment activity outside of the intended roadway and future bombing in the target area. Shovel probes were used to access subsurface deposits, and the use of a backhoe allowed for the documentation of the geomorphological structure of the TS-5 landform. No cultural material was found, but data were collected that will aid future archaeological efforts. The results of the monitoring and geomorphological investigations indicate that development of the TS-5-2 access road and target area will have no effect on cultural resources.

DTIC

Geomorphology; Roads; Structural Properties (Geology); Environmental Quality; Archaeology; Military Air Facilities

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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*.

20030093536 NASA Glenn Research Center, Cleveland, OH, USA
Test of Hydrogen-Oxygen PEM Fuel Cell Stack at NASA Glenn Research Center
Bents, David J.; Scullin, Vincent J.; Chang, Bei-Jiann; Johnson, Donald W.; Garcia, Christopher P.; Jakupca, Ian J.; September 2003; 14 pp.; In English; First International Energy Conversion Engineering Conference, 17-21 Aug. 2003, Portsmouth, VA, USA
Contract(s)/Grant(s): WBS 22-710-10-02
Report No.(s): NASA/TM-2003-212374; E-13950; NAS 1.15:212374; AIAA Paper 2003-6123; No Copyright; Avail: CASI; A03, Hardcopy

This paper describes performance characterization tests of a 64 cell hydrogen oxygen PEM fuel cell stack at NASA Glenn Research Center in February 2003. The tests were part of NASA's ongoing effort to develop a regenerative fuel cell for aerospace energy storage applications. The purpose of the tests was to verify capability of this stack to operate within a regenerative fuel cell, and to compare performance with earlier test results recorded by the stack developer. Test results obtained include polarization performance of the stack at 50 and 100 psig system pressure, and a steady state endurance run at 100 psig. A maximum power output of 4.8 kWe was observed during polarization runs, and the stack sustained a steady power output of 4.0 kWe during the endurance run. The performance data obtained from these tests compare reasonably close to the stack developer's results although some additional spread between best to worst performing cell voltages was observed. Throughout the tests, the stack demonstrated the consistent performance and repeatable behavior required for regenerative fuel cell operation.
Author
Hydrogen Oxygen Fuel Cells; Regenerative Fuel Cells; Performance Tests

20030093650 Northland Scientific, Inc., Olmstead Falls, OH, USA
Initial Design and Construction of a Mobil Regenerative Fuel Cell System
Colozza, Anthony J.; Maloney, Thomas; Hoberecht, Mark, Technical Monitor; September 2003; 36 pp.; In English
Contract(s)/Grant(s): NCC3-70731-K; WBS 708-87-11
Report No.(s): NASA/CR-2003-212539; E-14105; NAS 1.26:212539; No Copyright; Avail: CASI; A03, Hardcopy

The design and initial construction of a mobile regenerative power system is described. The main components of the power system consists of a photovoltaic array, regenerative fuel cell and electrolyzer. The system is mounted on a modified landscape trailer and is completely self contained. An operational analysis is also presented that shows predicted performance for the system at various times of the year. The operational analysis consists of performing an energy balance on the system based on array output and total desired operational time.
Author
Regenerative Fuel Cells; Solar Arrays; Systems Engineering; Mechanical Engineering; Fuel Cell Power Plants

20030098020 Electric Power Research Inst., Knoxville, TN, USA
Fast Response, Load-Matching Hybrid Fuel Cell
Key, T. S.; Sitzlar, H. E.; Geist, T. D.; Jun. 2003; In English
Report No.(s): DE2003-15003880; NREL/SR-560-32743; No Copyright; Avail: National Technical Information Service (NTIS)

Hybrid distributed energy resource technologies are systems that combine two complementary generation or storage technologies. Interconnected with the grid, these systems can provide improved performance over a single power source and add value when matched to appropriate applications. In a typical residence, for electric power technologies interconnected with the grid, a key measure of hybrid system performance is the response of the system to nonlinear loads and step loads, e.g., motors. Of further interest is the ability of the hybrid system to improve the quality of electric service provided by the utility. The interconnected hybrid system could provide power during a utility outage and also compensate for voltage sags in utility service. Such a hybrid system would then function as a premium power provider and eliminate the potential need for an uninterruptible power supply. In this research project, a proton exchange membrane (PEM) fuel cell is combined with a relatively new product-an asymmetrical ultracapacitor-to provide a more robust power response to changes in system

loading. Together, the fuel cell and the ultracapacitor serve both full-time and momentary loading. The very fast power response of the ultracapacitor complements the slower but longer-term power output of the fuel cell. The hybrid combination provides for power system response characteristics that are desired to serve a range of load and grid-interface requirements. This project also demonstrates the potential of hybrid DER technologies to improve overall power system capacity and compatibility with a variety of loads. This report covers the activities and accomplishments during the base year of a proposed 3-year option project.
NTIS
Fuel Cells; Electrochemical Capacitors; Electric Power Supplies

20030098023 National Renewable Energy Lab., Golden, CO
Optimized Hydrogen and Electricity Generation from Wind
Fingersh, L. J.; Jun. 2003; In English
Report No.(s): DE2003-15003977; NREL-TP-500-34364; No Copyright; Avail: National Technical Information Service (NTIS)

Several optimizations can be employed to create hydrogen or hydrogen and electricity from a wind energy source. The key element in hydrogen production from any electrical source is an electrolyzer to convert water and electricity into hydrogen and oxygen. An electrolyzer is inherently a nearly constant, low-voltage, direct-current device requiring some form of control system and power electronics to connect to a high-voltage, alternating-current source of power. Likewise, modern wind turbines employ a control system used in conjunction with power electronics in order to connect to the grid. It may be possible to use the turbines controller and power electronics system to operate the electrolyzer as well, thereby eliminating component duplication. Such a coupled system would reduce the overall cost of independent stand-alone systems. Additionally, this approach would increase efficiency as only one electrical conversion (from AC to DC), instead of three (from AC to DC to AC and back to DC), would have to occur.
NTIS
Hydrogen Production; Windpower Utilization

20030098029 National Renewable Energy Lab., Golden, CO
Tolerance of Three-Stage CIGS Deposition to Variations Imposed by Roll-to-Roll Processing
Beck, M. E.; Repins, I. L.; Jun. 2003; In English
Report No.(s): DE2003-15003976; NREL/SR-520-34314; No Copyright; Avail: National Technical Information Service (NTIS)

Global Solar Energy, Inc. (GSE) and lower-tier subcontractor ITN Energy Systems, Inc. (ITN) are addressing these process tolerance issues in this program. The definition and resolution of process tolerance issues satisfy many of the goals of the Thin Film Photovoltaics Partnerships Program (TFPPP). First, the investigation is likely to identify acceptable ranges for critical deposition parameters. This will have the benefit of providing upper and lower control limits for in-situ process monitoring components, thus increasing average efficiency as well as yield of product. Second, the exploration may uncover insensitivities to some processing procedures, allowing manufacture of modules at increased throughput and decreased cost. The exploration allows a quantitative evaluation of the trade-offs between performance, throughput, and costs. Third, the proposed program also satisfies the TFPPP goal of establishing a wider research and development base for higher-efficiency processing. Fourth, the acquisition of data defining sensitivity to processing has important implications for the required accuracy of process sensors and control. Finally, the program helps the photovoltaic community advance toward a better understanding of CIGS growth, a longer-term goal of the TFPPP.
NTIS
Photovoltaic Conversion; Thin Films

20030102115 Military Academy, West Point, NY, USA
Land Warrior Power Management
Sanders, David; Jun. 2003; 36 pp.; In English
Report No.(s): AD-A414902; DSE-R-03-03; No Copyright; Avail: CASI; A03, Hardcopy

The Soldier Tactical Mission System (STMS) requires power to operate power that must be carried out by the soldier. As the system becomes more advanced the power usage of each component is diminished, while the power carrying capacity, in terms of duration, improves. The improvement is incremental; yet the goal of power management for this system is to significantly increase the length of time a single source can supply the system with power without resupply. In order to develop

a power management architecture for the system it is necessary to ascertain what components, under specified conditions, provides the most utility to the soldier. After this is done, tradeoffs can be made and, under conditions of restricted power supply, decisions can be made to turn off components that are less beneficial. Determining the utility of those components is the focus of this report. We examine STMS with the use of complexity theory and combat simulations based upon Agent Based Models, developing a conceptual framework with to analyze the components. Further work needs to be done to analyze the system in various scenarios, specified in the Operational Requirements Document, to obtain the utilities described above.
DTIC
Service Life; Electric Power; Military Technology

20030102122 Helsinki Univ. of Technology, Espoo
Development of Procedures for Performance Measurements and Lifetime Testing of Thin Film Photovoltaic Devices
Roschier, S.; 2003; In English
Report No.(s): PB2003-107339; TKK-F-A811; No Copyright; Avail: National Technical Information Service (NTIS)

In this work single junction a-Si, CdTe and CIGS modules and prototype modules and mini-modules were investigated to reliably be able to characterize these technologies for electrical performance and to find out potential failure mechanisms in accelerated lifetime testing. Thin film modules may increase their share of the market in the future. A-Si modules have been manufactured already for several years and CdTe and CIGS modules are shortly entering the market. However, there is a lack of characterization and testing methods to reliably predict the power output and service lifetime of these technologies. In this work physics, material and manufacturing issues related to a-Si, CdTe and CIS thin film technologies were reviewed to understand possible failure mechanisms in reliability testing. The calibration measurement procedures and in particular the choice of the reference device for the thin film photovoltaic materials was investigated.
NTIS
Photovoltaic Cells; Solar Cells

20030105692 Aerospace Corp., El Segundo, CA
Hydroxide-Limited Silver-Zinc Cells
Thaller, L. H.; Feb. 25, 2003; 18 pp.; In English
Contract(s)/Grant(s): F04701-00-C-0009
Report No.(s): AD-A416550; TR-2003(1413)-2; SMC-TR-03-18; No Copyright; Avail: CASI; A03, Hardcopy

Silver-zinc cells under certain circumstances can be limited in capacity by the amount of hydroxide ion added during cell activation. This report examines the reasons for this limiting condition and suggests techniques to determine whether cells are limited by their hydroxide content. In addition, the report found that the projected cell capacities as a function of wet-stand duration followed the same capacity trend line as a group of cells that were affected by hydroxide- limitation problems that resulted in low ampere capacities during cell discharge.
DTIC
Silver Zinc Batteries; Hydroxides; Corrosion

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ENVIRONMENT POLLUTION

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

20030093497 Environmental Protection Agency, Las Vegas, NV, USA
Spatial Prediction of Fine Particulate Matter
Holland, D. M.; Fuentes, M.; 2002; 12 pp.; In English
Report No.(s): PB2003-106595; EPA/600/A-02/040; No Copyright; Avail: CASI; A03, Hardcopy

A new national monitoring network for the measurement of fine particular matter (PM2.5) is currently under development. A primary goal of this network is to collect monitoring data in residential communities for the evaluation of compliance with particulate air quality standards. In this analysis, the authors apply an empirical Bayesian approach to predict PM2.5 at selected points within multi-state regions covering the eastern U.S.
NTIS
Particulates; Air Pollution; Pollution Monitoring

20030093498 Denver Univ., Denver, CO, USA
On-Road Remote Sensing of Automobile Emissions in the LaBrea Area: Year 2
Williams, M. J.; Bikshop, G. A.; Stedman, D. H.; Feb. 2003; In English
Report No.(s): PB2003-106859; No Copyright; Avail: National Technical Information Service (NTIS)

The University of Denver conducted a five-day remote sensing study in the LaBrea, California area in October of 2001. The remote sensor used in this study is capable of measuring the ratios of CO, HC, and NO to CO2 in motor vehicle exhaust. From these ratios, we calculate mass emissions per kg (or gallon) of fuel and the percent concentrations of CO, CO2, HC and NO in motor vehicle exhaust which would be observed by a tailpipe probe, corrected for water and any excess oxygen not involved in combustion. The system used in this study was also configured to determine the speed and acceleration of the vehicle, and was accompanied by a video system to record the license plate of the vehicle. Five days of fieldwork, October 15-19, 2001, were conducted as vehicles entered I-10 eastbound frontage road from LaBrea Blvd. in west Lost Angles basin. A database was compiled containing 26,975 records. Of these records the State of California provided make and model year information on 20,319 which contained valid measurements for at least CO and CO2, and most contained valid measurements for HC and NO as well.
NTIS
Remote Sensing; Automobiles; Infrared Detectors; Exhaust Emission

20030098027 Lawrence Livermore National Lab., Livermore, CA
Combustion of Shock-Dispersed Fuel in a Chamber
Neuwald, P.; Reichenbach, H.; Kuhl, A. L.; Apr. 23, 2003; 20 pp.; In English
Report No.(s): DE2003-15003915; UCRL-JC-152263; No Copyright; Avail: Department of Energy Information Bridge

In previous studies we have investigated after-burning effects of a fuel-rich explosive (TNT). In that case the detonation only releases about 30% of the available energy, but generates a hot cloud of fuel that can burn in the ambient air, thus evoking an additional energy release that is distributed in space and time. The current series of small-scale experiments can be looked upon as a natural generalization of this mechanism: a booster charge disperses a (non-explosive) fuel, provides mixing with air and - by means of the hot detonation products - energy to ignite the fuel. The current version of our miniature Shock-Dispersed-Fuel (SDF) charges consists of a spherical booster charge of 0.5 g PETN, embedded in a paper cylinder of approximately 2.2 cm3, which is filled with powdered fuel compositions. The main compositions studied up to now contain aluminum powder, hydrocarbon powders like polyethylene or sucrose and/or carbon particles. These charges were studied in three different chambers of 4-1, 6.6-1 and 40.5-1 volume.
NTIS
Combustion Chambers; Combustion Products; Boosters (Explosives); Afterburning

20030102120 General Accounting Office, Washington, DC
Clean Air Act: EPA Should Use Available Data to Monitor the Effects of Its Revisions to the New Source Review Program
Aug. 2003; 38 pp.
Report No.(s): PB2003-107331; GAO-03-947; No Copyright; Avail: CASI; A03, Hardcopy

A recent Environmental Protection Agency (EPA) final rule changing the Clean Air Act's New Source Review (NSR) program-a key means to protect public health and enhance air quality-has been under scrutiny by the Congress, industry, environmental groups, state and local air quality agencies, and the courts. GAO was asked to determine the basis of EPA's conclusions that (1) the rule's economic impacts would not be significant enough to merit a detailed analysis and (2) the NSR program, prior to the rule, discouraged some energy efficiency projects. GAO, among other things, reviewed EPA's analysis of the rule and its impacts, as well as guidance from EPA and the Office of Management and Budget (OMB) on analyzing such impacts. GAO also met with industry and environmental stakeholders.
NTIS
Air Quality; Environment Protection

20030105578 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Intercontinental Transport of Ozone from Tropical Biomass Burning
Thompson, A. M.; [2003]; 45 pp.; In English; No Copyright; Avail: CASI; A03, Hardcopy

Researchers have been looking at the connection between tropical biomass burning and ozone formation and long-range transport for roughly 15 years. One can see the linkage and transport patterns from satellite though aircraft and/or

balloon-sonde profiles are required to observe the fine structure (ozone transport over thousands of km often happens in thin layers). In this review, I survey the pyrogenic ozone transport in the large oceanic basins - Indian Ocean, Pacific and Atlantic. Mechanistic complexities are discussed and examples shown from satellite, aircraft and soundings, including NASA results from TOMS, the GTE experiments and the SHADOZ sounding program. Experiments referred to include SAFARI-92, TRACE-A, INDOEX, PEM-Tropics and TRACE-P. augmented by subsidence, a variable tropopause height, and lightning - even ozone pollution from the Indian Ocean has been implicated. Over the Indian Ocean, pollution interacts with convection and the monsoon cycle.
Author
Ozone; Ocean Surface; Biomass Burning; Total Ozone Mapping Spectrometer

20030105587 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Entrainment and Optical Properties of an Elevated Forest Fire Plume Transported into the Planetary Boundary Layer near Washington, D.C.
Colarco, P. R.; Schoeberl, M. R.; Marufu, L. T.; Torres, O.; Welton, E. J.; Doddridge, B. G.; [2003]; 37 pp.; In English; Copyright; Avail: CASI; A03, Hardcopy

Smoke and pollutants from Canadian forest fires were transported over the northeastern USA in July 2002. Lidar observations at the NASA Goddard Space Flight Center show the smoke from these fires arriving in an elevated plume that was subsequently transported to the surface. Trajectory and three-dimensional model calculations confirm the origin of the smoke and show that it mixed to the surface after it was intercepted by the turbulent planetary boundary layer. Modeled smoke optical properties agreed well with aircraft and remote sensing observations provided coagulation of smoke particles was accounted for in the model. Our results have important implications for the long-range transport of pollutants and their subsequent entrainment to the surface, as well as the evolving optical properties of smoke from boreal forest fires.
Author
Entrainment; Optical Properties; Plumes; Forest Fires; Pollution Transport; Planetary Boundary Layer

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GEOPHYSICS

Includes Earth structure and dynamics, aeronomy; upper and lower atmosphere studies; ionospheric and magnetospheric physics; and geomagnetism. For related information see *47 Meteorology and Climatology*; and *93 Space Radiation*.

20030093542 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Reply to Gopalswamy et al.
Cane, H. V.; Richardson, I. G.; [2003]; ISSN 0094-8276; 3 pp.; In English; Copyright; Avail: Other Sources

The comment of Gopalswamy et al. (thereafter GMY) relates to a letter discussing coronal mass ejections, interplanetary ejecta and geomagnetic storms written nearly three years ago. Cane et al. (2000) shows the transit times of solar wind disturbances associated with CMEs observed by LASCO. The disturbance travel time is that of the shock or upstream wavelike feature if present, or that of the ejecta if the ejecta speed is sufficiently slow that there is no upstream feature. In 74% of the events, the disturbance time corresponds to the passage of a shock. We chose to show disturbance travel times because (a) they are more relevant to the onset of CME-related effects at Earth than ejecta travel times, (b) the disturbance arrival time is usually well defined whereas the time of ejecta leading edge passage is often difficult to determine precisely, and (c) though less of an issue for the current solar cycle, the shock arrival time is easily established (from the geomagnetic storm sudden commencement) for events where there are limited solar wind observations, and the disturbance therefore provides a consistent event time for extended studies of solar wind transients. However, on rereading the paper, we agree that we neglected to draw attention to this point sufficiently clearly in the text.
Derived from text
Coronal Mass Ejection; Ejecta; Magnetic Storms; Solar Wind

20030093548 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Satellite Detection of the Convection Generated Stresses in Earth
Liu, Han-Shou; Kolenkiewicz, Ronald; Li, Jin-Ling; Chen, Jiz-Hong; [2003]; 27 pp.; In English; No Copyright; Avail: CASI; A03, Hardcopy

We review research developments on satellite detection of the convection generated stresses in the Earth for seismic hazard assessment and Earth resource survey. Particular emphasis is laid upon recent progress and results of stress calculations

from which the origin and evolution of the tectonic features on Earth's surface can be scientifically addressed. An important aspect of the recent research development in tectonic stresses relative to earthquakes is the implications for earthquake forecasting and prediction. We have demonstrated that earthquakes occur on the ring of fire around the Pacific in response to the tectonic stresses induced by mantle convection. We propose a systematic global assessment of the seismic hazard based on variations of tectonic stresses in the Earth as observed by satellites. This space geodynamic approach for assessing the seismic hazard is unique in that it can pinpoint the triggering stresses for large earthquakes without ambiguities of geological structures, fault geometries, and other tectonic properties. Also, it is distinct from the probabilistic seismic hazard assessment models in the literature, which are based only on extrapolations of available earthquake data.
Author
Earth Surface; Tectonics; Geodynamics; Convection; Satellite Observation; Stress Analysis; Detection

20030102152 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Mesospheric Non-Migrating Tides Generated With Planetary Waves, 1, Characteristics
Mayr, H. G.; Mengel, J. G.; Talaat, E. L.; Porter, H. S.; Chan, K. L.; [2003]; 39 pp.; In English; Copyright; Avail: CASI; A03, Hardcopy

We discuss results from a modeling study with our Numerical Spectral Model (NSM) that specifically deals with the non-migrating tides generated in the mesosphere. The NSM extends from the ground to the thermosphere, incorporates Hines' Doppler Spread Parameterization for small-scale gravity waves (GWs), and it describes the major dynamical features of the atmosphere including the wave driven equatorial oscillations (QBO and SAO), and the seasonal variations of tides and planetary waves. Accounting solely for the excitation sources of the solar migrating tides, the NSM generates through dynamical interactions also non-migrating tides in the mesosphere that are comparable in magnitude to those observed. Large non-migrating tides are produced in the diurnal and semi-diurnal oscillations for the zonal mean (m = 0) and in the semidiurnal oscillation for m = 1. In general, significant eastward and westward propagating tides are generated for all the zonal wave numbers m = 1 to 4. To identify the cause, the NSM is run without the solar heating for the zonal mean (m = 0), and the amplitudes of the resulting non-migrating tides are then negligibly small. In this case, the planetary waves are artificially suppressed, which are generated in the NSM through instabilities. This leads to the conclusion that the non-migrating tides are generated through non-linear interactions between planetary waves and migrating tides, as Forbes et al. and Talaat and Liberman had proposed. In an accompanying paper, we present results from numerical experiments, which indicate that gravity wave filtering contributes significantly to produce the non-linear coupling that is involved.
Author
Mathematical Models; Mesosphere; Planetary Waves; Tides; Parameterization; Diurnal Variations

20030102160 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Effect of Varying Crustal Thickness on CHAMP Geopotential Data
Patrick, Taylor; Kis, K. I.; vonFrese, R. R. B.; Korhonen, J. V.; Wittmann, G.; Kim, H. R.; Potts, L. V.; [2003]; 6 pp.; In English; 2nd CHAMP Science Meeting, 1-4 Sep. 2003, Potsdam,, Germany; No Copyright; Avail: Other Sources; Abstract Only

To determine the effect of crustal thickness variation on satellite-altitude geopotential anomalies we compared two regions of Europe with vastly different values, Central/Southern Finland and the Pannonian Basin. Crustal thickness exceeds 62 km in Finland and is less than 26 km in the Pannonian Basin. Heat-flow maps indicate that the thinner and more active crust of the Pannonian Basin has a value nearly three times that of the Finnish Svecofennian Province. Ground based gravity mapping in Hungary shows that the free-air gravity anomalies across the Pannonian Basin are near 0 to +20 mGal with shorter wavelength anomalies from +40 to less than +60 mGal and some 0 to greater than -20 mGal. Larger anomalies are detected in the mountainous areas. The minor value anomalies can indicate the isostatic equilibrium for Hungary (the central part of the Pannonian Basin). Gravity data over Finland are complicated by de-glaciation. CHAMP gravity data (400 km) indicates a west-east positive gradient of greater than 4 mGal across Central/Southern Finland and an ovoid positive anomaly (approximately 4 mGal) quasi-coincidental with the magnetic anomaly traversing the Pannonian Basin. CHAMP magnetic data (425 km) reveal elongated semicircular negative anomalies for both regions with South-Central Finland having larger amplitude (less than -6 nT) than that over the Pannonian Basin, Hungary (less than -5 nT). In both regions subducted oceanic lithosphere has been proposed as the anomalous body.
Author
Crusts; Geopotential; Gravity Anomalies; Earth Gravitation; Magnetic Fields; Thickness

20030102174 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Mesospheric Non-Migrating Tides Generated With Planetary Waves: II Influence of Gravity Waves
Mayr, H. G.; Mengel, J. G.; Talaat, E. L.; Porter, H. S.; Chan, K. L.; [2003]; 24 pp.; In English; Copyright; Avail: CASI; A03, Hardcopy

We demonstrated that, in our model, non-linear interactions between planetary waves (PW) and migrating tides could generate in the upper mesosphere non-migrating tides with amplitudes comparable to those observed. The Numerical Spectral Model (NSM) we employ incorporates Hines Doppler Spread Parameterization for small-scale gravity waves (GW), which affect in numerous ways the dynamics of the mesosphere. The latitudinal (seasonal) reversals in the temperature and zonal circulation, which are largely caused by GWs (Lindzen, 198l), filter the PWs and contribute to the instabilities that generate the PWs. The PWs in turn are amplified by the momentum deposition of upward propagating GWs, as are the migrating tides. The GWs thus affect significantly the migrating tides and PWs, the building blocks of non-migrating tides. In the present paper, we demonstrate that GW filtering also contributes to the non-linear coupling between PWs and tides. Two computer experiments are presented to make this point. In one, we simply turn off the GW source to show the effect. In the second case, we demonstrate the effect by selectively suppressing the momentum source for the m = 0 non-migrating tides.
Author
Gravity Waves; Mathematical Models; Mesosphere; Planetary Waves; Tides; Gravitational Effects

20030102176 NASA Goddard Space Flight Center, Greenbelt, MD, USA
30-Year Satellite Record Reveals Contrasting Arctic and Antarctic Decadal Sea Ice Variability
Cavalieri, D. J.; Parkinson, C. L.; Vinnikov, K. Y.; [2003]; 16 pp.; In English
Contract(s)/Grant(s): NA06GP0403; Copyright; Avail: CASI; A03, Hardcopy

A 30-year satellite record of sea ice extents derived mostly from satellite microwave radiometer observations reveals that the Arctic sea ice extent decreased by 0.30+0.03 x 10(exp 6) square kilometers per 10 yr from 1972 through 2002, but by 0.36 plus or minus 0.05 x 10(exp 6) square kilometers per 10yr from 1979 through 2002, indicating an acceleration of 20% in the rate of decrease. In contrast, the Antarctic sea ice extent decreased dramatically over the period 1973-1977, then gradually increased. Over the full 30-year period, the Antarctic ice extent decreased by 0.15 plus or minus 0.08 x 10(exp 6) square kilometers per 10 yr. The trend reversal is attributed to a large positive anomaly in Antarctic sea ice extent in the early 1970's, an anomaly that apparently began in the late 1960's, as observed in early visible and infrared satellite images.
Author
Antarctic Regions; Periodic Variations; Satellite Imagery; Sea Ice; Arctic Ocean; Microwave Radiometers

20030102191 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Interannual Variability in Intercontinental Transport
Gupta, Mohan; Douglass, Anne; Kawa, S. Randy; Pawson, Steven; [2003]; 20 pp.; In English; No Copyright; Avail: CASI; A03, Hardcopy

We have investigated the importance of intercontinental transport using source-receptor relationship. A global radon-like and seven regional tracers were used in three-dimensional model simulations to quantify their contributions to column burdens and vertical profiles at world-wide receptors. Sensitivity of these contributions to meteorological input was examined using different years of meteorology in two atmospheric simulations. Results show that Asian emission influences tracer distributions in its eastern downwind regions extending as far as Europe with major contributions in mid- and upper troposphere. On the western and eastern sides of the US, Asian contribution to annual average column burdens are 37% and 5% respectively with strong monthly variations. At an altitude of 10 km, these contributions are 75% and 25% respectively. North American emissions contribute more than 15% to annual average column burden and about 50% at 8 km altitude over the European region. Contributions from tropical African emissions are wide-spread in both the hemispheres. Differences in meteorological input cause non-uniform redistribution of tracer mass throughout the troposphere at all receptors. We also show that in model-model and model-data comparison, correlation analysis of tracer's spatial gradients provides an added measure of model's performance.
Author
Three Dimensional Models; Variability; Annual Variations; Transport Theory

20030102214
Software Development: Digitizing Historical Analog Seismograms for Wave Climate Analyses
Bromirski, Peter D.; Jun. 20, 2003; 8 pp.; In English
Contract(s)/Grant(s): N00014-01-1-0403
Report No.(s): AD-A415719; No Copyright; Avail: CASI; A02, Hardcopy

North Pacific storm systems strongly affect the California coast, with long period waves representing the single largest source of energy driving coastal processes. The understanding and modeling of near shore sediment transport over time requires a long record of wave statistics. The instrumental buoy wave record along the West Coast begins in the mid-1970's. The wave record along the California coast from 1930 to the beginning of the instrumental record can be obtained from analog long-period seismograms archived at UC Berkeley. Quantitative estimates of wave energy and climate change from archived seismograms require digital data for spectral processing. New software (SeisDig) has been developed for the efficient digitization of day-long seismograms for climatological studies. SeisDig is a Matlab based graphical user interface interactive digitizing package that produces digitized data from electronically scanned 'tif' images for wave climate reconstructions in Seismic Analysis Code (SAC2000) format.
DTIC
Computer Programs; Seismograms; Climatology

20030105723 Scripps Institution of Oceanography, La Jolla, CA
Turbulence Processes in the Stable Marine Atmospheric Boundary Layer
Dorman, Clive E.; Brooks, Ian M.; Aug. 7, 2003; 6 pp.; In English
Contract(s)/Grant(s): N00014-01-1-0258
Report No.(s): AD-A416595; No Copyright; Avail: CASI; A02, Hardcopy

The long-term goals of this study are to improve our understanding of turbulence processes within the stable marine atmospheric boundary layer in spatially heterogeneous coastal environments with the aim of improving numerical representation of such environments.
DTIC
Turbulence; Boundary Layer Stability

47
METEOROLOGY AND CLIMATOLOGY

Includes weather observation forecasting and modification.

20030088723 Florida State Univ., Tallahassee, FL, USA
Atmospheric Transport During the Transport and Chemical Evolution over the Pacific TRACE-P Experiment
Fuelberg, Henry E.; Kiley, C. M.; Hannan, J. R.; Westberg, D. J.; Avery, M. A.; Newell, R. E.; September 14, 2003; 1 pp.; In English
Contract(s)/Grant(s): NCC1-412; FSU-1338-832-26; Copyright; Avail: Other Sources; Abstract Only

Atmospheric transport over the Pacific Basin is described during NASA's Transport and Chemical Evolution Over the Pacific Experiment (TRACE-P) that was conducted between February - April 2001. The mission included extensive chemical sampling from two aircraft based primarily in Hong Kong and Yokota Air Base, Japan. Meteorological conditions during TRACE-P changed rapidly due to the seasonal winter/spring transition and the decay of prolonged ENSO cold phase (La Nina) conditions. To document these changes, TRACE-P was divided into two halves, and mean flow patterns during each half are presented and discussed. Important circulation features are the semi-permanent Siberian anticyclone and transient middle latitude cyclones that form near eastern Asia and then move eastward over the northern Pacific. Five-day backward trajectories from the various flight tracks show that air sampled by the aircraft had been transported from a variety of locations. Some parcels remained over the tropical western North Pacific during the entire period, while other important origins were Southeast Asia, Africa, and central Asia. Patterns of satellite-derived precipitation and lightning are described. TRACE-P occurs during a neutral to weak La Nina period of relatively cold sea surface temperatures in the tropical Pacific. Compared to climatology, the TRACE-P period exhibits deep convection located west of its typical position; however, tropospheric flow patterns do not exhibit a strong La Nina signal. Circulation patterns during TRACE-P are found to be generally similar to those during NASA's PEM WEST-B mission that occurred in the same region during February - March 1994.
Author
Atmospheric Circulation; Transport Theory; Chemical Evolution; Air Sampling; Chemical Analysis; Pacific Ocean

20030088794 Florida State Univ., Tallahassee, FL, USA
The Role of Wave Cyclones in Transporting Boundary Layer Air to the Free Troposphere During the Spring 2001 NASA / TRACE-P Experiment
Fuelberg, Henry E.; Hannan, J. R.; Crawford, J. H.; Sachse, G. W.; Blake, D. R.; September 14, 2003; 1 pp.; In English
Contract(s)/Grant(s): NCC1-412; FSU-1338-835-26; No Copyright; Avail: Other Sources; Abstract Only

Transport of boundary layer air to the free troposphere by cyclones during NASA's Transport and Chemical Evolution over the Pacific (TRACE-P) experiment is investigated. Airstreams responsible for boundary layer venting are diagnosed using results from a high-resolution meteorological model (MM5) together with in situ and remotely sensed chemical data. Hourly wind data from the MM5 are used to calculate three-dimensional grids of backward air trajectories. A reverse domain filling (RDF) technique then is employed to examine the characteristics of airstreams over the computational domain, and to isolate airstreams ascending from the boundary layer to the free troposphere during the previous 36 hours. Two cases are examined in detail. Results show that airstreams responsible for venting the boundary layer differ considerably from those described by classic conceptual models and in the recent literature. In addition, airstreams sampled by the TRACE-P aircraft are found to exhibit large variability in chemical concentrations. This variability is due to differences in the boundary layer histories of individual airstreams with respect to anthropogenic sources over continental Asia and Japan. Complex interactions between successive wave cyclones also are found to be important in determining the chemical composition of the airstreams. Particularly important is the process of post-cold frontal boundary layer air being rapidly transported offshore and recirculated into ascending airstreams of upstream cyclones.
Author
Atmospheric Boundary Layer; Cyclones; Troposphere; Atmospheric Circulation

20030091482 Meteorological Satellite Center, Kiyose, Japan
Monthly Report of the Meteorological Satellite Center: June 2003
June 2003; In English; In Japanese; Document files and Satellite data are recorded in either ASCII or shift JIS code; Full Disk Earth's Cloud Images are recorded in Bit-Map (BMP) format; Copyright; Avail: Other Sources

The CD-ROM concerning the June 2003 Monthly Report of the Meteorological Satellite Center (MSC) contains the observation data derived from the Geostationary Meteorological Satellite (GMS) of Japan and the Polar Orbital Meteorological Satellites operated by NOAA. The CD-ROM contains the following observation data: Full Disk Earth's Cloud Image; Cloud Image of Japan and its vicinity; Cloud Amount; Sea Surface Temperature; Cloud Motion Wind; Water Vapor Motion Wind; Equivalent Blackbody Temperature; OLR (Out-going Longwave Radiation), Solar Radiation; Snow and Ice Index; Orbit Data; Attitude Data; VISSR Image Data Catalog (Cartridge Magnetic Tape (CMT), Micro Film); TOVS (TIROS Operational Vertical Sounder) Vertical Profile of Temperature and Precipitable Water; and TOVS Total Ozone Amount.
Derived from text
Satellite Observation; Satellite Sounding; Atmospheric Sounding; Meteorological Parameters; Satellite Imagery; Japan

20030093552 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Inertio Gravity Waves in the Upper Mesosphere
Mayr, H. G.; Mengel, J. G.; Talaat, E. L.; Porter, H. S.; Chan, K. L.; [2003]; 14 pp.; In English; No Copyright; Avail: CASI; A03, Hardcopy

In the polar region of the upper mesosphere, horizontal wind oscillations have been observed with periods around 10 hours (Hernandez et al., 1992). Such waves are generated in our Numerical Spectral Model (NSM) and appear to be inertio gravity waves (IGW). Like the planetary waves (PW) in the model, the IGWs are generated by instabilities that arise in the mean zonal circulation. In addition to stationary waves for m = 0, eastward and westward propagating waves for m = 1 to 4 appear above 70 km that grow in magnitude up to about 110 km, having periods between 9 and 11 hours. The m = 1 westward propagating IGWs have the largest amplitudes, which can reach at the poles 30 m/s. Like PWs, the IGWs are intermittent but reveal systematic seasonal variations, with the largest amplitudes occurring generally in winter and spring. The IGWs propagate upward with a vertical wavelength of about 20 km.
Author
Gravity Waves; Mathematical Models; Zonal Flow (Meteorology); Mesosphere; Spectral Theory; Polar Regions

20030093556 Florida State Univ., Tallahassee, FL, USA
An Intercomparison and Evaluation of Aircraft-Derived and Simulated CO from Seven Chemical Transport Models During the TRACE-P Experiment
Kiley, C. M.; Fuelberg, Henry E.; Palmer, P. I.; Allen, D. J.; Carmichael, G. R.; Jacob, D. J.; Mari, C.; Pierce, R. B.; Pickering, K. E.; Tang, Y., et al.; 2002; 1 pp.; In English
Contract(s)/Grant(s): NCC1-412
Report No.(s): FSU-1338-835-26; No Copyright; Avail: Other Sources; Abstract Only

Four global scale and three regional scale chemical transport models are intercompared and evaluated during NASA's

TRACE-P experiment. Model simulated and measured CO are statistically analyzed along aircraft flight tracks. Results for the combination of eleven flights show an overall negative bias in simulated CO. Biases are most pronounced during large CO events. Statistical agreements vary greatly among the individual flights. Those flights with the greatest range of CO values tend to be the worst simulated. However, for each given flight, the models generally provide similar relative results. The models exhibit difficulties simulating intense CO plumes. CO error is found to be greatest in the lower troposphere. Convective mass flux is shown to be very important, particularly near emissions source regions. Occasionally meteorological lift associated with excessive model-calculated mass fluxes leads to an overestimation of mid- and upper- tropospheric mixing ratios. Planetary Boundary Layer (PBL) depth is found to play an important role in simulating intense CO plumes. PBL depth is shown to cap plumes, confining heavy pollution to the very lowest levels.
Author
Atmospheric Models; Carbon Monoxide; Atmospheric Composition

20030093582 Chicago State Univ., Chicago, IL, USA
Lightning Location
Solakiewicz, Richard; The 2002 NASA Faculty Fellowship Program Research Reports; April 2003, pp. XLVII-1 - XLVII-5; In English; See also 20030093576
Contract(s)/Grant(s): NAG8-1859; No Copyright; Avail: CASI; C01, CD-ROM; A01, Hardcopy

The Lightning Mapping Array (LMA) is a collection of radio wave Time of Arrival (TOA) sensors. With knowledge of the sensors, positions and TOA's from a source, it is possible to locate the source and find its time of occurrence. The n sensors' locations are specified by (h(sub j), V(sub j), lambda(sub j)), j = 1, 2,..., n, where h denotes altitude above the Earth's surface, V is the geodetic latitude, and lambda is the longitude. We will also use spherical coordinates (R, phi, lambda), with R being the distance from the center of the Earth and phi denoting spherical latitude. Oblate spheroidal coordinates are given by (epsilon, eta, lambda), where epsilon = constant represents an oblate spheroid and eta is the spheroidal latitude. The longitudes in all 3 systems are the same.
Derived from text
Coordinates; Geodesy; Latitude; Oblate Spheroids; Radio Waves

20030093643 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Non-Migrating Diurnal Tides Generated with Planetary Waves in the Mesosphere
Mayr, H. G.; Mengel, J. G.; Talaat, E. R.; Porter, H. S.; Chan, K. L.; May 2003; 18 pp.; In English
Contract(s)/Grant(s): NAS5-97179; No Copyright; Avail: CASI; A03, Hardcopy

We report here the results from a modeling study with our Numerical Spectral Model (NSM) that extends from the ground into thermosphere. The NSM incorporates Hines Doppler Spread Parameterization for small-scale gravity waves (GWs) and describes the major dynamical features of the atmosphere, including the wave driven equatorial oscillations (QBO and SAO), and the seasonal variations of tides and planetary waves. Accounting solely for the solar migrating tidal excitation sources, the NSM generates through dynamical interactions also non-migrating tides in the mesosphere that have amplitudes comparable to those observed. The model produces the diurnal (and semidiurnal) oscillations of the zonal mean (m = 0), and eastward and westward propagating tides for zonal wave numbers m = 1 to 4. To identify the mechanism of excitation for these tides, a numerical experiment is performed. The NSM is run without the heat source for the zonal-mean circulation and temperature variation, and the amplitudes of the resulting nonmigrating tides are then negligibly small. This leads to the conclusion that the planetary waves, which normally are excited in the NSM by instabilities but are suppressed in this case, generate the nonmigrating tides through nonlinear interactions with the migrating tides.
Author
Diurnal Variations; Mathematical Models; Mesosphere; Planetary Waves; Zonal Flow (Meteorology); Spectral Theory

20030093717 NASA Goddard Space Flight Center, Greenbelt, MD, USA
The Madden-Julian Oscillation and its Impact on Northern Hemisphere Weather Predictability during Wintertime
Jones, Charles; Waliser, Duane E.; Lau, K. M.; Stern, W.; [2003]; 25 pp.; In English
Contract(s)/Grant(s): NSF ATM-00-94387; NA16GP1019; NA16GP1030; NSF ATM-00-94416; NA16GP2021; No Copyright; Avail: CASI; A03, Hardcopy

The Madden-Julian Oscillation (MJO) is known as the dominant mode of tropical intraseasonal variability and has an important role in the coupled-atmosphere system. This study used twin numerical model experiments to investigate the influence of the MJO activity on weather predictability in the midlatitudes of the Northern Hemisphere during boreal winter.

The National Aeronautics and Space Administration (NASA) Goddard laboratory for the Atmospheres (GLA) general circulation model was first used in a 10-yr simulation with fixed climatological SSTs to generate a validation data set as well as to select initial conditions for active MJO periods and Null cases. Two perturbation numerical experiments were performed for the 75 cases selected [(4 MJO phases + Null phase) _ 15 initial conditions in each]. For each alternative initial condition, the model was integrated for 90 days. Mean anomaly correlations in the midlatitudes of the Northern Hemisphere (2O deg N_60 deg.N) and standardized root-mean-square errors were computed to validate forecasts and control run. The analyses of 500-hPa geopotential height, 200-hPa Streamfunction and 850-hPa zonal wind component systematically show larger predictability during periods of active MJO as opposed to quiescent episodes of the oscillation.
Author
Anomalies; Atmospheric General Circulation Models; Atmospheric Models; Madden-Julian Oscillation; Mathematical Models; Root-Mean-Square Errors

20030093737 NASA Goddard Space Flight Center, Greenbelt, MD, USA
The Earth System Model
Schoeberl, Mark; Rood, Richard B.; Hildebrand, Peter; Raymond, Carol; [2003]; 6 pp.; In English; IGARSS 2003, 21-25 Jul. 2003, Toulouse, France; No Copyright; Avail: CASI; A02, Hardcopy

The Earth System Model is the natural evolution of current climate models and will be the ultimate embodiment of our geophysical understanding of the planet. These models are constructed from components - atmosphere, ocean, ice, land, chemistry, solid earth, etc. models and merged together through a coupling program which is responsible for the exchange of data from the components. Climate models and future earth system models will have standardized modules, and these standards are now being developed by the ESMF project funded by NASA. The Earth System Model will have a variety of uses beyond climate prediction. The model can be used to build climate data records making it the core of an assimilation system, and it can be used in OSSE experiments to evaluate. The computing and storage requirements for the ESM appear to be daunting. However, the Japanese ES theoretical computing capability is already within 20% of the minimum requirements needed for some 2010 climate model applications. Thus it seems very possible that a focused effort to build an Earth System Model will achieve succcss.
Derived from text
Climate Models; Predictions; Earth Sciences; Geophysics

20030093751 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Validation and Error Characterization for the Global Precipitation Measurement
Bidwell, Steven W.; Adams, W. J.; Everett, D. F.; Smith, E. A.; Yuter, S. E.; [2003]; 4 pp.; In English; 2003 International Geoscience and Remote Sensing Symposium, July 2003, Toulouse, France; Copyright; Avail: CASI; A01, Hardcopy

The Global Precipitation Measurement (GPM) is an international effort to increase scientific knowledge on the global water cycle with specific goals of improving the understanding and the predictions of climate, weather, and hydrology. These goals will be achieved through several satellites specifically dedicated to GPM along with the integration of numerous meteorological satellite data streams from international and domestic partners. The GPM effort is led by the National Aeronautics and Space Administration (NASA) of the USA and the National Space Development Agency (NASDA) of Japan. In addition to the spaceborne assets, international and domestic partners will provide ground-based resources for validating the satellite observations and retrievals. This paper describes the validation effort of Global Precipitation Measurement to provide quantitative estimates on the errors of the GPM satellite retrievals. The GPM validation approach will build upon the research experience of the Tropical Rainfall Measuring Mission (TRMM) retrieval comparisons and its validation program. The GPM ground validation program will employ instrumentation, physical infrastructure, and research capabilities at Supersites located in important meteorological regimes of the globe. NASA will provide two Supersites, one in a tropical oceanic and the other in a mid-latitude continental regime. GPM international partners will provide Supersites for other important regimes. Those objectives or regimes not addressed by Supersites will be covered through focused field experiments. This paper describes the specific errors that GPM ground validation will address, quantify, and relate to the GPM satellite physical retrievals. GPM will attempt to identify the source of errors within retrievals including those of instrument calibration, retrieval physical assumptions, and algorithm applicability. With the identification of error sources, improvements will be made to the respective calibration, assumption, or algorithm. The instrumentation and techniques of the Supersites will be discussed. The GPM core satellite, with its dual-frequency radar and conically scanning radiometer, will provide insight into precipitation drop-size distributions and potentially increased measurement capabilities of light rain and snowfall. The

ground validation program will include instrumentation and techniques commensurate with these new measurement capabilities.
Author
Satellite Observation; Proving; Error Analysis; Climate; Weather; Hydrology

20030095973 NASA Goddard Space Flight Center, Greenbelt, MD, USA
The Correlation Between Tropical Convection and Upper Tropospheric Momentum Flux Convergence
O'CStarr, David; Boehm, Matthew T.; July 31, 2003; 49 pp.; In English; Copyright; Avail: CASI; A03, Hardcopy

In this study, the relationship between tropical convection and the meridional convergence of zonal momentum flux in the tropical upper troposphere is investigated using NOAA interpolated outgoing longwave radiation data and NCEP-NCAR reanalysis wind data. In particular, a variety of correlation coefficients are calculated between the data sets, both of which are filtered to isolate disturbances with frequencies and wavenumbers consistent with the Madden-Julian oscillation. The results show regions of significant correlation during each season, with the magnitude and area covered by significant correlation coefficients varying with season. Furthermore, it is found that the correlation structures look very similar to theoretical calculations of the atmospheric response to a region of tropical heating. This result suggests that tropical waves, in particular mixed Rossby-gravity waves, play an important role in the meridional transport zonal momentum into the deep tropical upper troposphere. Finally, these findings have implications to the generation of rising motion near the tropical tropopause, which in turn has ramifications for vertical moisture transport and tropopause cirrus formation.
Author
Atmospheric Stratification; Correlation Coefficients; Troposphere; Convection

20030096007 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Tropospheric Wind Profiles Obtained with the GLOW Molecular Doppler Lidar during the 2002 International H2O Project
Gentry, Bruce M.; Chen, Huai-Lin; Li, Steven X.; Mathur, S.; Dobler, Jeremy; Hasselbrack, William; [2003]; 3 pp.; In English; International Symposium on Tropospheric Profiling: Needs and Technologies, 14-20 Sep. 2003, Leipzig, Germany; Copyright; Avail: CASI; A01, Hardcopy

The Goddard Lidar Observatory for Winds (GLOW) is a mobile direct detection Doppler lidar system which uses the double edge technique to measure the Doppler shift of the molecular backscattered laser signal at a wavelength of 355 nm. In the spring of 2002 GLOW was deployed to the western Oklahoma profiling site (36 deg 33.500 min N, 100 deg 36.371 min W) to participate in the International H2O Project (IHOP). During the IHOP campaign over 240 hours of wind profiles were obtained with the GLOW lidar in support of a variety of scientific investigations.
Author
Doppler Radar; Troposphere; Wind Profiles; Observatories; Water

20030098022 National Oceanic and Atmospheric Administration, Boulder, CO, USA
Analysis of CASES-99 Lidar and Turbulence Data in Support of Wind Turbine Effects
Banta, R. M.; Jun. 2003; In English
Report No.(s): DE2003-15003886; No Copyright; Avail: National Technical Information Service (NTIS)

The nocturnal low-level jet (LLJ) of the Great Plains of the central USA has been identified as a promising source of high-momentum wind flow for wind energy. Wind turbine installation has been proposed near Oxford, Kansas, and Lamar, Colorado. The acceleration of the winds after sunset above the surface produces a jet profile in the wind velocity, as described by Blackadar (1957), with maximum speeds that often exceed 10 m s-1 or more at heights near 100 m or more. These high wind speeds are advantageous for wind energy generation. The high speeds aloft, however, also produce a region of high shear between the LLJ and the earth's surface, where the nocturnal flow is often calm or nearly so. This shear zone below the LLJ generates atmospheric waves and turbulence that can cause strong vibration in the turbine rotors. It has been suggested that these vibrations contribute to premature failures in large wind turbines (Kelley et al. 2000), which, of course, would be a considerable disadvantage for wind energy applications. Concerns center around periodic fluctuations or coherent turbulent structures in the flow and wind shears at rotor heights as a cause of premature failure in large wind turbines. The most critical heights are the 50-200 m levels above ground level (AGL).
NTIS
Atmospheric Turbulence; Jet Streams (Meteorology); Optical Radar; Turbulent Flow; Wind Turbines; Great Plains Corridor (North America)

20030098043 NASA Goddard Space Flight Center, Greenbelt, MD, USA
MOD06 Optical and Microphysical Retrievals
King, Michael D.; Platnick, Steven; Arnold, G. T.; Dinsick, J.; Gatebe, C. K.; Gray, M. A.; Hubanks, P. A.; Moody, E. G.; Wind, B.; Wind, G.; July 2003; 15 pp.; In English
Report No.(s): Rept-34; No Copyright; Avail: CASI; A03, Hardcopy

Major efforts over the past six months included: (1) submission of MOD06 Optical and Microphysical Retrieval recompetition proposal, (2) delivery of a MODIS Atmosphere Level-3 update, (3) delivery of the MODIS Atmosphere s new combined Level-2 product, (4) development of an above-cloud precipitable water research algorithm and a multi-layer cloud detection algorithm, (5) continued development of a Fortran 90 version of the retrieval code for use with MAS as well as operational MODIS processing, (6) preliminary analysis of CRYSTAL-FACE field experiment in July 2002, (7) continued analysis of data obtained during the SAFARI 2000 dry season campaign in southern Africa, and the Arctic FIRE-ACE experiment.
Author
Algorithms; Clouds (Meteorology)

20030102117 Air Force Weather Agency, Offutt AFB, NE, USA
Spring Regimes
Weber, Eugene M.; Apr. 15, 2003; 157 pp.; In English; Original contains color illustrations
Report No.(s): AD-A415555; AFWA/TN-03/001; No Copyright; Avail: CASI; A08, Hardcopy

This technical note presents a back-to-basics approach to forecasting the transitional weather system of spring. Although it is especially designed for new and inexperienced forecasters, it is an excellent review for all forecasters. As spring approaches, the CONUS becomes a battleground between cold winter-type air masses and warm summer-type air masses. This technical note presents synoptic patterns and regimes that routinely occur during the spring months Synoptic pattern recognition remains one of the most important considerations when producing a forecast and will help in determining if forecast model guidance is 'on track.'
DTIC
Spring (Season); Meteorology; Weather Forecasting

20030102189 Army Research Lab., White Sands Missile Range, NM, USA
Post-Processing for the Battlescale Forecast Model and Mesoscale Model Version 5
Passner, Jeffrey E.; Jun. 2003; 57 pp.; In English
Report No.(s): AD-A415683; ARL-TR-2988; No Copyright; Avail: CASI; A04, Hardcopy

The Battlescale Forecast Model (BFM) produces many forecasting parameters including temperature, pressure, dewpoint, relative humidity, wind information, as well as precipitation amounts. While these output data provide valuable weather information Tactical Decision Aids such as the Integrated Weather Effects Decision Aids (IWEDA) have a need for additional parameters such as icing and turbulence. The IWEDA generates current and forecasted impacts on approximately 70 weapon systems, such as attack helicopters and fixed wing aircraft, and personnel. Of most consequence to IWEDA, are the weather hazards on military operations. These hazards include three-dimensional (3-D) weather effects such as icing, turbulence, and clouds as well as several two-dimensional products that include surface visibility, fog, and thunderstorms. The raw output fields from the BFM and the MM5 can be used to derive these vital weather parameters.
DTIC
Mesoscale Phenomena; Military Helicopters; Weapon Systems; Weather Forecasting; Atmospheric Models; Aircraft Configurations

20030102236 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Performance of Goddard Earth Observing System GCM Column Radiation Models under Heterogeneous Cloud Conditions
Oreopoulos, L.; Chou, M.-D.; Khairoutdinov, M.; Barker, H. W.; Cahalan, R. F.; [2003]; 36 pp.; In English
Contract(s)/Grant(s): DE-AI02-00ER-62939; NAG5-11631; No Copyright; Avail: CASI; A03, Hardcopy

We test the performance of the shortwave (SW) and longwave (LW) Column Radiation Models (CORAMs) of Chou and collaborators with heterogeneous cloud fields from a global single-day dataset produced by NCAR's Community Atmospheric Model with a 2-D CRM installed in each gridbox. The original SW version of the CORAM performs quite well compared to reference Independent Column Approximation (ICA) calculations for boundary fluxes, largely due to the success of a

combined overlap and cloud scaling parameterization scheme. The absolute magnitude of errors relative to ICA are even smaller for the LW CORAM which applies similar overlap. The vertical distribution of heating and cooling within the atmosphere is also simulated quite well with daily-averaged zonal errors always below 0.3 K/d for SW heating rates and 0.6 K/d for LW cooling rates. The SW CORAM's performance improves by introducing a scheme that accounts for cloud inhomogeneity. These results suggest that previous studies demonstrating the inaccuracy of plane-parallel models may have unfairly focused on worst scenario cases, and that current radiative transfer algorithms of General Circulation Models (GCMs) may be more capable than previously thought in estimating realistic spatial and temporal averages of radiative fluxes, as long as they are provided with correct mean cloud profiles. However, even if the errors of the particular CORAMs are small, they seem to be systematic, and the impact of the biases can be fully assessed only with GCM climate simulations.
Author
Earth Observing System (Eos); Atmospheric General Circulation Models

20030102242 NASA Goddard Space Flight Center, Greenbelt, MD, USA
The Impact of a Amazonian Deforestation on Dry-Season Rainfall
Negri, Andrew J.; Adler, Robert F.; Xu, Liming; Surratt, Jason; [2003]; 30 pp.; In English; Copyright; Avail: CASI; A03, Hardcopy

Many modeling studies have concluded that widespread deforestation of Amazonia would lead to decreased rainfall. We analyze geosynchronous infrared satellite data with respect to percent cloudiness, and analyze rain estimates from microwave sensors aboard the Tropical Rainfall Measuring Mission satellite. We conclude that in the dry-season, when the effects of the surface are not overwhelmed by synoptic-scale weather disturbances, shallow cumulus cloudiness, deep convective cloudiness, and rainfall occurrence all are larger over the deforested and non-forested (savanna) regions than over areas of dense jungle. This difference is in response to a local circulation initiated by the differential heating of the region s varying forestation. Analysis of the diurnal cycle of cloudiness reveals a shift in the onset of convection toward afternoon hours in the deforested and towards the morning hours in the savanna regions when compared to the neighboring forested regions. Analysis of 14 years of monthly estimates from the Special Sensor Microwave/Imager data revealed that in only in August was there a pattern of higher monthly rainfall amounts over the deforested region.
Author
Amazon Region (South America); Deforestation; Rain; Climatology; Seasons

20030102243 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Retrieval of Precipitation Profiles from Multiresolution, Multifrequency, Active and Passive Microwave Observations
Grecu, Mircea; Olson, William S.; Anagnostou, Emmanouil N.; [2003]; 35 pp.; In English; Copyright; Avail: CASI; A03, Hardcopy

In this study, a technique for estimating vertical profiles of precipitation from multifrequency, multiresolution active and passive microwave observations is investigated. The technique is applicable to the Tropical Rainfall Measuring Mission (TRMM) observations and it is based on models that simulate high-resolution brightness temperatures as functions of observed reflectivity profiles and a parameter related to the rain drop-size-distribution. The modeled high-resolution brightness temperatures are used to determine normalized brightness temperature polarizations at the microwave radiometer resolution. An optimal estimation procedure is employed to minimize the differences between the simulated and observed normalized polarizations by adjusting the drop-size-distribution parameter. The impact of other unknowns that are not independent variables in the optimal estimation but affect the retrievals is minimized through statistical parameterizations derived from cloud model simulations. The retrieval technique is investigated using TRMM observations collected during the Kwajalein Experiment (KWAJEX). These observations cover an area extending from 5 deg to deg N latitude and 166 deg to 172 deg E longitude from July to September 1999, and are coincident with various ground-based observations, facilitating a detailed analysis of the retrieved precipitation. Using the method developed in this study, precipitation estimates consistent with both the passive and active TRMM observations are obtained. Various parameters characterizing these estimates, i.e. the rain rate, the precipitation water content, the drop-size-distribution intercept, and the mass weighted mean drop diameter, are in good qualitative agreement with independent experimental and theoretical estimates. Combined rain estimates are in general higher than the official TRMM Precipitation Radar (PR) only estimates for the area and the period considered in the study. Ground-based precipitation estimates, derived from an analysis of rain gauge and ground radar data, are in better agreement with the combined estimates than with the TRMM PR-only estimates, which suggests that information useful for improving the radar-only estimates is contained in the brightness temperature data.
Author
Precipitation Particle Measurement; Drop Size; Size Distribution; Profiles; Precipitation (Meteorology)

20030102245 NASA Goddard Space Flight Center, Greenbelt, MD, USA

A Physical Model to Determine Snowfall over Land by Microwave Radiometry

Skofronick-Jackson, G.; Kim, M.-J.; Weinman, J. A.; Chang, D.-E.; [2003]; 28 pp.; In English; IEEE TGARS; Copyright; Avail: CASI; A03, Hardcopy

Because microwave brightness temperatures emitted by snow covered surfaces are highly variable, snowfall above such surfaces is difficult to observe using window channels that occur at low frequencies (v less than 100 GHz). Furthermore, at frequencies v less than or equal to 37 GHz, sensitivity to liquid hydrometeors is dominant. These problems are mitigated at high frequencies (v greater than 100 GHz) where water vapor screens the surface emission and sensitivity to frozen hydrometeors is significant. However the scattering effect of snowfall in the atmosphere at those higher frequencies is also impacted by water vapor in the upper atmosphere. This work describes the methodology and results of physically-based retrievals of snow falling over land surfaces. The theory of scattering by randomly oriented dry snow particles at high microwave frequencies appears to be better described by regarding snow as a concatenation of equivalent ice spheres rather than as a sphere with the effective dielectric constant of an air-ice mixture. An equivalent sphere snow scattering model was validated against high frequency attenuation measurements. Satellite-based high frequency observations from an Advanced Microwave Sounding Unit (AMSU-B) instrument during the March 5-6, 2001 New England blizzard were used to retrieve snowfall over land. Vertical distributions of snow, temperature and relative humidity profiles were derived from the Pennsylvania State University-National Center for Atmospheric Research (PSU-NCAR) fifth-generation Mesoscale Model (MM5). Those data were applied and modified in a radiative transfer model that derived brightness temperatures consistent with the AMSU-B observations. The retrieved snowfall distribution was validated with radar reflectivity measurements obtained from the National Oceanic and Atmospheric Administration (NOAA) National Weather Service (NWS) ground-based radar network.

Author

Advanced Microwave Sounding Unit; Microwave Radiometers; Atmospheric Models; Meteorology; Snow

20030102247 NASA Goddard Space Flight Center, Greenbelt, MD, USA

The 'RED Versa NIR' Plane to Retrieve Broken-Cloud Optical Depth from Ground-Based Measurements'

Marshak, A.; Knyazikhin, Y.; Evans, K.; Wiscombe, W.; [2003]; 29 pp.; In English

Contract(s)/Grant(s): DE-A105-90ER-61069; NAG5-11373; No Copyright; Avail: CASI; A03, Hardcopy

A new method for retrieving cloud optical depth from ground-based measurements of zenith radiance in the RED and near infrared (MR) spectral regions is introduced. Because zenith radiance does not have a one-to-one relationship with optical depth, it is absolutely impossible to use a monochromatic retrieval. On the other side, algebraic combinations of spectral radiances such as NDCI while largely removing nouniquiness and the radiative effects of cloud inhomogeneity, can result in poor retrievals due to its insensitivity to cloud fraction. Instead, both RED and NIR radiances as points on the 'RED vs. NIR' plane are proposed to be used for retrieval. The proposed retrieval method is applied to Cimel measurements at the Atmospheric Radiation Measurements (ARM) site in Oklahoma. Cimel, a multi-channel sunphotometer, is a part of AERONET - a ground-based network for monitoring aerosol optical properties. The results of retrieval are compared with the ones from Microwave Radiometer (MWR) and Multi-Filter Rotating Shadowband Radiometers (MFRSR) located next to Cimel at the ARM site. In addition, the performance of the retrieval method is assessed using a fractal model of cloud inhomogeneity and broken cloudiness. The preliminary results look very promising both theoretically and from measurements.

Author

Optical Thickness; Cloud Cover; Radiance; Visible Spectrum; Infrared Spectra

20030102259 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Seasonal Evolution and Variability Associated with the West African Monsoon System

Gu, Guojun; Adler, Robert F.; January 2003; 42 pp.; In English; No Copyright; Avail: CASI; A03, Hardcopy

In this study, we investigate the seasonal variations in surface rainfall and associated large-scale processes in the tropical eastern Atlantic and West African region. The 5-yr (1998-2002) high-quality TRMM rainfall, sea surface temperature (SST), water vapor and cloud liquid water observations are applied along with the NCEP/NCAR reanalysis wind components and a 3-yr (2000-2002) Quickscat satellite-observed surface wind product. Major mean rainfall over West Africa tends to be concentrated in two regions and is observed in two different seasons, manifesting an abrupt shift of the mean rainfall zone during June-July. (i) Near the Gulf of Guinea (about 5 degN), intense convection and rainfall are seen during April-June and roughly follow the seasonality of SST in the tropical eastern Atlantic. (ii) Along the latitudes of about 10 deg. N over the interior West African continent, a second intense rain belt begins to develop from July and remains there during the later summer season. This belt co-exists with a northwardmoved African Easterly Jet (AEJ) and its accompanying horizonal and

vertical shear zones, the appearance and intensification of an upper tropospheric Tropical Easterly Jet (TEJ), and a strong low-level westerly flow. Westward-propagating wave signals [i e . , African easterly waves (AEWs)] dominate the synoptic-scale variability during July-September, in contrast to the evident eastward-propagating wave signals during May-June. The abrupt shift of mean rainfall zone thus turns out to be a combination of two different physical processes: (i) Evident seasonal cycles in the tropical eastern Atlantic ocean which modulate convection and rainfall in the Gulf of Guinea by means of SST thermal forcing and SST-related meridional gradient; (ii) The interaction among the AEJ, TEJ, low-level westerly flow, moist convection and AEWs during July-September which modulates rainfall variability in the interior West Africa, primarily within the ITCZ rain band. Evident seasonality in synoptic-scale wave signals is shown to be a good evidence for this seasonal evolution.
Author
Monsoons; Trmm Satellite; Clouds (Meteorology); Africa; Annual Variations

20030102265 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Regional-Scale Modeling at NASA Goddard Space Flight Center
Tao, W.-K.; Adler, R.; Baker, D.; Braun, S.; Chou, M.-D.; Jasinski, M. F.; Jia, Y.; Kakar, R.; Karyampudi, M.; Lang, S., et al.; [2003]; 74 pp.; In English; Copyright; Avail: CASI; A04, Hardcopy

Over the past decade, the Goddard Mesoscale Modeling and Dynamics Group has used a popular regional scale model, MM5, to study precipitation processes. Our group is making contributions to the MM5 by incorporating the following physical and numerical packages: improved Goddard cloud processes, a land processes model (Parameterization for Land-Atmosphere-Cloud Exchange - PLACE), efficient but sophisticated radiative processes, conservation of hydrometeor mass (water budget), four-dimensional data assimilation for rainfall, and better computational methods for trace gas transport. At NASA Goddard, the MM5 has been used to study: (1) the impact of initial conditions, assimilation of satellite-derived rainfall, and cumulus parameterizations on rapidly intensifying oceanic cyclones, hurricanes and typhoons, (2) the dynamic and thermodynamic processes associated with the development of narrow cold frontal rainbands, (3) regional climate and water cycles, (4) the impact of vertical transport by clouds and lightning on trace gas distributiodproduction associated with South and North American mesoscale convective systems, (5) the development of a westerly wind burst (WWB) that occurred during the TOGA COARE and the diurnal variation of precipitation in the tropics, (6) a Florida sea breeze convective event and a Mid-US flood event using a sophisticated land surface model, (7) the influence of soil heterogeneity on land surface energy balance in the southwest GCIP region, (8) explicit simulations (with 1.33 to 4 km horizontal resolution) of hurricanes Bob (1991) and Bonnie (1998), (9) a heavy precipitation event over Taiwan, and (10) to make real time forecasts for a major NASA field program. In this paper, the modifications and simulated cases will be described and discussed.
Author
Precipitation (Meteorology); Atmospheric Models; Climate Models

20030102268 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Global Precipitation Measurement (GPM) Orbit Design and Autonomous Maneuvers
Folta, David; Mendelsohn, Chad; Mailhe, Laurie; [2003]; 19 pp.; In English; 2003 AAS/AIAA Astrodynamics Specialist Conference Meeting, 3-7 Aug. 2003, Big Sky, MT, USA
Report No.(s): AAS-03-618; Copyright; Avail: CASI; A03, Hardcopy

The NASA Goddard Space Flight Center's Global Precipitation Measurement (GPM) mission must meet the challenge of measuring worldwide precipitation every three hours. The GPM core spacecraft, part of a constellation, will be required to maintain a circular orbit in a high drag environment at a near-critical inclination. Analysis shows that a mean orbit altitude of 407 km is necessary to prevent ground track repeating. Combined with goals to minimize maneuver operation impacts to science data collection and to enable reasonable long-term orbit predictions, the GPM project has decided to fly the GSFC autonomous maneuver system, AutoCon(TM). This system is a follow-up version of the highly successful New Millennium Program technology flown onboard the Earth Observing-1 formation flying mission. This paper presents the driving science requirements and goals of the GPM mission and shows how they will be met. Selection of the mean semi-major axis, eccentricity, and the AV budget for several ballistic properties are presented. The architecture of the autonomous maneuvering system to meet the goals and requirements is presented along with simulations using GPM parameters. Additionally, the use of the GPM autonomous system to mitigate possible collision avoidance and to aid other spacecraft systems during navigation outages is explored.
Author
Precipitation Measurement; Precipitation (Meteorology); Orbit Calculation; Autonomy; Maneuvers

20030105556 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Simulation of the Onset of the Southeast Asian Monsoon During 1997 and 1998: The Impact of Surface Processes

Wang, Yansen; Tao, W.-K.; Lau, K.-M.; Wetzel, Peter J.; [2003]; 38 pp.; In English; No Copyright; Avail: CASI; A03, Hardcopy

The onset of the southeast Asian monsoon during 1997 and 1998 was simulated with a coupled mesoscale atmospheric model (MM5) and a detailed land surface model. The rainfall results from the simulations were compared with observed satellite data fiom the TRMM (Tropical Rainfall Measuring Mission) TMI (TRMM Microwave Imager) and GPCP (Global Precipitation Climatology Project). The simulation with the land surface model captured basic signatures of the monsoon onset processes and associated rainfall statistics. The sensitivity tests indicated that land surface processes had a greater impact on the simulated rainfall results than that of a small sea surface temperature change during the onset period. In both the 1997 and 1998 cases, the simulations were significantly improved by including the land surface processes. The results indicated that land surface processes played an important role in modifying the low-level wind field over two major branches of the circulation; the southwest low-level flow over the Indo- China peninsula and the northern cold front intrusion from southern China. The surface sensible and latent heat exchange between the land and atmosphere modified the lowlevel temperature distribution and gradient, and therefore the low-level. The more realistic forcing of the sensible and latent heat from the detailed land surface model improved the monsoon rainfall and associated wind simulation.

Author

Monsoons; Atmospheric Models

20030105560 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Measurement of Low Amounts of Precipitable Water Vapor Using Ground-Based Millimeterwave Radiometry

Racette, Paul E.; Westwater, Ed R.; Han, Yong; Gasiewski, Albin J.; Klein, Marian; Cimini, Domenico; Jones, David C.; Manning, WIll; Kim, Edward J.; Wang, James R., et al.; [2003]; 43 pp.; In English; Copyright; Avail: CASI; A03, Hardcopy

Extremely dry conditions characterized by amounts of precipitable water vapor (PWV) as as 1-2 mm commonly occur in high-latitude regions during the winter months. While such atmospheres carry only a few percent of the latent heat energy compared to tropical atmospheres, the effects of low vapor amounts on the polar radiation budget - both directly through modulation of longwave radiation and indirectly through the formation of clouds - are considerable. Accurate measurements of precipitable water vapor (PWV) during such dry conditions are needed to improve polar radiation models for use in understanding and predicting change in the climatically sensitive polar regions. To this end, the strong water vapor absorption at 183.310 GHz provides a unique means of measuring low amounts of PWV. Weighting function analysis, forward model calculations based upon a 7-year radiosonde dataset, and retrieval simulations consistently predict that radiometric measurements made using several millimeter-wavelength (MMW) channels near the 183 GHz line, together with established microwave (MW) measurements at the 22.235 GHz water vapor line and -3 1 GHz atmospheric absorption window can be used to determine within 5% uncertainty the full range of PWV expected in the Arctic. This unique collective capability stands in spite of accuracy limitations stemming from uncertainties due to the sensitivity of the vertical distribution of temperature and water vapor at MMW channels. In this study the potential of MMW radiometry using the 183 GHz line for measuring low amounts of PWV is demonstrated both theoretically and experimentally. The study uses data obtained during March 1999 as part of an experiment conducted at the Department of Energy s Cloud and Radiation Testbed (CART) near Barrow, Alaska. Several radiometers from both NOAA and NASA were deployed during the experiment to provide the first combined MMW and MW ground-based data set during dry arctic conditions. Single-channel retrievals of PWV were performed using the MW and MMW data. Discrepancies in the retrieved values were found to be consistent with differences observed between measured brightness temperatures (TBs) and forward-modeled TBs based on concurrent radiosonde profiles. These discrepancies are greater than can be explained by measurement error alone and are attributed to absorption model uncertainty. We discuss here the measurements, retrieval technique, and line model discrepancies along with difficulties and potential of MMW/MW PWV measurement.

Author

Water Vapor; Measurement; Measuring Instruments; Precipitation (Meteorology)

20030105577 NASA Goddard Space Flight Center, Greenbelt, MD, USA

NASA's EOS Terra Mission Update

Ranson, K. Jon; [2003]; 2 pp.; In English; International Geoscience and Remote Sensing Symposium, 21-25 Jul. 2003, Toulouse, France; No Copyright; Avail: CASI; A01, Hardcopy

NASA launched the Terra spacecraft, first major platform for the Earth Observing System, in December 1999. The platform has five instruments that acquire global data for a wide variety of scientific studies of the Earth's land, oceans, and

atmosphere. The Terra mission initiated a process of long-term measurements designed to assess and monitor the health of the Earth. This paper provides an overview of the Terra mission and the status of the spacecraft and instruments during the past year.
Author
Earth Atmosphere; Earth Observing System (Eos)

20030105585 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Early Results from AIRS/AMSU/HSB
Susskind, Joel; Barnet, Christopher; Blaisdell, John; Iredell, Lena; Keita, Fricky; Kouvaris, Lou; [2003]; 9 pp.; In English; SPIE Conference 48th Annual Meeting, 3-8 Aug. 2003, San Diego, CA, USA; No Copyright; Avail: CASI; A02, Hardcopy

AIRS was launched on EOS Aqua on May 5, 2002, together with AMSU A and HSB, to form a next generation polar orbiting infiared and microwave atmospheric sounding system. The primary products of AIRS/AMSU/HSB are twice daily global fields of atmospheric temperature-humidity profiles, ozone profiles, sea/land surface skin temperature, and cloud related parameters including OLR. The sounding goals of AIRS are to produce 1 km tropospheric layer mean temperatures with an rms error of lK, and layer precipitable water with an rms error of 20%, in cases with up to 80% effective cloud cover. Pre-launch simulation studies indicated that these results should be achievable. Minor modifications have been made to the pre-launch retrieval algorithm as described in this paper. Sample fields of parameters retrieved from AIRS/AMSU/HSB data are presented and validated as a function of retrieved fractional cloud cover. As in simulation, the degradation of retrieval accuracy with increasing cloud cover is small. Select fields are also compared to those contained in the ECMWF analysis, done without the benefit of AIRS data, to demonstrate information that AIRS can add to that already contained in the ECMWF analysis.
Author
Atmospheric Sounding; Infrared Radiation; Microwave Sounding; Algorithms; Spacecraft Instruments

20030105586 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Analysis of Measurements of Saharan Dust by Airborne and Ground-based Remote Sensing Methods during the Puerto Rico Dust Experiment (PRIDE)
Reid, Jeffrey S.; Kinney, James E.; Westphal, Douglas L.; Holben, Brent N.; Welton, E. Judd; Tsay, Si-Chee; Eleuterio, Daniel P.; Campbell, James; Christopher, Sundar A.; Jonsson, Haflidi H., et al.; [2003]; 48 pp.; In English
Contract(s)/Grant(s): N000-1401-WX20194; Copyright; Avail: CASI; A03, Hardcopy

For 26 days in mid-June and July 2000, a research group comprised of U.S. Navy, NASA, and university scientists conducted the Puerto Rico Dust Experiment (PRIDE). In this paper we give a brief overview of mean meteorological conditions during the study. We focus on findings on African dust transported into the Caribbean utilizing Navajo aircraft and AERONET Sun photometer data. During the study midvisible aerosol optical thickness (AOT) in Puerto Rico averaged 0.25, with a maximum less than 0.5 and with clean marine periods of _0.08. Dust AOTs near the coast of Africa (Cape Verde Islands and Dakar) averaged _0.4, 30% less than previous years. By analyzing dust vertical profiles in addition to supplemental meteorology and MPLNET lidar data we found that dust transport cannot be easily categorized into any particular conceptual model. Toward the end of the study period, the vertical distribution of dust was similar to the commonly assumed Saharan Air Layer (SAL) transport. During the early periods of the study, dust had the highest concentrations in the marine and convective boundary layers with only a, weak dust layer in the SAL being present, a state usually associated with wintertime transport patterns. We corroborate the findings of Maring et al. that in most cases, there was an unexpected lack of vertical stratification of dust particle size. We systematically analyze processes which may impact dust vertical distribution and determine and speculate that dust vertical distribution predominately influenced by flow patterns over Africa and differential advection couple with mixing by easterly waves and regional subsidence.
Author
Boundary Layers; Dust; Flow Distribution; Meteorology; Weather

48
OCEANOGRAPHY

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

20030091495 Scripps Institution of Oceanography, La Jolla, CA, USA
Optimal Observations for Variational Data Assimilation
Koehl, Armin; Stammer, Detlef; September 24, 2003; 41 pp.; In English; Original contains black and white illustrations
Contract(s)/Grant(s): NAG5-8623; ONR N00014-99-1-1049; No Copyright; Avail: CASI; A03, Hardcopy

An important aspect of Ocean state estimation is the design of an observing system that allows the efficient study of climate aspects in the ocean. A solution of the design problem is presented here in terms of optimal observations that emerge as nondimensionalized singular vectors of the modified data resolution matrix. The actual computation is feasible only for scalar quantities in the limit of large observational errors. In the framework of a lo resolution North Atlantic primitive equation model it is demonstrated that such optimal observations when applied to determining the strength of the volume and heat transport across the Greenland-Scotland ridge, perform significantly better than traditional section data. On seasonal to inter-annual time-scales optimal observations are located primarily along the continental shelf and information about heat-transport, wind stress and stratification is being communicated via boundary waves and advective processes. On time-scales of about a month, sea surface height observations appear to be more efficient in reconstructing the cross-ridge heat transport than hydrographic observations. Optimal observations also provide a tool for understanding how the ocean state is effected by anomalies of integral quantities such as meridional heat transport.
Author
Wind Shear; Climate; Hydrography; Ocean Surface; Atlantic Ocean

20030093567 NASA Wallops Flight Center, Wallops Island, VA, USA
TOPEX Project Radar Altimeter Development Requirements and Specifications, Version 6.0
Rossi, Laurence C.; May 2003; 78 pp.; In English
Report No.(s): NASA/TM-2003-212236/VOL1/VER6.0; Rept-2003-015660-/VOL1/VER66.0; NAS 1.15:212236/VOL1/VER6.0; No Copyright; Avail: CASI; A05, Hardcopy

This document provides the guidelines by which the TOPEX Radar Altimeter hardware development effort for the TOPEX flight project shall be implemented and conducted. The conduct of this activity shall take maximum advantage of the efforts expended during the TOPEX Radar Altimeter Advanced Technology Model development program and other related Radar Altimeter development efforts. This document complies with the TOPEX Project Office document 633-420 (D-2218), entitled, 'TOPEX Project Requirements and Constraints for the NASA Radar Altimeter' dated December 1987.
Author
Radio Altimeters; Specifications; Topex; NASA Programs; Ocean Surface

20030093642 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Ocean Optics Protocols for Satellite Ocean Color Sensor Validation, Revision 4, Volume IV: Inherent Optical Properties: Instruments, Characterizations, Field Measurements and Data Analysis Protocols
Mueller, J. L.; Fargion, G. S.; McClain, C. R., Editor; Pegau, S.; Zanefeld, J. R. V.; Mitchell, B. G.; Kahru, M.; Wieland, J.; Stramska, M.; [May 2003]; 85 pp.; In English
Report No.(s): NASA/TM-2003-211621/REV7-VOL-IV; NAS 1.15:211621-REV7-VOL-IV; No Copyright; Avail: CASI; A05, Hardcopy

This document stipulates protocols for measuring bio-optical and radiometric data for the Sensor Intercomparision and Merger for Biological and Interdisciplinary Oceanic Studies (SIMBIOS) Project activities and algorithm development. The document is organized into 6 separate volumes as Ocean Optics Protocols for Satellite Ocean Color Sensor Validation, Revision 4. Volume I: Introduction, Background, and Conventions; Volume II: Instrument Specifications, Characterization and Calibration; Volume III: Radiometric Measurements and Data Analysis Methods; Volume IV: Inherent Optical Properties: Instruments, Characterization, Field Measurements and Data Analysis Protocols; Volume V: Biogeochemical and Bio-Optical Measurements and Data Analysis Methods; Volume VI: Special Topics in Ocean Optics Protocols and Appendices. The earlier version of Ocean Optics Protocols for Satellite Ocean Color Sensor Validation, Revision 3 is entirely superseded by the six volumes of Revision 4 listed above.
Author
Water Color; Protocol (Computers); Ocean Surface; Oceanographic Parameters; Ocean Color Scanner; Satellite Observation

20030093716 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Black Carbon in Estuarine and Coastal Ocean Dissolved Organic Matter
Mannino, Antonio; Harvey, H. Rodger; [2003]; 10 pp.; In English; No Copyright; Avail: CASI; A02, Hardcopy

Analysis of high-molecular-weight dissolved organic matter (DOM) from two estuaries in the northwest Atlantic Ocean reveals that black carbon (BC) is a significant component of previously uncharacterized DOM, suggesting that river-estuary systems are important exporters of recalcitrant dissolved organic carbon to the ocean.
Author
Carbon; Coasts; Dissolved Organic Matter; Estuaries; Oceans

20030093729 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Simultaneous Ocean Wave Measurements by the Jason and Topex Satellites, With Buoy and Model Comparisons
Ray, Richard D.; Beckley, B. D.; [June 11, 2003]; 36 pp.; In English; Original contains black and white illustrations; No Copyright; Avail: CASI; A03, Hardcopy

The verification phase of the Jason-1 satellite altimeter mission presents a unique opportunity for comparing near-simultaneous, independent satellite measurements. We here examine simultaneous significant wave height measurements by the Jason-1 and Topex/Poseidon altimeters. These data are also compared with in-situ measurements from deep-ocean buoys and with predicted wave heights from the Wave Watch 111 operational model. The rms difference between Jason and Topex wave heights is 21 cm, and this can be further lowered by application of median filters to reduce high-frequency noise. This noise is slightly larger in the Jason dataset, amounting to about 7 cm rms for frequencies above 0.05 Hz, which is the frequency at which the coherence between Topex and Jason measurements drops to zero. The probability density function for Jason shows a dearth of small waves relative to Topex. Buoy comparisons confirm that this problem lies with the Jason measurements. The buoy comparisons confirm previous reports that Topex wave heights are roughly 5% smaller than buoy measurements for waves between 2 and 5m; Jason heights in general are 2.7% smaller than Topex. Spurious dips in the Topex density function for 3- and 6-meter waves, a problem that has existed since the beginning of the mission, can be solved by waveform retracking..
Author
In Situ Measurement; Mathematical Models; Ocean Surface; Water Waves; Waveforms

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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*.

20030093621 Mississippi State Univ., Mississippi State, MS, USA
NASA's Bioreactor: Growing Cells in a Simulated Microgravity Environment
Richardson, Denise; The 2002 NASA Faculty Fellowship Program Research Reports; April 2003, pp. XXXVII-1 - XXXVII-5; In English; See also 20030093576
Contract(s)/Grant(s): NAG8-1859; No Copyright; Avail: CASI; C01, CD-ROM; A01, Hardcopy

National Science Education Standards (NSES), Science for All Americans, the Secretary's Commission on Achieving Necessary Skills (SCANS) as well as the National Aeronautics and Space Administration (NASA) are all making an effort to promote scientific literacy in America. Unfortunately, major evaluation programs such as the National Assessment of Educational Progress (NAEP) and the Third International Mathematics and Science Study (TIMSS) have provided information that suggested our students are not able to compete with peers from comparable countries. Although results indicated that American students are recalling memorized, factual knowledge well enough, the real problem is the ability to apply what they know. Concerned with these reports, the National Science Teacher's Association (NSTA) has developed a mission to support innovation and high quality in science teaching and learning for every student. NSTA recommends less emphasis on factual knowledge (memorization) and information and more understanding of the concepts. Science process skills are considered imperative to prepare America's students for the 21st century. The National Aeronautics and Space Administration (NASA) supports this mission and adds that NASA strives to help prepare and encourage the next generation of researchers and explorers. One method that NASA supports educators and its mission is to publish educational briefs. NASA describes a brief as a publication that ranges from one-to-thirty pages. The focus is on mission discoveries and results. The brief provides curriculum to educators that supports their objectives and NASA's interest. Educational Briefs are specific to the grade level

and course so that educators may have choices that fit their methods and students level. Sometimes, the brief includes lessons and activities teachers may use. For example, NASA's Microgravity Division has designed a student bioreactor. Consequently, an Educational Brief is being written that focuses on how to build a student bioreactor and experiments that can be conducted in it. These experiments mimic the experiments done by NASA and other researchers in the real world of work.
Author
NASA Programs; Education; Bioreactors; Microgravity

20030095825 Nippon Telegraph and Telephone Public Corp., Atsugi, Japan
Human Speech Production Mechanisms
Honda, Masaaki; NTT Technical Review, Volume 1, No. 2; May 2003, pp. 24-29; In English; See also 20030095822; Original contains color illustrations; Copyright; Avail: Other Sources

We use language every day without devoting much thought to the process, but articulatory movement - the movement of the lips, tongue, and other organs - is among the subtlest and most adept of any actions performed by human beings. Here, I discuss the mechanisms of speech production, introduce functions for producing sound by controlling the movement of vocal organs, and consider models for achieving speech functions that will enable a computer to mimic a voice that it hears.
Author
Human Beings; Speech

20030095836 Nippon Telegraph and Telephone Public Corp., Atsugi, Japan
Human Auditory Mechanisms
Kashino, Makio; NTT Technical Review, Volume 1, No. 2; May 2003, pp. 18-23; In English; See also 20030095822; Original contains color illustrations; Copyright; Avail: Other Sources

What we hear does not simply correspond to the physical properties of the sounds reaching our ears. In many cases, auditory perception changes systematically depending on the preceding and subsequent sounds. Under certain conditions, even physically missing sounds can be perceived as if they were present. An understanding of the characteristics of auditory perception and the underlying brain mechanisms involved will provide clues for improving tele presence and virtual reality technologies.
Author
Auditory Perception; Virtual Reality; Brain

20030102224 NASA Goddard Space Flight Center, Greenbelt, MD, USA
The Forest, The Fly, and the Virus?
Tucker, Compton J.; Pinzon, Jorge E.; Wilson, James M.; [2003]; 3 pp.; In English; International Geoscience and Remote Sensing Symposium, 2003; No Copyright; Avail: CASI; A01, Hardcopy

All known outbreaks of Ebola have been linked to tropical forests. We undertook a study of environmental conditions associated with Ebola hemorrhagic fever after preliminary reports strongly suggested that simultaneous outbreaks occurred, during two limited time periods in the 1970s and 1990s, immediately following sudden transitions between dry and wet seasons.
Derived from text
Viral Diseases; Rain Forests; Tropical Regions; Seasons; Epidemiology; Infectious Diseases; Remote Sensing

20030105564 Texas Univ., Austin, TX, USA
Evolutionary Origin of Body Axis Segmentation in Annelids and Arthropods
Shankland, S. Martin; [2003]; 4 pp.; In English
Contract(s)/Grant(s): NASA-98-HEDS-02; NAG2-1349; No Copyright; Avail: CASI; A01, Hardcopy

During the period of this report, we have made a number of important discoveries. To date this work has led to 4 peer-reviewed publications in primary research journals plus 1 minireview and 1 chapter in the proceedings of a meeting. Publications resulting from this grant support are enumerated at the end of the report. Two additional, on-going studies also described. 1. Using laser cell ablation, we have obtained evidence that an annelid - the leech Helobdella robusta - patterns the anteroposterior (AP) polarity of its nascent segment primordia independent of cell interactions oriented along the AP axis. 2. We cloned a Helobdella homologue (hro-hh) of the Drosophila segment polarity gene hedgehog, and used in situ hybridization and northern blots to characterize its expression in the embryo. 3. We have used laser cell ablations to examine the possible

role of cell interactions during the developmental patterning of the 4 rostralmost 'head' segments of the leech Helobdella robusta.
Derived from text
Arthropods; Drosophila; Embryos

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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*.

20030096569 Army Research Inst. of Environmental Medicine, Natick, MA
Load Carriage Model Development and Testing with Field Data
Santee, William R.; Blanchard, Laurie A.; Speckman, Karen L.; Gonzalez, Julio A.; Wallace, Robert F.; Jun. 2003; 22 pp.; In English
Report No.(s): AD-A415788; USARIEM-TN03-3; No Copyright; Avail: CASI; A03, Hardcopy

The results of a field study of the energy cost of downhill walking and load carriage were used to test a modification of the Pandolf equation (PE) for the prediction of downhill load carriage energy costs. PE is a predictive equation for the energy cost of walking and load carriage on level and uphill terrain. The field study objective was to broaden the database to include slower walking speeds. A new dataset was collected in the field with loads of 0 kg and 27.2 kg at speeds of 0.89 m(x)/s and 1.12 m(x)s- on grades of 0%, -4%, -8.6% and -10.2%. Oxygen uptake was collected using portable oxygen monitors. To adjust the PE for downhill movement, a correction factor (CF) was derived using data from a prior laboratory study. The final equation is CF = hx(Gx(W+L)xV)/3.5 -((W+L)x(G+6)2)/W) + (25-v2). The adjusted values, using the M = PE - CF format, fit well for walking at 1.12 m(dot)/s, but at 0.89 m(dot)/s, values were underestimated. Thus, an adjusted PE derived from a laboratory study for walking, and load carriage was valid at 1.12 m(dot)/s for loads up to 27 kg, but was not acceptable at 0.89 m(dot)/s.
DTIC
Human Performance; Walking

20030099647 Abaxis, Inc., Union City, CA, USA
Express Testing Makes for More Effective Vet Visit
Spinoff 2003: 100 Years of Powered Flight; 2003, pp. 20-21; In English; See also 20030099639; Original contains color illustrations; No Copyright; Avail: National Technology Transfer Center (NTTC), Wheeling, WV

This paper presents a discussion on Vetscan, a system designed to provide veterinarians with instant diagnostic information needed for rapid treatment decisions. VetScan is designed for point-of-care testing in any treatment setting, including mobile environments, where veterinarians can operate the analyzer from a car-lighter adapter. A full range of tests is available for almost every species normally treated by veterinarians, including cats, dogs, birds, reptiles, and large animals, such as those in the equine and bovine families.
Derived from text
Veterinary Medicine; Medical Electronics; Analyzers; Scanners

20030099648 Enduro Medical Technology, East Hartford, CT, USA
Striding Towards Better Physical Therapy
Spinoff 2003: 100 Years of Powered Flight; 2003, pp. 24-25; In English; See also 20030099639; Original contains color illustrations; No Copyright; Avail: National Technology Transfer Center (NTTC), Wheeling, WV

This paper presents a discussion on a new rehabilitative device that promises to improve physical therapy for patients working to regain the ability to walk after facing traumatic injuries or a degenerative illness. Produced by Enduro Medical Technology, of East Hartford, Connecticut, the Secure Ambulation Module (S.A.M.) creates a stable and secure environment for patients as they stand during ambulation therapy.
Derived from text
Biotechnology; Walking Machines; Physical Exercise; Therapy

20030099659 BioStim, Inc., USA

Hearing is Believing

Spinoff 2003: 100 Years of Powered Flight; 2003, pp. 14-15; In English; See also 20030099639; Original contains color illustrations; No Copyright; Avail: National Technology Transfer Center (NTTC), Wheeling, WV

This paper presents a discussion on the cochlear implant. This device was developed by Adam Kissiah, who suffers from hearing loss. Driven by his own hearing problem and three failed corrective surgeries, Kissiah started working in the mid-1970s on this surgically implantable device that provides hearing sensation to persons with severe-to-profound hearing loss who receive little or no benefit from hearing aids. Uniquely, the cochlear implant concept was not based on theories of medicine, as Kissiah had no medical background whatsoever. Instead, he utilized the technical expertise he learned while working as an electronics instrumentation engineer at NASA s Kennedy Space Center for the basis of his invention. This took place over 3 years, when Kissiah would spend his lunch breaks and evenings in Kennedy s technical library, studying the impact of engineering principles on the inner ear. In April of 2003, Kissiah was inducted into the Space Foundation's U.S. Space Technology Hall of Fame for his invention

Derived from text

Auditory Defects; Cochlea; Medical Science; Ear; Hearing

20030099661 Cybernet Systems Corp., Ann Arbor, MI, USA

Monitoring Outpatient Care

Spinoff 2003: 100 Years of Powered Flight; 2003, pp. 28-29; In English; See also 20030099639; Original contains color illustrations; No Copyright; Avail: National Technology Transfer Center (NTTC), Wheeling, WV

Each year, health care costs for managing chronically ill patients increase as the life expectancy of Americans continues to grow. To handle this situation, many hospitals, doctors practices, and home care providers are turning to disease management, a system of coordinated health care interventions and communications, to improve outpatient care. By participating in daily monitoring programs, patients with congestive heart failure, chronic obstructive pulmonary disease, diabetes, and other chronic conditions requiring significant self-care are facing fewer emergency situations and hospitalizations. Cybernet Medical, a division of Ann Arbor, Michigan-based Cybernet Systems Corporation, is using the latest communications technology to augment the ways health care professionals monitor and assess patients with chronic diseases, while at the same time simplifying the patients interaction with technology. Cybernet s newest commercial product for this purpose evolved from research funded by NASA, the National Institute of Mental Health, and the Advanced Research Projects Agency. The research focused on the physiological assessment of astronauts and soldiers, human performance evaluation, and human-computer interaction. Cybernet Medical's MedStar Disease Management Data Collection System is an affordable, widely deployable solution for improving in-home-patient chronic disease management. The system's battery-powered and portable interface device collects physiological data from off-the-shelf instruments.

Derived from text

Cybernetics; Data Management; Portable Equipment; Monitors; Patients

20030102125 Finch Univ. of Health Sciences/Chicago Medical School, Chicago, IL, USA

Emotional Expression and Psychological Adjustment to Prostate Cancer: A brief Intervention for Patients and Their Partners

Zakowski, Sandra G.; Feb. 2003; 9 pp.; In English

Contract(s)/Grant(s): DAMD17-00-1-0017

Report No.(s): AD-A415607; No Copyright; Avail: CASI; A02, Hardcopy

The current study examines the effects of a psychological intervention that encourages emotional expression in prostate cancer patients and their partners. Prostate cancer patients (n= 130) and their partners are randomly assigned to an intervention or a control group. Following Pennebaker's model, subjects in the intervention group are asked to write about their deepest thoughts and feelings regarding their cancer experience for 20 minutes each day for three consecutive days. The control group is asked to write about trivial non- emotional topics. Outcome variables including psychological distress, quality of life, and physical symptoms is assessed at baseline and over a period of nine months after the intervention (one week, three, six, and nine months). In accordance with our approved Statement of Work data collection is currently underway. To date 126 subjects have been enrolled and are at various stages of the data collection process. Data processing is continuing as planned, including data entry and verification, which has been completed for all subjects currently enrolled in the project. Preliminary data analyses are being conducted.

DTIC

Cancer; Prostate Gland; Stress (Psychology); Patients

20030102170

Short-Term Fatigue Management: A Cross- Study Analysis of the Effects of Dextroamphetamine and Modafinil in Sleep-Deprived Aviators

Caldwell, John A.; May 2003; 35 pp.; In English

Contract(s)/Grant(s): Proj-7757

Report No.(s): AD-A415654; AFRL-HE-BR-TR-2003-0059; No Copyright; Avail: CASI; A03, Hardcopy

Fatigue has been identified as an important operational problem in both military and civilian aviation (Caldwell, 1997; Rosekind et al., 2000). Requirements for extended duty periods. inconsistent work/rest schedules, multiple-time-zone operations, and night flights combine to potentially degrade performance and alertness in the cockpit. Duty-time limitations traditionally have been relied upon to manage aircrew fatigue; but problems persist as evidenced by the fact that significant fatigue-related mishaps continue to occur. Because of this, it may be worthwhile to consider the limited use of alternative strategies such as stimulants. The data from five placebo-controlled studies (four with dextroamphetamine and one with modafinil) were combined to examine the overall efficacy of stimulants for preserving flight performance, physiological alertness, and subjective vigilance in sleep deprived pilots. Statistically-significant ($p<.05$) drug main effects and drug-by-time interactions revealed that both compounds maintained flight performance across six maneuvers, attenuated deprivation-related increases in slow-wave electroencephalogram (EEG) activity, and preserved subjective ratings of psychological vigor throughout 34-39 hours of continuous wakefulness, whereas substantial difficulties were observed under placebo. Furthermore, the drug-related effects were remarkably consistent across all of the five studies that were examined. Dextroamphetamine and modafinil are effective for sustaining aviator alertness and performance (although, some potentially dose-related adverse effects were observed with modafinil). While it may be ill-advised to rely upon the long-term use of these or other pharmacological strategies as the sole remedy for fatigue in aviation, stimulants can be counted upon to temporarily mitigate the deleterious effects of fatigue during operations in which no other countermeasures are feasible.

DTIC

Pilots; Sleep Deprivation

53
BEHAVIORAL SCIENCES

Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric research.

20030095823 Nippon Telegraph and Telephone Public Corp., Japan

Search for Ideal Image Presentation Technology for Human Visual System

Nishida, Shinya; NTT Technical Review, Volume 1, No. 2; May 2003, pp. 4-9; In English; See also 20030095822; Original contains black and white illustrations; Copyright; Avail: Other Sources

What is the ideal image for human viewing? Senior Research Scientist Shin'ya Nishida of the Sensory and Motor Research Group of the NTT Communication Science Laboratories aims to provide the answer to this question through his research into the mechanism via which the brain 'sees' things. The editors spoke with Dr. Nishida about his theory on the asynchronous perception of color and motion, a theory that may lead to the development of new technology and the changing of paradigms in brain studies.

Author

Motion Perception; Visual Perception; Color Vision; Information Processing (Biology); Brain

20030095828 Nippon Telegraph and Telephone Public Corp., Atsugi, Japan

Human Visual Mechanism

Nishida, Shinya; NTT Technical Review, Volume 1, No. 2; May 2003, pp. 13-17; In English; See also 20030095822; Original contains color illustrations; Copyright; Avail: Other Sources

What we see is not exactly what is there. In this paper, I review three visual illusions lurking in our daily experiences: slit view, surface reflectance perception, and color-motion asynchrony. I discuss the implications of these illusions for information processing by our visual system and for visual telecommunications technology for humans.

Author

Human Beings; Vision; Visual Perception; Optical Illusion

20030095829 Nippon Telegraph and Telephone Public Corp., Atsugi, Japan
Human Motor Control Mechanism
Gomi, Hiroaki; NTT Technical Review, Volume 1, No. 2; May 2003, pp. 30-34; In English; See also 20030095822; Original contains color illustrations; Copyright; Avail: Other Sources

This paper introduces a hierarchical structure of information processing for generating movements and an experimental test of a major hypothesis of the human movement production mechanism called equilibrium-point control from the viewpoint of stiffness control. It also presents experimental observations of stiffness control of the human arm in interactions with the external world and of coordinative speech articulation. This research has future applications in the design of new types of man-machine interfaces for communication devices and of artificial brain processing mechanisms for humanoid robots.
Author
Data Processing; Brain; Human Beings; Efferent Nervous Systems

20030096003 Army Research Inst. for the Behavioral and Social Sciences, Alexandria, VA
Enhancing U.S. Army Aircrew Coordination Training
Katz, Lawrence C.; Grubb, Gary N.; May 2003; 32 pp.; In English
Report No.(s): AD-A415767; ARI-SR-56; No Copyright; Avail: CASI; A03, Hardcopy

The US Army defines aircrew coordination as a set of principles, attitudes, procedures, and techniques that transforms individuals into an effective crew. The stated objective of Aircrew Coordination Training (ACT) is to provide aircrews the knowledge, skills and attitudes necessary to increase their mission effectiveness, while decreasing the errors that lead to accidents. ACT and Crew/ Cockpit Resource Management (CRM) programs were instituted in the 1980's, first in commercial aviation and later in military aviation, to address adverse mishap rate trends that showed the inability of many aviators to work well together in periods of high stress or workload (Helmreich, Merritt, & Wilhelm, 1999). Minor aircraft malfunctions were resulting in fatal accidents with alarming frequency. While aviators generally displayed excellent knowledge and understanding of aircraft systems, operating procedures, rules and regulations and other technical information, they often displayed a glaring inability to communicate effectively, distribute workload, maintain or regain situational awareness and make sound decisions. Military aviation took note of the success of CRM in the civilian sector and instituted similar training programs (Orlady & Foushee, 1987).
DTIC
Flight Crews; Flight Training; Military Aviation

20030098015
The Effects of 37 Hours of Continuous Wakefulness on the Physiological Arousal, Cognitive Performance, Self-Reported Mood, and Simulator Flight Performance of F-117A Pilots
Caldwell, John; Caldwell, J. L.; Brown, David; Smythe, Nicholas; Smith, Jennifer; Jun. 2003; 83 pp.; In English
Contract(s)/Grant(s): Proj-7757
Report No.(s): AD-A415792; AFRL-HE-BR-TR-2003-0086; No Copyright; Avail: CASI; A05, Hardcopy

Over the past 30 years, fatigue has contributed to a number of Air Force mishaps. Resource cutbacks combined with increased operational tempos, sustained operations, and night fighting could exacerbate the problem. Extended wakefulness and circadian factors can be especially problematic in military aviation where mission demands sometimes necessitate flights as long as 17-44 hours. To effectively counter fatigue in such operations, the effects of this threat must be objectively measured and understood. This study assessed F-117A pilots during a 37-hour period of continuous wakefulness. Although none of the pilots crashed, substantial decrements were found in flight-skills, reaction times, mood, and brain activation as early as after the 26% hour of continuous wakefulness. The greatest flight degradations occurred after 27-33 hours awake, even though many pilots believed their worst performance was earlier. The decrements found in this relatively-benign test environment may be more serious under operational conditions unless personnel anticipate the most dangerous times and administer valid fatigue countermeasures.
DTIC
Cognition; Aircraft Pilots; Flight Simulation; Fatigue (Biology); Sleep Deprivation; Pilot Performance

20030099658 CyberLearning Technology, LLC, Plymouth Meeting, PA, USA
A Real Attention-Getter
Spinoff 2003: 100 Years of Powered Flight; 2003, pp. 12-13; In English; See also 20030099639; Original contains color illustrations; No Copyright; Avail: National Technology Transfer Center (NTTC), Wheeling, WV

While most parents would agree that playing videos games is the antithesis of time well spent for their children, recent advances involving NASA biofeedback technology are proving otherwise. The same techniques used to measure brain activity in NASA pilots during flight simulation exercises are now a part of a revolutionary video game system that is helping to improve overall mental awareness for Americans of all ages, including those who suffer from Attention Deficit Hyperactivity Disorder (ADHD).
Derived from text
Aerospace Technology Transfer; Technology Utilization; Games; Attention; Disorders; Flight Simulation; Biofeedback

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*.

20030086428 NASA Langley Research Center, Hampton, VA, USA
Three Experiments Examining the Use of Electroencephalogram,Event-Related Potentials, and Heart-Rate Variability for Real-Time Human-Centered Adaptive Automation Design
Prinzel, Lawrence J., III; Parasuraman, Raja; Freeman, Frederick G.; Scerbo, Mark W.; Mikulka, Peter J.; Pope, Alan T.; September 2003; 70 pp.; In English
Contract(s)/Grant(s): 727-05-50-01
Report No.(s): NASA/TP-2003-212442; L-18316; NAS 1.60:212442; No Copyright; Avail: CASI; A04, Hardcopy

Adaptive automation represents an advanced form of human-centered automation design. The approach to automation provides for real-time and model-based assessments of human-automation interaction, determines whether the human has entered into a hazardous state of awareness and then modulates the task environment to keep the operator in-the-loop , while maintaining an optimal state of task engagement and mental alertness. Because adaptive automation has not matured, numerous challenges remain, including what the criteria are, for determining when adaptive aiding and adaptive function allocation should take place. Human factors experts in the area have suggested a number of measures including the use of psychophysiology. This NASA Technical Paper reports on three experiments that examined the psychophysiological measures of event-related potentials, electroencephalogram, and heart-rate variability for real-time adaptive automation. The results of the experiments confirm the efficacy of these measures for use in both a developmental and operational role for adaptive automation design. The implications of these results and future directions for psychophysiology and human-centered automation design are discussed.
Author
Human Factors Engineering; Psychophysiology; Automation

20030093589 Alabama Univ., AL, USA
Membrane-Based Gas Traps for Ammonia, Freon-21, and Water Systems to Simplify Ground Processing
Ritchie, Stephen M. C.; The 2002 NASA Faculty Fellowship Program Research Reports; April 2003, pp. XXXVIII-1 - XXXVIII-5; In English; See also 20030093576
Contract(s)/Grant(s): NAG8-1859; No Copyright; Avail: CASI; C01, CD-ROM; A01, Hardcopy

Gas traps are critical for the smooth operation of coolant loops because gas bubbles can cause loss of centrifugal pump prime, interference with sensor readings, inhibition of heat transfer, and blockage of passages to remote systems. Coolant loops are ubiquitous in space flight hardware, and thus there is a great need for this technology. Conventional gas traps will not function in micro-gravity due to the absence of buoyancy forces. Therefore, clever designs that make use of adhesion and momentum are required for adequate separation, preferable in a single pass. The gas traps currently used in water coolant loops on the International Space Station are composed of membrane tube sets in a shell. Each tube set is composed of a hydrophilic membrane (used for water transport and capture of bubbles) and a hydrophobic membrane (used for venting of air bubbles). For the hydrophilic membrane, there are two critical pressures, the pressure drop and the bubble pressure. The pressure drop is the decrease in system pressure across the gas trap. The bubble pressure is the pressure required for air bubbles to pass across the water filled membrane. A significant difference between these pressures is needed to ensure complete capture of air bubbles in a single pass. Bubbles trapped by the device adsorb on the hydrophobic membrane in the interior of the hydrophilic membrane tube. After adsorption, the air is vented due to a pressure drop of approximately 1 atmosphere across the membrane. For water systems, the air is vented to the ambient (cabin). Because water vapor can also transport across the hydrophobic membrane, it is critical that a minimum surface area is used to avoid excessive water loss (would like to have a closed loop

for the coolant). The currently used gas traps only provide a difference in pressure drop and bubble pressure of 3-4 psid. This makes the gas traps susceptible to failure at high bubble loading and if gas venting is impaired. One mechanism for the latter is when particles adhere to the hydrophobic membrane, promoting formation of a water layer about it that can blind the membrane for gas transport (Figure 1). This mechanism is the most probable cause for observed failures with the existing design. The objective of this project was to devise a strategy for choosing new membrane materials (database development and procedure), redesign of the gas trap to mitigate blinding effects, and to develop a design that can be used in ammonia and Freon-21 coolant loops.
Author
Cooling Systems; International Space Station; Vapor Traps; Spacecraft Environments

55
EXOBIOLOGY

Includes astrobiology; planetary biology; and extraterrestrial life. For the biological effects of aerospace environments on humans see *52 Aerospace Medicine*; on animals and plants see *51 Life Sciences*. For psychological and behavioral effects of aerospace environments see *53 Behavioral Sciences*.

20030093599 Alabama Univ., Birmingham, AL, USA
Identification and Characterization of Extremophile Microorganisms with Significance to Astrobiology
Bej, Asim K.; The 2002 NASA Faculty Fellowship Program Research Reports; April 2003, pp. VI-1 - VI-5; In English; See also 20030093576; Original contains color illustrations
Contract(s)/Grant(s): NAG8-1859; No Copyright; Avail: CASI; C01, CD-ROM; A01, Hardcopy

It is now well recognized that microorganisms thrive in extreme ecological conditions such as geothermal vents, polar region, acid and alkaline lakes, and the cold pressurized depth of the ocean floor of this planet. Morphological, physiological, biochemical and genetic adaptations to extreme environments by these extremophile microorganisms have generated immense interest amongst astrobiologists who increasingly believe in the existence of extraterrestrial life. The evidence collected by NASA's space probe Galileo suggested the presence of liquid water and volcanic activity on Mars and Jupiter's satellite Europa. Volcanic activity provides some of the heat necessary to keep the water on Europa from freezing that could provide important dissolved chemicals needed by living organisms. The possibility of the existence of hypersaline alkaline lakes and evaporites confined within closed volcanic basins and impact craters on Mars, and a layer of liquid water under the ice on Europa provide sufficient 'raison d'etre' to study microorganisms in similar extreme environments on Earth, which could provide us with a model that would help establish the existence of extraterrestrial life on other planetary bodies. The objectives of the summer research project were as follows: (1) application of molecular approaches to help establish new species of extremophile microorganisms isolated from a hypersaline alkaline lake; and (2) identification of a major cold-shock gene (cspA) homolog from a psychrotolerant microorganism, PmagG1.
Author
Extraterrestrial Life; Biochemistry; Microorganisms; Genes; Cold Tolerance; Salinity; Alkalinity

20030093741 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Foliar Reflectance and Fluorescence Responses for Plants Under Nitrogen Stress Determined with Active and Passive Systems
Middleton, E. M.; McMurtrey, J. E.; Campbell, P. K. Entcheva; Corp, L. A.; Butcher, L. M.; Chappelle, E. W.; [2003]; 1 pp.; In English; IGARSS 2003 (International Geoscience and Remote Sensing Symposium), 21-25 Jul. 2003, Toulouse, France; No Copyright; Avail: Other Sources; Abstract Only

Vegetation productivity is driven by nitrogen (N) availability in soils. Both excessive and low soil N induce physiological changes in plant foliage. In 2001, we examined the use of spectral fluorescence and reflectance measurements to discriminate among plants provided different N fertilizer application rates: 20%, 50%, 100% and 150% of optimal N levels. A suite of optical, fluorescence, and biophysical measurements were collected on leaves from field grown corn (Zea mays L.) and soybean plants (Glycine max L.) grown in pots (greenhouse + ambient sunlight daily). Three types of steady state laser-induced fluorescence measurements were made on adaxial and abaxial surfaces: 1) fluorescence images in four 10 nm bands (blue, green, red, far-red) resulting from broad irradiance excitation; 2) emission spectra (5 nm resolution) produced by excitation at single wavelengths (280,380 or 360, and 532 nm); and 3) excitation spectra (2 nm resolution), with emission wavelengths fixed at wavelengths centered on selected solar Fraunhofer lines (532,607,677 and 745 nm). Two complementary sets of high resolution (less than 2 nm) optical spectra were acquired for both adaxial and abaxial leaf surfaces: 1) optical

properties (350-2500 nm) for reflectance, transmittance, and absorptance; and 2) reflectance spectra (500-1000 nm) acquired with and without a short pass filter at 665 nm to determine the fluorescence contribution to apparent reflectance in the 650-750 spectrum, especially at the 685 and 740 nm chlorophyll fluorescence (ChIF) peaks. The strongest relationships between foliar chemistry and optical properties were demonstrated for C/N content and two optical parameters associated with the red edge inflection point. Select optical properties and ChIF parameters were highly correlated for both species. A significant contribution of ChIF to apparent reflectance was observed, averaging 10-25% at 685 nm and 2 - 6% at 740 nm over all N treatments. Discrimination of N treatment groups was possible with specific fluorescence band ratios (e.g., F740/F525 obtained with 380EX). From all measurements assessing fluorescence, higher ChIF and blue/green emissions were measured from the abaxial leaf surfaces; Abaxial surfaces also produced higher reflectances in the 400-800 nm spectrum. Fluorescence information collected in Fraunhofer regions located on the shoulders of ChIF features compared favorably with peak emissions. This supports the potential capability of a future space-born interferometer sensor to capture plant canopy fluorescence.
Author
Nitrogen; Reflectance; Fluorescence; Plants (Botany); Emission Spectra

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*.

20030093585 Alabama Univ., Huntsville, AL, USA
An Improved RLV Stability Analysis Via a Continuation Approach
Friedman, Mark; The 2002 NASA Faculty Fellowship Program Research Reports; April 2003, pp. XV-1 - XV-5; In English; See also 20030093576
Contract(s)/Grant(s): NAG8-1859; No Copyright; Avail: CASI; C01, CD-ROM; A01, Hardcopy
The continuation of Invariant Subspaces (CIS) algorithm produces a smooth orthogonal similarity transformation to block triangular form of A(s). A practical CIS algorithm and stability analysis of the X-33 are described.
Derived from text
Algorithms; Invariant Imbeddings; X-33 Reusable Launch Vehicle; Stability Tests; Continuity (Mathematics); Branching (Mathematics)

20030095841 Old Dominion Univ., Hampton, VA, USA
Perspectives on Advanced Learning Technologies and Learning Networks and Future Aerospace Workforce Environments
Noor, Ahmed K., Compiler; Advanced Learning Technologies and Learning Networks and Their Impact on Future Aerospace Workforce; September 2003, pp. 1-34; In English; See also 20030095837; No Copyright; Avail: CASI; A03, Hardcopy
An overview of the advanced learning technologies is given in this presentation along with a brief description of their impact on future aerospace workforce development. The presentation is divided into five parts (see Figure 1). In the first part, a brief historical account of the evolution of learning technologies is given. The second part describes the current learning activities. The third part describes some of the future aerospace systems, as examples of high-tech engineering systems, and lists their enabling technologies. The fourth part focuses on future aerospace research, learning and design environments. The fifth part lists the objectives of the workshop and some of the sources of information on learning technologies and learning networks.
Author
Aerospace Systems; Education; Computer Networks

20030098011
Wireless Task Force Report: Wireless Priority Service
Aug. 2002; 36 pp.
Report No.(s): PB2003-106136; No Copyright; Avail: CASI; A03, Hardcopy
Table of Contents: Executive summary ; Introduction and charge; Issues related to the ubiquitous rollout of wps; Recommendations to the president; Appendix A: Task force members and other participants; Appendix B: Briefer

questionnaire on wps; Appendix C: How wps works and Appendix D: Minority opinion.
NTIS
Telecommunication; Computer Security

20030098012
Wireless Task Force Report: Wireless Security
Jan. 2003; 30 pp.
Report No.(s): PB2003-106137; No Copyright; Avail: CASI; A03, Hardcopy

Table of Contents: Executive summary; Introduction and charge; Issues related to wireless security; Recommendations to the President; Appendix A: Task force members and other participants and Appendix B: Briefer questionnaire on wireless security.
NTIS
Telecommunication; Computer Networks

20030098013 National Inst. of Standards and Technology, Gaithersburg, MD
User Manual for Finite Element and Finite Difference Programs: A Parallel Version of NIST IR 6269
Bohn, R. B.; Garboczi, E. J.; 2003; 286 pp.; In English
Report No.(s): PB2003-106470; NISTIR-6997; No Copyright; Avail: CASI; A13, Hardcopy

This document contains the descriptions, algorithms, user information and listings of the parallel Fortran90/MPI versions of the suite of programs found in NIST-IR 6269 (1), Finite Element and Finite Difference Programs for Computing the Linear Electric and Elastic Properties of Digital Images of Random Materials. These programs use 3-D digital image data on random materials as input and then calculate the effective properties of the random material when subjected to applied fields (for example, mechanical/thermal stresses and AC/DC electric fields). The purpose behind this undertaking is to execute these programs in a parallel computing environment (for example, Linux clusters), so as to decrease real-time execution, increase the potential problem size, and increase digital resolution/problem accuracy.
NTIS
Finite Difference Theory; Finite Element Method; Parallel Processing (Computers); User Manuals (Computer Programs); Mathematical Models

20030098030
Value Measuring Methodology: How-to-Guide
2003; In English
Report No.(s): PB2003-106135; No Copyright; Avail: National Technical Information Service (NTIS)

The purpose of the Value Measuring Methodology (VMM) is to define, capture, and measure value associated with electronic services unaccounted for in traditional Return-on-investment (ROI) calculations, to fully account for costs, and to identify and consider risk. Developed in response to the changing definition of value brought on by the advent of the Internet and advanced software technology, VMM incorporates aspects of numerous traditional business analysis theories and methodologies, as well as newer hybrid approaches. VMM is designed to be used by organizations across the Federal Government to steer the development of an e-Government initiative, assist decision-makers in choosing among investment alternatives, provide the information required to manage effectively and to maximize the benefit of an investment to the Government, to direct users and to society as a whole.
NTIS
Internet Resources; On-Line Systems

60
COMPUTER OPERATIONS AND HARDWARE

Includes hardware for computer graphics, firmware and data processing. For components see *33 Electronics and Electrical Engineering*. For computer vision see *63 Cybernetics, Artificial Intelligence and Robotics*.

20030093613 Alabama Agricultural and Mechanical Univ., Normal, AL, USA
Parallel Information Processing (Image Transmission Via Fiber Bundle and Multimode Fiber
Kukhtarev, Nicholai; The 2002 NASA Faculty Fellowship Program Research Reports; April 2003, pp. XXVI-1 - XXVI-5; In English; See also 20030093576; No Copyright; Avail: CASI; C01, CD-ROM; A01, Hardcopy

Growing demand for visual, user-friendly representation of information inspires search for the new methods of image transmission. Currently used in-series (sequential) methods of information processing are inherently slow and are designed mainly for transmission of one or two dimensional arrays of data. Conventional transmission of data by fibers requires many fibers with array of laser diodes and photodetectors. In practice, fiber bundles are also used for transmission of images. Image is formed on the fiber-optic bundle entrance surface and each fiber transmits the incident image to the exit surface. Since the fibers do not preserve phase, only 2D intensity distribution can be transmitted in this way. Each single mode fiber transmit only one pixel of an image. Multimode fibers may be also used, so that each mode represent different pixel element. Direct transmission of image through multimode fiber is hindered by the mode scrambling and phase randomization. To overcome these obstacles wavelength and time-division multiplexing have been used, with each pixel transmitted on a separate wavelength or time interval. Phase-conjugate techniques also was tested in, but only in the unpractical scheme when reconstructed image return back to the fiber input end. Another method of three-dimensional imaging over single mode fibers was demonstrated in, using laser light of reduced spatial coherence. Coherence encoding, needed for a transmission of images by this methods, was realized with grating interferometer or with the help of an acousto-optic deflector. We suggest simple practical holographic method of image transmission over single multimode fiber or over fiber bundle with coherent light using filtering by holographic optical elements. Originally this method was successfully tested for the single multimode fiber. In this research we have modified holographic method for transmission of laser illuminated images over commercially available fiber bundle (fiber endoscope, or fiberscope).
Author
Acousto-Optics; Bundles; Parallel Processing (Computers); Information Retrieval; Imaging Techniques; Optical Fibers

20030093620 Alabama Univ., Huntsville, AL, USA
Using CASE to Exploit Process Modeling in Technology Transfer
Renz-Olar, Cheryl; The 2002 NASA Faculty Fellowship Program Research Reports; April 2003, pp. XXXVI-1 - XXXVI-4; In English; See also 20030093576
Contract(s)/Grant(s): NAG8-1859; No Copyright; Avail: CASI; C01, CD-ROM; A01, Hardcopy
A successful business will be one that has processes in place to run that business. Creating processes, reengineering processes, and continually improving processes can be accomplished through extensive modeling. Casewise(R) Corporate Modeler(TM) CASE is a computer aided software engineering tool that will enable the Technology Transfer Department (TT) at NASA Marshall Space Flight Center (MSFC) to capture these abilities. After successful implementation of CASE, it could then go on to be applied in other departments at MSFC and other centers at NASA. The success of a business process is dependent upon the players working as a team and continuously improving the process. A good process fosters customer satisfaction as well as internal satisfaction in the organizational infrastructure. CASE provides a method for business process success through functions consisting of systems and processes business models; specialized diagrams; matrix management; simulation; report generation and publishing; and, linking, importing, and exporting documents and files. The software has an underlying repository or database to support these functions. The Casewise. manual informs us that dynamics modeling is a technique used in business design and analysis. Feedback is used as a tool for the end users and generates different ways of dealing with the process. Feedback on this project resulted from collection of issues through a systems analyst interface approach of interviews with process coordinators and Technical Points of Contact (TPOCs).
Author
Technology Transfer; Software Development Tools; Design Analysis

20030098016 Fisk Univ., Nashville, TN
Upgrade Computer Facilities for Education and Research
Apr. 11, 2003; 5 pp.; In English
Contract(s)/Grant(s): F49620-01-1-0519; Proj-4276
Report No.(s): AD-A415834; AFRL-SR-AR-TR-03-0238; No Copyright; Avail: CASI; A01, Hardcopy
The computer facilities purchased in this grant have had an immediate impact in education and research of materials science at Fisk University. The electron spectrometer at the Physics Department is one of the main instruments, 4-6 graduate and 2-4 undergraduate students are regular users. The instrument is also used for student training in the Summer Undergraduate Research Program, and the course 'Materials Structures and Characterization Techniques'. A total of about 20-25 students in physics, materials science, and chemistry majors use the instrument each year. The research projects at the Surface Science Group include surface and interface physics on wide band-gap semiconductor, chemical sensing materials, and 'soft' processed nano-composites, funded by NASA. The instrument is also used for research and student training of the II-VI semiconductors, the optical materials, and the chemical physics groups at the Department. The impact of this project is

demonstrated in that the instrumentation are being used for multiple project, groups, teaching and training.
DTIC
Computers; Facilities

20030099682 NanoMatrix, Inc., Santa Cruz, CA, USA
Nanoscale Liquid Jets Shape New Line of Business
Spinoff 2003: 100 Years of Powered Flight; 2003, pp. 78-79; In English; See also 20030099639; Original contains color illustrations; No Copyright; Avail: National Technology Transfer Center (NTTC), Wheeling, WV

Just as a pistol shrimp stuns its prey by quickly closing its oversized claw to shoot out a shock-inducing, high-velocity jet of water, NanoMatrix, Inc., is sending shockwaves throughout the nanotechnology world with a revolutionary, small-scale fabrication process that uses powerful liquid jets to cut and shape objects. Emanuel Barros, a former project engineer at NASA s Ames Research Center, set out to form the Santa Cruz, California-based NanoMatrix firm and materialize the micro/nano cutting process partially inspired by the water-spewing crustacean. Early on in his 6-year NASA career, Barros led the development of re-flown flight hardware for an award-winning Spacelab project called NeuroLab. This project, the sixteenth and final Spacelab mission, focused on a series of experiments to determine the effects of microgravity on the development of the mammalian nervous system.
Derived from text
Fabrication; Fluid Jets; Cutting; Nanotechnology

20030099693 Derivation Systems, Inc., Carlsbad, CA, USA
Reconfigurable Hardware Adapts to Changing Mission Demands
Spinoff 2003: 100 Years of Powered Flight; 2003, pp. 73; In English; See also 20030099639; Original contains color illustrations; No Copyright; Avail: National Technology Transfer Center (NTTC), Wheeling, WV

A new class of computing architectures and processing systems, which use reconfigurable hardware, is creating a revolutionary approach to implementing future spacecraft systems. With the increasing complexity of electronic components, engineers must design next-generation spacecraft systems with new technologies in both hardware and software. Derivation Systems, Inc., of Carlsbad, California, has been working through NASA s Small Business Innovation Research (SBIR) program to develop key technologies in reconfigurable computing and Intellectual Property (IP) soft cores. Founded in 1993, Derivation Systems has received several SBIR contracts from NASA s Langley Research Center and the U.S. Department of Defense Air Force Research Laboratories in support of its mission to develop hardware and software for high-assurance systems. Through these contracts, Derivation Systems began developing leading-edge technology in formal verification, embedded Java, and reconfigurable computing for its PF3100, Derivational Reasoning System (DRS), FormalCORE IP, FormalCORE PCI/32, FormalCORE DES, and LavaCORE Configurable Java Processor, which are designed for greater flexibility and security on all space missions.
Derived from text
Reconfigurable Hardware; Space Missions; Architecture (Computers); Aerospace Systems

20030099694 DATASTAR, Inc., Picayune, MS, USA
Easy and Accessible Imaging Software
Spinoff 2003: 100 Years of Powered Flight; 2003, pp. 54-55; In English; See also 20030099639; Original contains color illustrations; No Copyright; Avail: National Technology Transfer Center (NTTC), Wheeling, WV

DATASTAR, Inc., of Picayune, Mississippi, has taken NASA s award-winning Earth Resources Laboratory Applications Software (ELAS) program and evolved it into a user-friendly desktop application and Internet service to perform processing, analysis, and manipulation of remotely sensed imagery data. NASA s Stennis Space Center developed ELAS in the early 1980s to process satellite and airborne sensor imagery data of the Earth s surface into readable and accessible information. Since then, ELAS information has been applied worldwide to determine soil content, rainfall levels, and numerous other variances of topographical information. However, end-users customarily had to depend on scientific or computer experts to provide the results, because the imaging processing system was intricate and labor intensive.
Derived from text
Applications Programs (Computers); Earth Resources; Imaging Techniques

20030102126

DEFACTO: A Design Environment for Adaptive Computing Technology

Hall, Mary; Diniz, Pedro; May 2003; 35 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): F30602-98-2-0113; ARPA ORDER-D002; Proj-D002

Report No.(s): AD-A415637; AFRL-IF-RS-TR-2003-110; No Copyright; Avail: CASI; A03, Hardcopy

This report describes the activities of the DEFACTO project, a Design Environment for Adaptive Computing Technology funded under the DARPA Adaptive Computing Systems and Just-In-Time-Hardware programs. The goal of DEFACTO is to derive system-level implementations of mappings to FPGA-based systems, from a high-level algorithmic description in standard C. We have demonstrated synthesis time reductions to 100-10000X with the automated design space exploration algorithm. The current reduction in design time, including human effort, has been approximately 40-60X for two case studies, SLD from Sandia ATR and Sobel edge detection. We have demonstrated end-to-end mapping on the Annapolis Wildstar board for both examples, with no minimal intervention, at DarpaTech on 31 July 2002.

DTIC

Algorithms; Edge Detection

61
COMPUTER PROGRAMMING AND SOFTWARE

Includes software engineering, computer programs, routines, algorithms, and specific applications, e.g., CAD/CAM. For computer software applied to specific applications, see also the associated category.

20030086406 Old Dominion Univ., Hampton, VA, USA

Emerging and Future Computing Paradigms and Their Impact on the Research, Training, and Design Environments of the Aerospace Workforce

Noor, Ahmed K., Compiler; August 2003; 472 pp.; In English; Emerging and Future Computing Paradigms and Their Impact on the Research, Training, and Design Environments of the Aerospace Workforce, 18-19 Mar. 2003, Hampton, VA, USA; See also 20030086407 - 20030086422; Original contains color and black and white illustrations

Contract(s)/Grant(s): 755-80-00-01

Report No.(s): NASA/CP-2003-212436; L-18290; NAS 1.55:212436; No Copyright; Avail: CASI; A20, Hardcopy

The document contains the proceedings of the training workshop on Emerging and Future Computing Paradigms and their impact on the Research, Training and Design Environments of the Aerospace Workforce. The workshop was held at NASA Langley Research Center, Hampton, Virginia, March 18 and 19, 2003. The workshop was jointly sponsored by Old Dominion University and NASA. Workshop attendees came from NASA, other government agencies, industry and universities. The objectives of the workshop were to a) provide broad overviews of the diverse activities related to new computing paradigms, including grid computing, pervasive computing, high-productivity computing, and the IBM-led autonomic computing; and b) identify future directions for research that have high potential for future aerospace workforce environments. The format of the workshop included twenty-one, half-hour overview-type presentations and three exhibits by vendors.

Author

Computer Programs; Computer Systems Performance

20030086408 Oracle Corp., Redwood Shores, CA, USA

GRID Computing Infrastructure

Brown, Geoff; Emerging and Future Computing Paradigms and Their Impact on the Research, Training, and Design Environments of the Aerospace Workforce; August 2003, pp. 315-354; In English; See also 20030086406; Original contains color illustrations; No Copyright; Avail: CASI; A03, Hardcopy

The core of the Oracle Unbreakable Software Infrastructure is information - your data. Your data is one of the most valuable resources of your company. Virtually all of your information systems are built on your data. By making data the core of an Unbreakable Software Infrastructure, you are building on the core of your company s valuable information. With Oracle s Unbreakable Software Infrastructure, you can keep all of your data in one centralized repository - data from your transactional (OLTP) systems, data used for business intelligence functions, and a wide variety of other documents, such as Web content, E-mail, and calendar and resource scheduling information. This centralized repository reduces your overall management overhead and allows you to consolidate the number of servers in your organization, which will further reduce

overhead. By having all of your data in a single repository, you also reduce the need for resource-consuming data transfers required for multiple uses of the same data.
Derived from text
Data Systems; Computer Programs

20030086411 DataSynapse, Inc., New York, NY, USA
DataSynapse: Do More With Less
Bernardin, James; Emerging and Future Computing Paradigms and Their Impact on the Research, Training, and Design Environments of the Aerospace Workforce; August 2003, pp. 355-369; In English; See also 20030086406; Original contains color illustrations; No Copyright; Avail: CASI; A03, Hardcopy

LiveCluster(trademark), a computing platform, enables applications requiring scalability to create a virtual environment that transforms IT resources into an on-demand, easily managed grid computing infrastructure.Benefits include: dramatically reduces cost and application; increase application and business performance;guarnatee application uptime and resilience; accelerate time to deploy for production systems;enable commodity compute models.
Derived from text
Computer Programs; Compatibility

20030086412 Star Bridge Systems, Inc., Midvale, UT, USA
Star Bridge Systems
Yardley, Jim; Emerging and Future Computing Paradigms and Their Impact on the Research, Training, and Design Environments of the Aerospace Workforce; August 2003, pp. 371-423; In English; See also 20030086406; Original contains color illustrations; No Copyright; Avail: CASI; A04, Hardcopy

Star Bridge Systems is a pioneer in the field of reconfigurable computing,a developer of highly innovative hardware and software turning FPGAs into inherently parallel, general-purpose, reconfigurable supercomputers.
Derived from text
Computer Programs; Operating Systems (Computers)

20030086419 National Coordination Office for Information Technology Research and Development, Arlington, VA, USA
Research by Federal Agencies That Will Affect Future Computing Paradigms for Aerospace
Nelson, David B.; Emerging and Future Computing Paradigms and Their Impact on the Research, Training, and Design Environments of the Aerospace Workforce; August 2003, pp. 221-230; In English; See also 20030086406; Original contains color illustrations; No Copyright; Avail: CASI; A02, Hardcopy

Research that will impact future computing paradigms for aerospace are described.Included are grid technology,performance measures of selected supercomputers, and agency conclusions.
CASI
Supercomputers; Computer Programs

20030093533 NASA Glenn Research Center, Cleveland, OH, USA
SCPS-TP, TCP, and Rate-Based Protocol Evaluation
Tran, Diepchi T.; Lawas-Grodek, Frances J.; Dimond, Robert P.; Ivancic, William D.; September 2003; 64 pp.; In English
Contract(s)/Grant(s): WBS 22-322-20-01
Report No.(s): NASA/TM-2003-212001; E-13673; NAS 1.15:212001; No Copyright; Avail: CASI; A04, Hardcopy

There have been numerous discussions relative to the role of the Space Communications Protocol Standards Transport Protocol (SCPS TP) in the ever-evolving Transmission Control Protocol (TCP) family, particularly with respect to other known TCP features that accommodate high-bandwidth and long delay networks (e.g., large windows and selective acknowledgments (SACKs)). To gain a better understanding of the performance of the SCPS TP relative to other TCP variants and to determine the maturity of the various options for use on higher rate space links, the NASA Space Communications and Data Systems (SCDS) Office requested that Glenn Research Center perform a comprehensive set of tests. The goals were to validate the operation of the reference implementation of the SCPS TP relative to its controlling CCSDS (Consultative Committee for Space Data Systems) specification and to perform a comprehensive comparison of SCPS TP options and other TCP options. We studied the effect of delay and bit error rate (BER) on the performance of congestion-based and rate-based

protocols in emulated space links under uncongested conditions and with limited congestion. The results correlate well with previous testing of TCP options, including the SCPS TP.
Author
Protocol (Computers); Bit Error Rate

20030093583 Alabama Univ., Huntsville, AL, USA
Using CASE to Adopt Organizational Learning at NASA
Templeton, Gary F.; The 2002 NASA Faculty Fellowship Program Research Reports; April 2003, pp. L-1 - L-7; In English; See also 20030093576
Contract(s)/Grant(s): NAG8-1859; No Copyright; Avail: CASI; C01, CD-ROM; A02, Hardcopy

The research direction was articulated in a statement of work created in collaboration between two program colleagues, an outside researcher and an internal user. The researcher was to deliver an implemented CASE tool (CasewiseTM) that was to be used to serve non-traditional (i.e., not software development related) organizational purposes. The explicitly stated functions of the tool were the support of 1) ISO-9000 compliance in the documentation of processes and 2) the management of process improvement. The collaborative team consisted of the researcher (GT), a full-time accompanying student (CRO), and the user (JD). The team originally focused on populating the CASE repository for the purpose of solving the two primary objectives. Consistent with the action research approach, several additional user requirements emerged as the project evolved, needs became apparent in discussions about how the tool would be used to solve organizational problems. These deliverables were contained within the CASE repository: 1) the creation of a paradigm diagram 2) the creation of a context diagram 3) the creation of child diagrams 4) the generation of 73 issues relating to organizational change 5) a compendium of stakeholder interview transcripts All record keeping was done manually and then keyed into the CASE interface. An issue is the difference between an organization s current situation (action) and its collective ideals.
Author
Software Development Tools; Project Management

20030093593 Tennessee Technological Univ., Cookeville, TN, USA
Development of a Tool for Dynamic Analysis of Momentum Exchange Electrodynamic Reboost Tethers
Canfield, Stephen; The 2002 NASA Faculty Fellowship Program Research Reports; April 2003; In English; See also 20030093576
Contract(s)/Grant(s): NAG8-1859; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

No abstract available
Momentum; Tetherlines; Software Development Tools; Numerical Analysis

20030093596 Lipscomb Univ., Nashville, TN, USA
Developing a MATLAB(registered)-Based Tool for Visualization and Transformation
Anderton, Blake J.; The 2002 NASA Faculty Fellowship Program Research Reports; April 2003, pp. III-1 - III-5; In English; See also 20030093576; Original contains color illustrations
Contract(s)/Grant(s): NAG8-1859; No Copyright; Avail: CASI; C01, CD-ROM; A01, Hardcopy

An important step in the structural design and development of spacecraft is the experimental identification of a structure s modal characteristics, such as its natural frequencies and modes of vibration. These characteristics are vital to developing a representative model of any given structure or analyzing the range of input frequencies that can be handled by a particular structure. When setting up such a representative model of a structure, careful measurements using precision equipment (such as accelerometers and instrumented hammers) must be made on many individual points of the structure in question. The coordinate location of each data point is used to construct a wireframe geometric model of the structure. Response measurements obtained from the accelerometers is used to generate the modal shapes of the particular structure. Graphically, this is displayed as a combination of the ways a structure will ideally respond to a specified force input. Two types of models of the tested structure are often used in modal analysis: an analytic model showing expected behavior of the structure, and an experimental model showing measured results due to observed phenomena. To evaluate the results from the experimental model, a comparison of analytic and experimental results must be made between the two models. However, comparisons between these two models become difficult when the two coordinate orientations differ in a manner such that results are displayed in an unclear fashion. Such a problem proposes the need for a tool that not only communicates a graphical image of a structure s wireframe geometry based on various measurement locations (called nodes), but also allows for a type of

transformation of the image s coordinate geometry so that a model s coordinate orientation is made to match the orientation of another model. Such a tool should also be designed so that it is able to construct coordinate geometry based on many different listings of node locations and is able to transform the wireframe coordinate orientation to match almost any possible orientation (i.e. it should not be a problem specific application) if it is to be of much value in modal analysis. Also, since universal files are used to store modal parameters and wireframe geometry, the tool must be able to read and extract information from universal files and use these files to exchange model data.The purpose of this project is to develop such a tool as a computer graphical user interface (GUI) capable of performing the following tasks: 1) Browsing for a particular universal file within the computer directory and displaying the name of this file to the screen; 2) Plotting each of the nodes within the universal file in a useful, descriptive, and easily understood figure; 3) Reading the node numbers from the selected file and listing these node numbers to the user for selection in an easily accessible format; 4) Allowing for user selection of a new model orientation defined by three selected nodes; and 5) Allowing the user to specify a directory to which the transformed model s node locations will be saved, and saving the transformed node locations to the specified file.
Derived from text
Computer Graphics; Scientific Visualization; Software Development Tools; Mathematical Models; Structural Engineering; Transformations (Mathematics)

20030093616 Alabama Univ., Huntsville, AL, USA
Self-Consistent Large-Scale Magnetosphere-Ionosphere Coupling: Computational Aspects and Experiments
Newman, Timothy S.; The 2002 NASA Faculty Fellowship Program Research Reports; April 2003, pp. XXXI-1 - XXXI-5; In English; See also 20030093576
Contract(s)/Grant(s): NAG8-1859; No Copyright; Avail: CASI; C01, CD-ROM; A01, Hardcopy

Both external and internal phenomena impact the terrestrial magnetosphere. For example, solar wind and particle precipitation effect the distribution of hot plasma in the magnetosphere. Numerous models exist to describe different aspects of magnetosphere characteristics. For example, Tsyganenko has developed a series of models (e.g., [TSYG89]) that describe the magnetic field, and Stern [STER75] and Volland [VOLL73] have developed an analytical model that describes the convection electric field. Over the past several years, NASA colleague Khazanov, working with Fok and others, has developed a large-scale coupled model that tracks particle flow to determine hot ion and electron phase space densities in the magnetosphere. This model utilizes external data such as solar wind densities and velocities and geomagnetic indices (e.g., Kp) to drive computational processes that evaluate magnetic, electric field, and plasma sheet models at any time point. These models are coupled such that energetic ion and electron fluxes are produced, with those fluxes capable of interacting with the electric field model. A diagrammatic representation of the coupled model is shown.
Derived from text
Electric Fields; Geomagnetism; High Temperature Plasmas; Hot Electrons; Mathematical Models; Plasma Layers; Solar Wind

20030093629 Alabama Univ., Huntsville, AL, USA
Evaluation of Advanced Computing Techniques and Technologies: Reconfigurable Computing
Wells, B. Earl; The 2002 NASA Faculty Fellowship Program Research Reports; April 2003, pp. LIII-1 - LIII-5; In English; See also 20030093576
Contract(s)/Grant(s): NAG8-1859; No Copyright; Avail: CASI; C01, CD-ROM; A01, Hardcopy

The focus of this project was to survey the technology of reconfigurable computing determine its level of maturity and suitability for NASA applications. To better understand and assess the effectiveness of the reconfigurable design paradigm that is utilized within the HAL-15 reconfigurable computer system. This system was made available to NASA MSFC for this purpose, from Star Bridge Systems, Inc. To implement on at least one application that would benefit from the performance levels that are possible with reconfigurable hardware. It was originally proposed that experiments in fault tolerance and dynamically reconfigurability would be perform but time constraints mandated that these be pursued as future research.
Author
Reconfigurable Hardware; Computer Systems Programs

20030095842 Air Force Air Education and Training Command, Randolph AFB, TX, USA
Technology Innovation Flight: Education and Training Technology Application Program
Levi, Ken; Advanced Learning Technologies and Learning Networks and Their Impact on Future Aerospace Workforce;

September 2003, pp. 309-329; In English; See also 20030095837; Original contains color illustrations; No Copyright; Avail: CASI; A03, Hardcopy

The briefing will cover the purpose of ETTAP; the process by which Air Force classrooms can obtain ETTAP funds; some examples of past and current projects, including a live demo of what we would consider the ideal; how we define a good project; the role of the project officer; how we evaluate new classroom technologies, some of the ETTAP programs that are going on nationwide; and finally, how you can reach the ETTAP program for more information.

Author

Education; On-Line Systems; Computer Assisted Instruction

20030095846 Air Force Air Education and Training Command, Randolph AFB, TX, USA

AETC Technology Integration and Development

Egts, Garald; Nguyen, Phong; Advanced Learning Technologies and Learning Networks and Their Impact on Future Aerospace Workforce; September 2003, pp. 331-352; In English; See also 20030095837; Original contains color illustrations; No Copyright; Avail: CASI; A03, Hardcopy

This presentation provides an overview of the U.S. Air Force Air Education and Training Command (AETC).The AETC provides technology education to AETC units.

Derived from text

Education; On-Line Systems

20030095961 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Obtaining the Greatest Scientific Benefit from Observational Platforms by Consideration of the Relative Benefit of Observations

Chelberg, David; Drews, Frank; Fleeman, David; Welch, Lonnie; Marquart, Jane; Pfarr, Barbara; [2003]; 8 pp.; In English; International Conference on Space Mission Challenges for Information Technology, 13-16 Jul. 2003, Pasadena, CA, USA; Copyright; Avail: CASI; A02, Hardcopy

One of the current trends in spacecraft software design is to increase the autonomy of onboard flight and science software. This is especially true when real-time observations may affect the observation schedule of a mission. For many science missions, such as those conducted by the Swift Burst Alert Telescope, the ability of the spacecraft to autonomously respond in real-time to unpredicted science events is crucial for mission success. We apply utility theory within resource management middleware to optimize the real-time performance of application software and achieve maximum system level benefit. We then explore how this methodology can be extended to manage both software and observational resources onboard a spacecraft to achieve the best possible observations.

Author

Autonomy; Software Engineering; Airborne/Spaceborne Computers; Space Missions; Spacecraft Instruments; Architecture (Computers); Mathematical Models

20030098051 Northwestern Univ., Evanston, IL

Optimization of Technique Factors for full-Field Digital Mammography and Comparison of Optimized Techniques to Screen-Film Mammography

Berns, Eric A.; Hendrick, R. E.; Sep. 2002; 13 pp.; In English

Contract(s)/Grant(s): DAMD17-99-1-9144

Report No.(s): AD-A415515; No Copyright; Avail: CASI; A03, Hardcopy

The technical objectives of this study are to determine optimum techniques for a flat-panel Cesium-iodide silicon-diode full-field digital mammography system and to compare those optimized techniques to screen-film mammography at equal breast doses. This project continued in the second year with work focused on analyzing the data and writing a manuscript for publication. Statistical analysis was performed using the SAS software package comparing contrast-detail scores and looking for trends among different target-filter combinations as kilo-voltage peak values were increased. From this, a manuscript was written titled 'Optimization of technique factors for a silicon diode array full-field digital mammography system and comparison to screen-film mammography with matched average glandular dose'. This paper represents presents the majority of results from this project to date. The paper was accepted for publication in Medical Physics for March 2003.

DTIC

Optimization; Digital Systems; Mammary Glands; Cancer; Medical Science; Computer Techniques

20030099650 Concepts NREC, White River Jct., VT, USA
Easier Analysis With Rocket Science
Spinoff 2003: 100 Years of Powered Flight; 2003, pp. 58-59; In English; See also 20030099639; Original contains color illustrations; No Copyright; Avail: National Technology Transfer Center (NTTC), Wheeling, WV

Analyzing rocket engines is one of Marshall Space Flight Center's specialties. When Marshall engineers lacked a software program flexible enough to meet their needs for analyzing rocket engine fluid flow, they overcame the challenge by inventing the Generalized Fluid System Simulation Program (GFSSP), which was named the co-winner of the NASA Software of the Year award in 2001. This paper describes the GFSSP in a wide variety of applications
Derived from text
Fluid Flow; Rocket Engines; Software Engineering; Computerized Simulation

20030099663 Tietronix Software, Inc., Houston, TX, USA
Software With Strong Ties to Space
Spinoff 2003: 100 Years of Powered Flight; 2003, pp. 62-63; In English; See also 20030099639; Original contains color illustrations; No Copyright; Avail: National Technology Transfer Center (NTTC), Wheeling, WV

TieFlow is a simple but powerful business process improvement solution. It can automate and simplify any generic or industry-specific work process, helping organizations to transform work inefficiencies and internal operations involving people, paper, and procedures into a streamlined, well-organized, electronicbased process. TieFlow increases business productivity by improving process cycle times. The software can expedite generic processes in the areas of product design and development, purchase orders, expense reports, benefits enrollment, budgeting, hiring, and sales. It can also shore up vertical market processes such as claims processing, loan application and processing, health care administration, contract management, and advertising agency traffic. The processes can be easily and rapidly captured in a graphical manner and enforced together with rules pertaining to assignments that need to be performed. Aside from boosting productivity, TieFlow also reduces organizational costs and errors. TieFlow was developed with Small Business Innovation Research (SBIR) assistance from Johnson. The SBIR support entitles all Federal Government agencies to utilize the TieFlow software technology free of charge. Tietronix emphasizes that TieFlow is an outstanding workflow resource that could produce dramatic productivity and cost improvements for all agencies, just as it has done and continues to do for NASA. The Space Agency is currently using the software throughout several mission-critical offices, including the Mission Operations Directorate and the Flight Director s Office, for worldwide participation of authorized users in NASA processes. At the Flight Director s Office, TieFlow allows personnel to electronically submit and review changes to the flight rules carried out during missions.
Derived from text
Computer Programs; Productivity; Industrial Management

20030099669 Safeware Engineering Corp., Seattle, WA, USA
Building Safer Systems With SpecTRM
Spinoff 2003: 100 Years of Powered Flight; 2003, pp. 72; In English; See also 20030099639; Original contains color illustrations; No Copyright; Avail: National Technology Transfer Center (NTTC), Wheeling, WV

System safety, an integral component in software development, often poses a challenge to engineers designing computer-based systems. While the relaxed constraints on software design allow for increased power and flexibility, this flexibility introduces more possibilities for error. As a result, system engineers must identify the design constraints necessary to maintain safety and ensure that the system and software design enforces them. Safeware Engineering Corporation, of Seattle, Washington, provides the information, tools, and techniques to accomplish this task with its Specification Tools and Requirements Methodology (SpecTRM). NASA assisted in developing this engineering toolset by awarding the company several Small Business Innovation Research (SBIR) contracts with Ames Research Center and Langley Research Center. The technology benefits NASA through its applications for Space Station rendezvous and docking. SpecTRM aids system and software engineers in developing specifications for large, complex safety critical systems. The product enables engineers to find errors early in development so that they can be fixed with the lowest cost and impact on the system design. SpecTRM traces both the requirements and design rationale (including safety constraints) throughout the system design and documentation, allowing engineers to build required system properties into the design from the beginning, rather than emphasizing assessment at the end of the development process when changes are limited and costly.System safety, an integral component in software development, often poses a challenge to engineers designing computer-based systems. While the relaxed constraints on software design allow for increased power and flexibility, this flexibility introduces more possibilities for error. As a result, system engineers must identify the design constraints necessary to maintain safety and ensure that the system and software design enforces them. Safeware Engineering Corporation, of Seattle, Washington, provides the

information, tools, and techniques to accomplish this task with its Specification Tools and Requirements Methodology (SpecTRM). NASA assisted in developing this engineering toolset by awarding the company several Small Business Innovation Research (SBIR) contracts with Ames Research Center and Langley Research Center. The technology benefits NASA through its applications for Space Station rendezvous and docking. SpecTRM aids system and software engineers in developing specifications for large, complex safety critical systems. The product enables engineers to find errors early in development so that they can be fixed with the lowest cost and impact on the system design. SpecTRM traces both the requirements and design rationale (including safety constraints) throughout the system design and documentation, allowing engineers to build required system properties into the design from the beginning, rather than emphasizing assessment at the end of the development process when changes are limited and costly.
Derived from text
Safety Factors; Safety; Integrated Circuits; Computer Programs; Systems Engineering; Errors

20030099677 Intelligent Light, Lyndhurst, NJ, USA
Free-Flowing Solutions for CFD
Spinoff 2003: 100 Years of Powered Flight; 2003, pp. 66-67; In English; See also 20030099639; Original contains color illustrations; No Copyright; Avail: National Technology Transfer Center (NTTC), Wheeling, WV

Licensed to over 1,500 customers worldwide, an advanced computational fluid dynamics (CFD) post-processor with a quick learning curve is consistently providing engineering solutions, with just the right balance of visual insight and hard data. FIELDVIEW is the premier product of JMSI, Inc., d.b.a. Intelligent Light, a woman-owned, small business founded in 1994 and located in Lyndhurst, New Jersey. In the early 1990s, Intelligent Light entered into a joint development contract with a research based company to commercialize the post-processing FIELDVIEW code. As Intelligent Light established itself, it purchased the exclusive rights to the code, and structured its business solely around the software technology. As a result, it is enjoying profits and growing at a rate of 25 to 30 percent per year. Advancements made from the earliest commercial launch of FIELDVIEW, all the way up to the recently released versions 8 and 8.2 of the program, have been backed by research collaboration with NASA's Langley Research Center, where some of the world's most progressive work in transient (also known as time-varying) CFD takes place.
Derived from text
Computational Fluid Dynamics; Software Engineering; Fluid Flow; Data Processing

20030099678 Stottler Henke Associates, Inc., San Mateo, CA, USA
A Tutor That's Up to the Task
Spinoff 2003: 100 Years of Powered Flight; 2003, pp. 60-61; In English; See also 20030099639; Original contains color illustrations; No Copyright; Avail: National Technology Transfer Center (NTTC), Wheeling, WV

With assistance from NASA s Marshall Space Flight Center, a new breed of ITS for technical training and complex problem-solving has hit the market to provide students and trainees with the decision-making skills necessary to succeed to the next level. The Task Tutor Toolkit (T3), developed by Stottler Henke Associates, Inc., of San Mateo, California, is a generic tutoring system shell and scenario authoring tool that emulates expert instructors and lowers the cost and difficulty of creating scenario-based ITS for technical training. The functionality of Stottler Henke Associates T3 far exceeds that of traditional computer-based training systems, which test factual recall and narrow skills by prompting students to answer multiple-choice or fill-inthe- blank questions. The T3, on the contrary, lets students assess situations, generate solutions, make decisions, and carry out actions in realistically complex scenarios.At the beginning of each scenario, the T3 tutoring system presents a briefing that describes the situation and the goals the students should pursue. Each scenario contains a solution template that specifies a partially-ordered sequence of action patterns that match correct sequences of student actions. During each scenario, the built-in simulator notifies the tutoring system of each student action. The T3 uses this information to evaluate the student action by comparing it with the scenario s solution template and with error rules that detect incorrect actions.
Author
Computer Assisted Instruction; Simulators; Technology Utilization

20030099679 Collier Research and Development Corp., Hampton, VA, USA
Efficient, Multi-Scale Designs Take Flight
Spinoff 2003: 100 Years of Powered Flight; 2003, pp. 68-69; In English; See also 20030099639; Original contains color illustrations; No Copyright; Avail: National Technology Transfer Center (NTTC), Wheeling, WV

Engineers can solve aerospace design problems faster and more efficiently with a versatile software product that performs

automated structural analysis and sizing optimization. Collier Research Corporation's HyperSizer Structural Sizing Software is a design, analysis, and documentation tool that increases productivity and standardization for a design team. Based on established aerospace structural methods for strength, stability, and stiffness, HyperSizer can be used all the way from the conceptual design to in service support. The software originated from NASA s efforts to automate its capability to perform aircraft strength analyses, structural sizing, and weight prediction and reduction. With a strategy to combine finite element analysis with an automated design procedure, NASA s Langley Research Center led the development of a software code known as ST-SIZE from 1988 to 1995. Collier Research employees were principal developers of the code along with Langley researchers. The code evolved into one that could analyze the strength and stability of stiffened panels constructed of any material, including light-weight, fiber-reinforced composites.
Derived from text
Software Engineering; Computer Programming; Aerospace Engineering; Composite Materials; Structural Analysis

20030099696 Auspice Corp., Framingham, MA, USA, Draper (Charles Stark) Lab., Inc., Cambridge, MA, USA
The Logical Extension
Spinoff 2003: 100 Years of Powered Flight; 2003, pp. 74-75; In English; See also 20030099639; Original contains color illustrations; No Copyright; Avail: National Technology Transfer Center (NTTC), Wheeling, WV

The same software controlling autonomous and crew-assisted operations for the International Space Station (ISS) is enabling commercial enterprises to integrate and automate manual operations, also known as decision logic, in real time across complex and disparate networked applications, databases, servers, and other devices, all with quantifiable business benefits. Auspice Corporation, of Framingham, Massachusetts, developed the Auspice TLX (The Logical Extension) software platform to effectively mimic the human decision-making process. Auspice TLX automates operations across extended enterprise systems, where any given infrastructure can include thousands of computers, servers, switches, and modems that are connected, and therefore, dependent upon each other. The concept behind the Auspice software spawned from a computer program originally developed in 1981 by Cambridge, Massachusetts-based Draper Laboratory for simulating tasks performed by astronauts aboard the Space Shuttle. At the time, the Space Shuttle Program was dependent upon paper-based procedures for its manned space missions, which typically averaged 2 weeks in duration. As the Shuttle Program progressed, NASA began increasing the length of manned missions in preparation for a more permanent space habitat. Acknowledging the need to relinquish paper-based procedures in favor of an electronic processing format to properly monitor and manage the complexities of these longer missions, NASA realized that Draper's task simulation software could be applied to its vision of year-round space occupancy. In 1992, Draper was awarded a NASA contract to build User Interface Language software to enable autonomous operations of a multitude of functions on Space Station Freedom (the station was redesigned in 1993 and converted into the international venture known today as the ISS)
Derived from text
Autonomy; Decision Theory; International Space Station; Telecommunication; Logic Circuits; NASA Space Programs

20030102116 California Inst. of Tech., Pasadena, CA, USA
De-Focusing Digital Particle Image Velocimetry System
Hornung, Hans G.; May 14, 2003; 8 pp.; In English
Contract(s)/Grant(s): F49620-01-1-0207
Report No.(s): AD-A415551; AFRL-SR-AR-TR-03-0227; No Copyright; Avail: CASI; A02, Hardcopy

The work under a Grant from DURIP is to build and test a velocimetry system in support of an AFOSR Grant for making three-dimensional, three-component velocity field measurements in supersonic transverse jet injection in the Caltech Ludwieg Tube. All of the components of the system have been purchased, and those that needed to be manufactured in the machine shop have been designed and built. Improvements in hardware, recognized during the design and construction, both from practical points of view and from the point of view of comparison of data with computation, have led to changes in design. These were implemented, but require extensive new software that is being generated prior to the calibration of the system. DTIC
Particle Image Velocimetry; Digital Systems; Wind Tunnel Tests; Software Engineering

20030102178 Army Research Lab., Aberdeen Proving Ground, MD
Developing a Chemical Reconnaissance Behavior for Unmanned Ground Vehicles Using the OneSAF Battlefield Simulation Tool
Fields, MaryAnne; Haug, Bailey T.; May 2003; 28 pp.; In English; Original contains color illustrations
Report No.(s): AD-A415682; ARL-TR-2972; No Copyright; Avail: CASI; A03, Hardcopy

One of the goals of the U.S. Army Ground Robotics Research Program is to develop individual and group behaviors that allow the robots to contribute to battlefield missions such as reconnaissance. By using simulation tools, we are able to develop, debug, and test behaviors before porting them to actual robotic platforms. This affords the researchers the opportunity to expeditiously evaluate the behaviors in a diverse set of environments and to explore variations in behavior algorithms without tying up limited robotic resources or putting these robotic vehicles at risk. This report describes our efforts to develop a proof-of-principle behavior initiated in simulation then ported to a team of surrogate robotic platforms. The issues discovered in porting the algorithm from simulation to the robotic platform are discussed. The report concludes with a discussion of possible extensions to the basic tool.
DTIC
Computerized Simulation; Robotics; Unmanned Ground Vehicles; Reconnaissance; Software Development Tools; Chemical Warfare

20030102255 NASA Goddard Space Flight Center, Greenbelt, MD, USA
A Computer-Aided Approach for Designing Edge-Slot Waveguide Arrays
Gosselin, Renee Brian; [2003]; 25 pp.; In English; Allerton 2003 Conference Proceedings; No Copyright; Avail: CASI; A03, Hardcopy

Traditional techniques for designing resonant edge-slot waveguide arrays have required an iterative trial-and-error process of measuring slot data from several prototypes. Since very little meaningful data has been published, this technology remains relatively immature and prohibitive for many smaller programs that could benefit from some advantages this antenna has to offer. A new Computer-Aided Design technique for designing resonant edge-slot waveguide arrays was used to successfuliy design such an X-band radiometer antenna for the NASA Light Rainfall Radiometer (LRR) instrument. Having the ability to rapidly create such an extremely accurate and efficient antenna design without the need to manufacture prototypes has also enabled inexpensive research that promises to improve the system-level performance of microwave radiometers for upcoming space-flight missions. This paper will present details of the LRR antenna design and describe some other current edge-slot array accomplishments at Goddard Space Flight Center.
Author
Antenna Design; Computer Aided Design; Antenna Arrays; Waveguides

20030102264 Mississippi State Univ., Mississippi State, MS
Pathfinder 2: In Situ Design Cost Trades (IDCT) Tool
Greenwood, Allen G.; May 2003; 255 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F33615-00-C-5902; Proj-2865
Report No.(s): AD-A416272; AFRL-ML-WP-TR-2003-4116; No Copyright; Avail: CASI; A12, Hardcopy

The integration of cost evaluations into the design process, i.e., making them in situ, requires a strategic cost evaluation framework. This framework must address three key components: (1) the processes by which design and cost evaluations are performed, (2) the methodologies/technologies (M/T) that are needed in order to effectively carry out these processes, and more specifically, (3) the way cost models are used, reused, and managed. In order to design in affordability early in design, engineering tools, including cost assessment tools, must be integrated into the design process and interact with tools that support other types of but related, analyses. Insertion of these technologies requires an understanding of the design, requirements, and cost-estimation processes. Therefore, definition of these key processes, and the relationships among the processes, are essential for defining and developing an integrated support tool to enhance these processes. There are many M/T available and being developed to support cost evaluations during design; however, they are not a part of an overall strategy or plan that considers the needs and requirements of the design trade study process and the relationships among the M/T. Models are an important element in cost estimating; they transform parameters and design variables into estimates of cost performance and risk.
DTIC
Cost Estimates; Software Development Tools; Cost Analysis; Design To Cost

20030105445
Evaluating the Feasibility of Developing National Outcomes Data Bases to Assist Patients with Marking Treatment Decisions
Damberg, Cheryl L.; Hiatt, Liisa; Chan, Kitty S.; Nolind, Rebecca; Greenberg, Michael; Jan. 2003; 139 pp.; In English
Report No.(s): AD-A416286; RAND-MR-1708-AHRQ; No Copyright; Avail: CASI; A07, Hardcopy

This report examines the potential for, and range of issues associated with, establishing national health outcomes data bases to help patients and their physicians evaluate tradeoffs among various treatment options. Patients are frequently faced with more than one treatment option and often those treatments have multiple outcomes that need to be understood and evaluated in terms of their risks and benefits to the patient. This work builds on previous Agency for Health care Research and Quality (AHRQ) - sponsored expert meetings funded by the Kanter Family Foundation-which focused on the possibility of developing data systems that would allow patients to share information with other patients about the decisions they had made when confronted with alternative treatment choices and the outcomes they had experienced.
DTIC
Data Bases; Evaluation; Feasibility Analysis; Health; Patients

20030105454 Howard Univ., Washington, DC, USA
Test Generation for Very High-Level Design Language (VHDL) Specifications Used in Avionics
Chouikha, Mohamed F.; Aug. 2002; 45 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F33615-97-C-1127; Proj-6096
Report No.(s): AD-A416255; AFRL-IF-WP-TR-2002-1522; No Copyright; Avail: CASI; A03, Hardcopy
This report describes a technique that automatically generates test pattern sequences for digital systems based on VHDL inputs. This research aims to design a method for detection and elimination of inconsistencies in the Extended Finite State Machine (EFSM) directed graph model of the VHDL by splitting the graph vertices and duplicating the edges minimally. It focuses mainly on detection and removal of condition-to- condition and action-to-action inconsistencies. Section 1 describes the general problem and lists different tools that already exist. Section 2 describes the algorithm for detection and removal of condition-to-condition inconsistencies. Section 3 presents a pseudocode of the combined detection/removal condition-to-condition inconsistencies. Section 4 describes the algorithm for detection and removal of action-to-action inconsistencies. Section 5 presents a pseudocode of the combined detection/removal action-to-action inconsistencies. Section 6 describes the implementation of the algorithm in C along with some examples.
DTIC
Avionics; High Level Languages; Algorithms; Design Analysis; Graph Theory; Hardware Description Languages

20030105552 Ohio Univ., OH, USA
Improving TCP Network Performance by Detecting and Reacting to Packet Reordering
Kruse, Hans; Ostermann, Shawn; Allman, Mark; [2003]; 15 pp.; In English
Contract(s)/Grant(s): NCC3-680; No Copyright; Avail: CASI; A03, Hardcopy
There are many factors governing the performance of TCP-basec applications traversing satellite channels. The end-to-end performance of TCP is known to be degraded by the reordering, delay, noise and asymmetry inherent in geosynchronous systems. This result has been largely based on experiments that evaluate the performance of TCP in single flow tests. While single flow tests are useful for deriving information on the theoretical behavior of TCP and allow for easy diagnosis of problems they do not represent a broad range of realistic situations and therefore cannot be used to authoritatively comment on performance issues. The experiments discussed in this report test TCP s performance in a more dynamic environment with competing traffic flows from hundreds of TCP connections running simultaneously across the satellite channel. Another aspect we investigate is TCP's reaction to bit errors on satellite channels. TCP interprets loss as a sign of network congestion. This causes TCP to reduce its transmission rate leading to reduced performance when loss is due to corruption. We allowed the bit error rate on our satellite channel to vary widely and tested the performance of TCP as a function of these bit error rates. Our results show that the average performance of TCP on satellite channels is good even under conditions of loss as high as bit error rates of 10(exp -5)
Author
Artificial Satellites; Computer Systems Performance; Detection; Packets (Communication); Communication Networks

20030105553 Lockheed Martin Space Systems Co., Denver, CO, USA
Evaluation of Algorithms for Compressing Hyperspectral Data
Cook, Sid; Harsanyi, Joseph; Faber, Vance; June 2003; 5 pp.; In English; 10th SPIE Remote Sensing Symposium, 8 Sep. 2003, Barcelona, Spain
Contract(s)/Grant(s): NAS5-00216; No Copyright; Avail: CASI; A01, Hardcopy
With EO-1 Hyperion in orbit NASA is showing their continued commitment to hyperspectral imaging (HSI). As HSI sensor technology continues to mature, the ever-increasing amounts of sensor data generated will result in a need for more

cost effective communication and data handling systems. Lockheed Martin, with considerable experience in spacecraft design and developing special purpose onboard processors, has teamed with Applied Signal & Image Technology (ASIT), who has an extensive heritage in HSI spectral compression and Mapping Science (MSI) for JPEG 2000 spatial compression expertise, to develop a real-time and intelligent onboard processing (OBP) system to reduce HSI sensor downlink requirements. Our goal is to reduce the downlink requirement by a factor > 100, while retaining the necessary spectral and spatial fidelity of the sensor data needed to satisfy the many science, military, and intelligence goals of these systems. Our compression algorithms leverage commercial-off-the-shelf (COTS) spectral and spatial exploitation algorithms. We are currently in the process of evaluating these compression algorithms using statistical analysis and NASA scientists. We are also developing special purpose processors for executing these algorithms onboard a spacecraft.
Author
Algorithms; Onboard Data Processing

20030105695 Prediction Systems, Inc., Spring Lake, NJ
High Efficiency, Scalable Parallel Processing
Jun. 30, 2003; 82 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAAH01-03-C-R031
Report No.(s): AD-A416556; PSI03004; No Copyright; Avail: CASI; A05, Hardcopy

PSI's CAD approach to simulation/software development cuts large system life cycle costs by an order of magnitude. A visual representation of software architecture that provides a one-to-one mapping to the code, it's based upon separation data from instructions, affording separation of architecture from language, and providing ease of control and reuse of complex modules. This paradigm shift for software brakes barriers to building complex systems, makes significant upgrades easy, and cuts support costs dramatically, by achieving module independence through visually enforced architectural design rules. Its success has resulted in huge simulations that meet customer validity contraints but now exceed single processor computer power by one or two orders of magnitude. Hardware designers produce parallel computers with speeds into teraflop ranges. However, their practical use on all but very special problems has been extremely limited due to software implementation problems. This research is to confirm hypotheses that graphical design rules that achieve software understandability and module independence also support allocation of processes to parallel processors. Fusion of this technology with parallel processors can result in an order of magnitude of speed improvement, yet making development easier on parallel machines than single processor machines due to concurrent memory access and management.
DTIC
Parallel Processing (Computers); Life Cycle Costs; Parallel Computers

20030105744 Dassault Aviation, Saint-Cloud, France
Reactive Planning in Air Combat Simulation
Degirmenciyan-Cartault, Irene; Intelligent Systems for Aeronautics; June 2003, pp. 6-1 - 6-14; In English; See also 20030105742; Original contains color illustrations; Copyright; Avail: CASI; C01, CD-ROM; A03, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

In real-world environments such in air combat missions the agents continuously receive perceptual inputs from the environment that is highly dynamic (unpredictable) and uncertain. The aircraft often have to reorganize themselves and to make decisions under time constraints. Two modes of control are thus necessary: planning and reaction. By planning we mean both building a course of action before execution, and reaction as dynamic replanning which interleaves planning and execution. Furthermore, in air combat simulation the plans adopted by the agents in response to external events are known in advance and are not generated by the agents as in other domains. To be reactive, the agents have to choose dynamically the appropriate plans and to coordinate their actions. We present how we take into account new events thanks to dynamic allocation of tasks by means of the graphs of dependencies between agents activities. Our current work aims to extend this model of tasks and goals by integrating time notions in the selection of action plans and coordinate mechanisms. Operations on plans under time constraints are also examined in order to enable the simultaneous management of several events.
Author
Combat; Air Navigation; Computerized Simulation; Artificial Intelligence; Mission Planning

20030105745 Alabama Univ., Tuscaloosa, AL, USA
Analyzing Rocket Plume Spectral Data with Neural Networks for Condition Monitoring
Whitaker, Kevin W.; Intelligent Systems for Aeronautics; June 2003, pp. 14-1 - 14-16; In English; See also 20030105742; Original contains color illustrations; Copyright; Avail: CASI; C01, CD-ROM; A03, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Space Shuttle Main Engine fault detection systems typically rely on sensor data analysis via redundant rulebased expert systems along with visual observations for the real-time assessment of engine health. A novel alternative to the traditional health monitoring approach is predicated upon the acquisition and subsequent neural network processing of electromagnetic plume emissions. Spectrometric examination of an emission spectrum provides a means for the identification and quantification of metallic species indigenous to the main engine plume flow. Knowledge of the metallic species eroding could pinpoint the specific location of component degradation within the engine as well as identify serious component failures at an early stage. Such an approach is advantageous because it allows for the detection of numerous internal failures that would otherwise go unnoticed by traditional monitoring methods. This paper details a radial basis function neural network architecture that is capable of inferring metallic state from a given plume spectrum. Specifically, a comprehensive discussion of the methodologies necessary for the development and implementation of the neural network approach are provided. The resulting neural networks are validated with actual test-stand data from an actual Space Shuttle Main Engine at NASA s Stennis Space Center.
Author
Neural Nets; Plumes; Space Shuttle Main Engine

20030105749 Dassault Aviation, Saint-Cloud, France
A Multi-Agent Approach for Complex System Design
Degirmenciyan-Cartault, Irene; Intelligent Systems for Aeronautics; June 2003, pp. 5-1 - 5-13; In English; See also 20030105742; Copyright; Avail: CASI; C01, CD-ROM; A03, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Multi-agent systems that arose from research in Distributed Artificial Intelligence are now considered as a new paradigm to design and model complex systems. The design of complex systems seems to be more intuitive with cognitive agents because the designer works at a high level of abstraction where the agent is an important granularity entity with aspects of calculation, reasoning and control which make it quasi autonomous. After a brief overview of the required notions to understand the multi-agent systems' domain, we describe the JACK agent-oriented environment on top of which we are developing the SCALA environment that provides a multiagent-based methodology and tool for the design of complex systems. In SCALA, the global behaviour (i.e. its goal) of the system is modelled through a functional approach based on the definition of a graph of dependencies between the basic behaviours (i.e. tasks to accomplish to achieve a goal). The definition of this graph provides the necessary knowledge to manage cooperation between the agents and to plan reactively their activities when new events occur and when they have to reorganize themselves.
Author
Artificial Intelligence; Autonomy; Complex Systems; Systems Engineering; Distributed Processing

20030105752 Sverdrup Technology, Inc., Eglin AFB, FL, USA
Conceptual Missile Design Using Genetic Algorithms
Anderson, Murray B.; Intelligent Systems for Aeronautics; June 2003, pp. 13-1 - 13-27; In English; See also 20030105742; Original contains color illustrations; Copyright; Avail: CASI; C01, CD-ROM; A03, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

This paper was written to show the potential of using an intelligent systems tool to rapidly conduct conceptual missile design studies. Rather than having separate teams of engineers developing/proposing discipline-specific designs (i.e. aerodynamics, propulsion, flight control system), a computer can quickly learn how to design a missile as an overall system to effectively defeat difficult targets.For these preliminary design studies, a pareto genetic algorithm was used to manipulate a solid rocket design code, an aerodynamic design code, and a three-loop autopilot to produce interceptor designs capable of defeating two different target scenarios. The first scenario is a ground-launched interceptor engaging a high-speed/high-altitude target like a re-entry vehicle. The second scenario is an air-to-air engagement against a highly maneuverable target. Twenty-nine design variables were required to define the optimization problem, and two primary goals were established to access the performance of the interceptor designs. Design goals included minimizing both miss distance and intercept time. The genetic algorithm was able to quickly develop several basic types of designs that performed very well for the individual target scenarios.
Author
Missile Design; Genetic Algorithms

20030105886 Carnegie-Mellon Univ., Pittsburgh, PA
Fifth DoD Product Line Practice Workshop Report
Bergey, John; Cohen, Sholom; Fisher, Matthew; Jones, Lawrence; Northrop, Linda; Jun. 2003; 52 pp.; In English
Contract(s)/Grant(s): F19628-00-C-0003
Report No.(s): AD-A416733; CMU/SEI-2003-TR-007; ESC*-TR-2003-007; No Copyright; Avail: CASI; A04, Hardcopy

The Software Engineering Institute (SEI(SM)) held the Fifth Department of Defense (DoD) Product Line Practice Workshop in August 2002 in conjunction with the Second Software Product Line Conference (SPLC2). The workshop was a hands-on meeting to identify industry-wide best practices in software product lines; to share DoD product line practices, experiences, and issues; to discuss ways in which specific product line practices are accomplished within the DoD; and to obtain feedback on the Version 2 pre-release draft of Software Product Line Acquisition: A Companion to a Framework for Software Product Line Practice written by the SEI. This report synthesizes the workshop presentations and discussions.
DTIC
Computer Programs; Architecture (Computers); Defense Program

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COMPUTER SYSTEMS

Includes computer networks and distributed processing systems. For information systems see *82 Documentation and Information Science*. For computer systems applied to specific applications, see the associated category.

20030086407 Indiana Univ., Bloomington, IN, USA
Reusable Components for Grid Computing Portals
Pierce, Marlon; Emerging and Future Computing Paradigms and Their Impact on the Research, Training, and Design Environments of the Aerospace Workforce; August 2003, pp. 205-219; In English; See also 20030086406; Original contains color illustrations; No Copyright; Avail: CASI; A03, Hardcopy

This viewgraph presentation states that computational grids can enable virtual organizations, but need computing environments for real users. Gateway Portals are a type of Grid Computing Environment (GCE). The presentation then addresses portlets for reusable portal components, which help users share end-to-end services.
CASI
Computer Networks; Computer Systems Design

20030086409 Old Dominion Univ., Hampton, VA, USA
Perspectives on Emerging/Novel Computing Paradigms and Future Aerospace Workforce Environments
Noor, Ahmed K.; Emerging and Future Computing Paradigms and Their Impact on the Research, Training, and Design Environments of the Aerospace Workforce; August 2003, pp. 1-33; In English; See also 20030086406; Original contains black and white illustrations; No Copyright; Avail: CASI; A03, Hardcopy

The accelerating pace of the computing technology development shows no signs of abating. Computing power reaching 100 Tflop/s is likely to be reached by 2004 and Pflop/s (10(exp 15) Flop/s) by 2007. The fundamental physical limits of computation, including information storage limits, communication limits and computation rate limits will likely be reached by the middle of the present millennium. To overcome these limits, novel technologies and new computing paradigms will be developed. An attempt is made in this overview to put the diverse activities related to new computing-paradigms in perspective and to set the stage for the succeeding presentations. The presentation is divided into five parts. In the first part, a brief historical account is given of development of computer and networking technologies. The second part provides brief overviews of the three emerging computing paradigms grid, ubiquitous and autonomic computing. The third part lists future computing alternatives and the characteristics of future computing environment. The fourth part describes future aerospace workforce research, learning and design environments. The fifth part lists the objectives of the workshop and some of the sources of information on future computing paradigms.
Author
Computation; Computer Networks; Technology Assessment; Computers

20030086410 National Inst. of Standards and Technology, Gaithersburg, MD, USA
The NIST Smart Space and Meeting Room Projects
Stanford, Vincent; Emerging and Future Computing Paradigms and Their Impact on the Research, Training, and Design Environments of the Aerospace Workforce; August 2003, pp. 287-314; In English; See also 20030086406; Original contains color illustrations; No Copyright; Avail: CASI; A03, Hardcopy

Pervasive computing devices, sensors, and networks, provide infrastructure for context-aware smart meeting rooms that sense ongoing human activities and respond to them. These technologies require advances in areas including networking, distributed computing, sensor data acquisition, signal processing, speech recognition, human identification, and natural language processing. Open interoperability and metrology standards for the sensor and recognition technologies can aid R&D programs in making these advances. To address this need the NIST Smart Space and Meeting Room projects are developing tools for data formats, transport, distributed processing, and metadata. We are using them to create annotated multi modal research corpora and measurement algorithms for smart meeting rooms, which we are making available to the research and development community.
Author
Data Acquisition; Distributed Processing; Data Management; Data Processing; Algorithms

20030086413 International Business Machines Corp., Research Triangle Park, NC, USA
Autonomic Computing: An Overview
Telford, Ric; Emerging and Future Computing Paradigms and Their Impact on the Research, Training, and Design Environments of the Aerospace Workforce; August 2003, pp. 35-50; In English; See also 20030086406; Original contains color illustrations; No Copyright; Avail: CASI; A03, Hardcopy

IBM introduced the concept of 'e-business on demand' last year to describe the next evolution of e-business. We are now at a stage where the need for e-business on demand is becoming the priority for companies. e-business on demand allows for a more loosely-coupled, service-oriented approach to e-business infrastructures. It allows for systems to combine and separate as required in real-time, to address the business problems at hand. It allows for the leveraging of systems not only within a data center, but across multiple data centers, other businesses, and service providers. This is the vision of computing - being able to construct systems easier, and being able to run these systems with minimal downtime and minimal human intervention. IBM realized a while back that we need some new, fundamental technologies to make this vision of dynamic ebusiness real. Specifically, the ability for IT systems to manage themselves - react to problems, re-configure based on load, guard against attacks and continually optimize based on set policies. This is autonomic computing.
Author
Information Systems; Real Time Operation; Operating Systems (Computers)

20030086414 Rutgers Univ., Piscataway, NJ, USA
Towards Autonomic Computational Science and Engineering (Autonomic Computing: Application Perspective)
Parashar, Manish; Emerging and Future Computing Paradigms and Their Impact on the Research, Training, and Design Environments of the Aerospace Workforce; August 2003, pp. 51-81; In English; See also 20030086406; Original contains color illustrations; No Copyright; Avail: CASI; A03, Hardcopy

This talk motivates and introduces autonomic computational science and engineering, and presents the AutoMate framework for enabling autonomic applications on Grid. It describes the AutoMate architecture and briefly presents each of its components. These include the ACCORD autonomic component framework, the RUDDER decentralized deductive engine, the SESAME context-sensitive dynamic access management framework, the Pawn peer-to-peer messaging substrate, and the SQUID decentralized discovery service. Finally, it describes two applications of autonomic computing to science and engineering - autonomic runtime management framework for adaptive applications (V-Grid) and autonomic interactions for oil reservoir optimization.
Author
Automatic Control; Computation; Computer Networks

20030086415 Case Western Reserve Univ., Cleveland, OH, USA
The Next Wave of Ubiquitous Computing in Knowledge Economy: Challenges and Opportunities
Yoo, Youngjin; Emerging and Future Computing Paradigms and Their Impact on the Research, Training, and Design Environments of the Aerospace Workforce; August 2003, pp. 83-105; In English; See also 20030086406; Original contains color and black and white illustrations; No Copyright; Avail: CASI; A03, Hardcopy

We can think of four distinctive waves of computing paradigms in organizations. It starts with data processing era where mainframe computers were used to automate the back-office tasks. In late 70's and early 80's, this wave was replaced by Micro wave, represented by personal computers and end-user productivity software (Word Perfect, Lotus 1-2-3, dBase III+, and Harvard Graphics). The introduction of local area network and, later, the Internet, once again changed the nature of computing and took us into Network era. At this point, we are yet again experiencing a transition from network to ubiquitous wave. Each

wave of computing not only represents more advanced and powerful computer hardware and software, but also changes of the strategic significance of IT in organizations. It is journey from the back-office to front-office. It is a journey from being utility to strategic assets. This trend will continue in ubiquitous wave.
Author
Local Area Networks; Central Processing Units; Computer Programs; Internets; Data Processing

20030086416 Platform Computing, Brampton, Ontario, Canada
GRID Computing: Changing the IT Infrastructure
Salkeld, Steve; Emerging and Future Computing Paradigms and Their Impact on the Research, Training, and Design Environments of the Aerospace Workforce; August 2003, pp. 143-172; In English; See also 20030086406; Original contains color illustrations; No Copyright; Avail: CASI; A03, Hardcopy

Adopting to the changing market place demands have left businesses challenged to rethink their approach to IT. The spending approach that was identified with the dotcom era or pre-recession times is no more. The investment decisions must be made carefully and in a real context of the demands of the business. It is no longer acceptable for IT to manage boxes - 99.99% uptime for networks is useless if the database the application depends on is down. Providing the complete view of the servers, applications, web services and data along with the people who are using them is increasingly the minimum stakes for IT. The under-current from the past few years have lead to the financial arm of the corporation expecting more then 'hand-waving' ROI. It bust be clear and linked to the business. The one constant in today s marketplace is change. It falls on IT to adapt to the changing demands of business units, economic trends and strategic decisions made by the corporation. Figure 3
Author
Commerce; Data Bases; Economics

20030086417 International Business Machines Corp., Norfolk, VA, USA
Grid and Autonomic Computing: The Next Evolution
Brittle, Nancy; Emerging and Future Computing Paradigms and Their Impact on the Research, Training, and Design Environments of the Aerospace Workforce; August 2003, pp. 107-142; In English; See also 20030086406; Original contains color illustrations; No Copyright; Avail: CASI; A03, Hardcopy

Grid is a key part of IBM's on demand strategy, a powerful vision for the computing enterprise. Our talk today is intended to focus less on the vision and strategy and more on what we have available to help solve your most pressing business and IT problems today.
Author
Computer Networks; Network Control

20030086418 NASA Ames Research Center, Moffett Field, CA, USA
IPG Power Grid Overview
Hinke, Thomas; Emerging and Future Computing Paradigms and Their Impact on the Research, Training, and Design Environments of the Aerospace Workforce; August 2003, pp. 173-203; In English; See also 20030086406; Original contains color illustrations; No Copyright; Avail: CASI; A03, Hardcopy

This presentation will describe what is meant by grids and then cover the current state of the IPG. This will include an overview of the middleware that is key to the operation of the grid. The presentation will then describe some of the future directions that are planned for the IPG. Finally the presentation will conclude with a brief overview of the Global Grid Forum, which is a key activity that will contribute to the successful availability of grid components.
Author
Computer Programs; Computational Grids

20030086420 Defense Advanced Research Projects Agency, Arlington, VA, USA
High Productivity Computing Systems
Graybill, Robert; Emerging and Future Computing Paradigms and Their Impact on the Research, Training, and Design Environments of the Aerospace Workforce; August 2003, pp. 231-241; In English; See also 20030086406; Original contains color illustrations; No Copyright; Avail: CASI; A03, Hardcopy

High performance computing is at a critical juncture. Over the past three decades, this important technology area has provided crucial superior computational capability for many important national security applications. Unfortunately, current

trends in commercial high performance computing, future complementary metal oxide semiconductor (CMOS) technology challenges and emerging threats are creating technology gaps that threaten continued U.S. superiority in important national security applications. As reported in recent DoD studies, there is a national security requirement for peta-scale high productivity computing systems. Without government R&D and participation, high-end computing will be available only through commodity manufacturers primarily focused on mass-market consumer and business needs. This solution would be ineffective for important national security applications. Improving system performance is no longer sufficient to increase system productivity. DARPA S High Productivity Computing Systems (HPCS) program must also improve system programmability, portability, and robustness. HPCS is pursuing the research and development of balanced, economically viable high productivity computing system solutions for the national security and industrial user communities.
Author
Computer Systems Performance; Cmos; Commerce; Security; Robustness (Mathematics)

20030086422 Defense Advanced Research Projects Agency, Arlington, VA, USA
DARPA's New Cognitive System Vision
Lemnios, Zachary; Emerging and Future Computing Paradigms and Their Impact on the Research, Training, and Design Environments of the Aerospace Workforce; August 2003, pp. 425-457; In English; See also 20030086406; Original contains color illustrations; No Copyright; Avail: CASI; A03, Hardcopy

The major focus for the newly formed IPTO is the development of cognitive systems. While computational performance has been increasing due to Moore s Law, the productivity and effectiveness of these systems are not increasing at the same rates. Development of cognitive systems will enable systems to become more usable; more flexible in application; less vulnerable to attacks and more robust in detecting and recovering; all while remaining cost-effective. Cognitive systems are enabled by a firm foundation in the underlying science and mathematics in algorithms and information assurance, which is then embodied in robust software and executed on advanced hardware. Future IPTO programs will also focus on the critical aspects of autonomous perception; knowledge representation and reasoning; machine learning; and communications and interactions.
Author
Algorithms; Machine Learning; Autonomy; Knowledge Representation

20030095826 Nippon Telegraph and Telephone Public Corp., Yokosuka, Japan
Operation of an Advanced Wireless Access System
Nakura, Masamitsu; Yoshioka, Masafumi; Yoshioka, Hiroki; Iwatani, Junichi; Shimizu, Yoshitaka; NTT Technical Review, Volume 1, No. 2; May 2003, pp. 75-78; In English; See also 20030095822; Original contains color illustrations; Copyright; Avail: Other Sources

To satisfy the demand for mobile communications with high-speed Internet access, we have developed an Advanced Wireless Access (AWA) system with a wireless transmission capacity of up to 36 Mbit/s. The AWA system provides distinctive services such as bandwidth guarantee in the wireless layer and non-authentication multicasting. This article describes the operations that are required to apply the AWA system.
Author
Mobile Communication Systems; Wireless Communication

20030095921 NASA Goddard Space Flight Center, Greenbelt, MD, USA
A High Performance Image Data Compression Technique for Space Applications
Yeh, Pen-Shu; Venbrux, Jack; [2003]; 5 pp.; In English; ESTC 2003, 24-26 Jun. 2003, College Park, MD, USA; Copyright; Avail: CASI; A01, Hardcopy

A highly performing image data compression technique is currently being developed for space science applications under the requirement of high-speed and pushbroom scanning. The technique is also applicable to frame based imaging data. The algorithm combines a two-dimensional transform with a bitplane encoding; this results in an embedded bit string with exact desirable compression rate specified by the user. The compression scheme performs well on a suite of test images acquired from spacecraft instruments. It can also be applied to three-dimensional data cube resulting from hyper-spectral imaging instrument. Flight qualifiable hardware implementations are in development. The implementation is being designed to compress data in excess of 20 Msampledsec and support quantization from 2 to 16 bits. This paper presents the algorithm, its applications and status of development.
Author
Data Compression; Technology Utilization; Aerospace Sciences; Algorithms; Imaging Techniques; Computer Systems Performance

20030102173

Information Operations Vulnerability/Survivability Assessment (IOVSA): process Structure (Revision A)

Revilla, Arturo; Christianson, Nora; Gunderson, Eric; Ochoa, Cruz; zum Brunnen, Rick; Jun. 2003; 33 pp.; In English

Report No.(s): AD-A415656; ARL-TR-2993; No Copyright; Avail: CASI; A03, Hardcopy

This document is a revision of the IOVSA methodology formalized in June 2000. The goal of this revised document will be the clarification of the work to be performed for each phase, the requirements, and the expected deliverables. Since this revision will be a living document, it will be updated as appropriate to include lessons learned. The intent of this revision is to facilitate the dialog between the U.S. Army Research Laboratory/Survivability Lethality Analysis Directorate (ARL/SLAD) and the decision-makers (program Executive Offices (PEOs), Program Managers (PMs), evaluators, contractors, etc.) for U.S. Army IT-based systems. As before, the IOVSA process will provide a structured methodology for assessing IT system/System of Systems (SoS) 10 susceptibilities and vulnerabilities. The process will provide flexibility that enables the analyst to customize it for the system/SoS under assessment. Additionally, the IOVSA results will provide critical information to system developers and decision-makers regarding the system's/SoS' 10 susceptibilities and vulnerabilities. Furthermore, enough information will be able to be extracted from the process to evaluate different countermeasure techniques and protection recommendations to determine their feasibility and cost/reward ratio.

DTIC

Systems Engineering; Information Systems

20030105731 Stanford Univ., Stanford, CA

Authenticated Address Notification for Mobile Communication

Datta, Anupam; Mitchell, John C.; Muller, Frederic; Pavlovic, Dusko; Jan. 2001; 12 pp.; In English

Contract(s)/Grant(s): N00014-01-C-0454

Report No.(s): AD-A416549; No Copyright; Avail: CASI; A03, Hardcopy

The authors present an improved protocol for authenticating Mobile IPv6 connections that addresses requirements established in the relevant Internet Draft. The protocol imposes minimal computational requirements on mobile nodes, uses as few messages as possible, and may be adapted to resist denial of service attacks. The protocol has two parts: an initialization phase and an update phase. The initialization phase takes advantage of available authentication infrastructure to set up a shared secret between a mobile node and a correspondent node. Each execution of the update phase uses the shared secret established in the previous phase to maintain security of the mobile connection. The authors have formally verified the correctness of the protocol using the finite-state analysis tool Murphi, which has been used previously to analyze hardware designs and security properties of several protocols. Following an introduction, the paper is structured as follows: Section 2 describes the requirements for security in Mobile IPv6, Section 3 briefly discusses the previous proposals for authenticating binding updates, Section 4 presents the authors' basic protocol, Section 5 presents modeling assumptions and analysis results, and Section 6 discusses extensions to prevent denial-of-service attacks.

DTIC

Cryptography; Message Processing; Mobile Communication Systems; Protocol (Computers); Wireless Communication

63
CYBERNETICS, ARTIFICIAL INTELLIGENCE AND ROBOTICS

Includes feedback and control theory, information theory, machine learning, and expert systems. For related information see also *54 Man/System Technology and Life Support*.

20030093500 Helsinki Univ. of Technology, Espoo, Finland

Design of Robust Controllers for Telecom Power Supplies

Godoura, I. A.; 2002; In English

Report No.(s): PB2003-107238; REPT-132; No Copyright; Avail: National Technical Information Service (NTIS)

A Telecom power supply is studied and analyzed from control system viewpoint. It consists of three stages: AC/DC rectifier, a backup battery, and a Telecom load. The AC/DC rectifier stage can be composed of paralleled DC/DC converters preceded by paralleled AC/DC converters. However, paralleled DC/DC converters are only considered in this thesis because they constitute the main dynamics in practice. A system of paralleled DC/DC converters operating in continuous inductor current mode with either voltage mode control or peak current mode control are modeled and analyzed using state-space representation. The H infinity control design is used in order to guarantee the robust stability and robust performance of the system in spite of different uncertainties. Also the H infinity loop-shaping design is used to design robust controllers in the

presence of uncertainties. Micro-analysis is used to evaluate the robustness of the system. Simulation results are presented to demonstrate the control design procedure and to compare between the two approaches presented. A Telecom power system can be composed of voltage-loop and current-loop subsystems. The multi-input-multi-output proportional-integral-derivative (PID) controller is first designed achieving robust stability and robust performance of the voltage-loop. Then, the multi-input-multi-output proportional-integral (PI) controller for current-loop is designed to achieve robust stability and robust performance of the overall system. Micro-analysis is used to evaluate the robustness of PID and PI controllers. Simulation results are also presented to demonstrate and validate the control design. The required output characteristic of a Telecom power system contains three modes of operation: constant-voltage, modified constant-power, and constant-current modes.
NTIS
Power Supplies; Telecommunication; Controllers

20030093817 Naval Undersea Warfare Center, Newport, RI
Neural Directors
Woodall, Roger L., Inventor; Apr. 2, 2003, pp. 1; In English
Patent Info.: Filed 11 Apr. 1999; US-Patent-Appl-SN-08436957
Report No.(s): AD-D020073; No Copyright; Avail: Other Sources

A neural director is provided which is a neural network constructed with weights that are determined a priori. The neural director receives an input vector X comprising 'I' input components 'X(sub i)' and generates in response an output vector Y comprising 'J' output components. The neural director has an input processing node layer which receives the input vector X and an output processing node layer which generates the output vector Y. The connections between the input and output processing node layers are a unique weighting set w(i,j) that contains an internal representation of a uniform spatial distribution of 'J' unit vectors throughout a unit sphere of 'I' dimensions. Thus the cosine value between any two adjacent unit vectors is a constant everywhere in the unit sphere.
DTIC
Neural Nets; Communication Networks; Artificial Intelligence

20030095830 Nippon Telegraph and Telephone Public Corp., Atsugi, Japan
Gaze Tracking System for Gaze-Based Human-Computer Interaction
Ohno, Takehiko; Mukawa, Naoki; Yoshikawa, Atsushi; NTT Technical Review, Volume 1, No. 2; May 2003, pp. 35-39; In English; See also 20030095822; Original contains color illustrations; Copyright; Avail: Other Sources

We introduce a novel gaze-tracking system called FreeGaze, which is designed to support gaze-based human-computer interaction (HCI). Existing gaze-tracking systems require complicated and burdensome calibration, which prevents gaze being used to operate computers. To simplify the calibration process, FreeGaze corrects the refraction at the surface of the cornea. Unlike existing systems, this calibration procedure requires each user to look at only two points on the display. After the initial calibration, our system needs no further calibration for later measurement sessions. A user study shows that its gaze detection accuracy is about 1.06 (view angle), which is sufficient for gaze-based HCI.
Author
Human-Computer Interface; Calibrating; Vision

20030095831 Nippon Telegraph and Telephone Public Corp., Atsugi, Japan
A Mechanism for Smooth Conversation
Dohsaka, Kohji; Yasuda, Norihito; Miyazaki, Noboru; Nakano, Mikio; Aikawa, Kiyoaki; NTT Technical Review, Volume 1, No. 2; May 2003, pp. 40-44; In English; See also 20030095822; Original contains color illustrations; Copyright; Avail: Other Sources

Spoken dialog systems provide an interface where computers communicate with their users in everyday speech. A weather information system 'HUME' is a spoken dialog system equipped with a new mechanism for establishing smooth conversation between computers and their users. This mechanism allows a spoken dialog system to convey information to users in as short a dialog as possible depending on the system's database. The results of dialog simulations prove the method's effectiveness. The shortened dialogs afforded by this mechanism bring the computer closer to everyday speech.
Author
Conversation; Speech Recognition; Information Systems

20030099646 Transitions Research Corp., USA, Pyxis Corp., San Diego, CA, USA, Cardinal Health, Inc., USA
A Robot to Help Make the Rounds
Spinoff 2003: 100 Years of Powered Flight; 2003, pp. 16-17; In English; See also 20030099639; Original contains color illustrations; No Copyright; Avail: National Technology Transfer Center (NTTC), Wheeling, WV

This paper presents a discussion on the Pyxis HelpMate SecurePak (SP) trackless robotic courier designed by Transitions Research Corporation, to navigate autonomously throughout medical facilities, transporting pharmaceuticals, laboratory specimens, equipment, supplies, meals, medical records, and radiology films between support departments and nursing floors.
CASI
Robots; Autonomy; Medical Equipment; Navigation

20030099667 ECT International, Inc., Brookfield, WI, USA
Promising More Information
Spinoff 2003: 100 Years of Powered Flight; 2003, pp. 57; In English; See also 20030099639; Original contains color and black and white illustrations; No Copyright; Avail: National Technology Transfer Center (NTTC), Wheeling, WV

When NASA needed a real-time, online database system capable of tracking documentation changes in its propulsion test facilities, engineers at Stennis Space Center joined with ECT International, of Brookfield, Wisconsin, to create a solution. Through NASA's Dual-Use Program, ECT developed Exdata, a software program that works within the company's existing Promise software. Exdata not only satisfied NASA s requirements, but also expanded ECT s commercial product line. Promise, ECT s primary product, is an intelligent software program with specialized functions for designing and documenting electrical control systems. An addon to AutoCAD software, Promis e generates control system schematics, panel layouts, bills of material, wire lists, and terminal plans. The drawing functions include symbol libraries, macros, and automatic line breaking. Primary Promise customers include manufacturing companies, utilities, and other organizations with complex processes to control.
Derived from text
Data Bases; Test Facilities; Software Engineering; Artificial Intelligence; On-Line Systems

20030099681 Barrett Technology, Inc., Cambridge, MA, USA
Lending a Helping Hand
Spinoff 2003: 100 Years of Powered Flight; 2003, pp. 76-77; In English; See also 20030099639; Original contains color illustrations; No Copyright; Avail: National Technology Transfer Center (NTTC), Wheeling, WV

Barrett Technology, Inc., of Cambridge, Massachusetts, received the 2003 Robotic Industries Association s Joseph Engelberger Award for Technology Leadership based on successful commercialization of its novel robotic manipulators. Designed for applications requiring superior adaptability, programmability, and dexterity, Barrett s devices provide state-of-the-art functionality and capability, as well as product integration with existing technology. The cutting-edge robotic manipulators originated through collaboration with NASA, the National Science Foundation, and the U.S. Air Force.
Derived from text
Robot Arms; Manipulators

20030102144 QSS Group, Inc., Moffett Field, CA, USA
A New Simulation Framework for Autonomy in Robotic Missions
Flueckiger, Lorenzo; Neukom, Christian; [2003]; 6 pp.; In English; Original contains black and white illustrations; No Copyright; Avail: CASI; A02, Hardcopy

Autonomy is a key factor in remote robotic exploration and there is significant activity addressing the application of autonomy to remote robots. It has become increasingly important to have simulation tools available to test the autonomy algorithms. While indus1;rial robotics benefits from a variety of high quality simulation tools, researchers developing autonomous software are still dependent primarily on block-world simulations. The Mission Simulation Facility I(MSF) project addresses this shortcoming with a simulation toolkit that will enable developers of autonomous control systems to test their system s performance against a set of integrated, standardized simulations of NASA mission scenarios. MSF provides a distributed architecture that connects the autonomous system to a set of simulated components replacing the robot hardware and its environment.
Author
Algorithms; Robotics; Autonomy

20030102215 Ohio State Univ., Columbus, OH

Encoding Strategy for Maximum Noise Tolerance Bidirectional Associative Memory

Shen, Dan; Cruz, Jose B., Jr; Jul. 2003; 18 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): F33615-01-C-3151; Proj-ARPF

Report No.(s): AD-A416239; AFRL-VA-WP-TP-2003-318; No Copyright; Avail: CASI; A03, Hardcopy

In this paper, the Basic Bidirectional Associative Memory (BAM) is extended by choosing weights in the correlation matrix, for a given set of training pairs, which result in a maximum noise tolerance set for BAM. This optimized BAM will recall the correct training pair if an input pair is within the maximum noise tolerance set. We define a hyper-radius, and we prove that for a given set of training pairs, the maximum noise tolerance set is the largest, in the sense that at least one pair outside the maximum noise tolerance set, and within a Hamming distance one larger than the hyper-radius associated with the maximum noise tolerance set, will not converge to the correct training pair. A standard Genetic Algorithm (GA) is used to calculate the weights to maximize the objective function which generates a maximum tolerance set for BAM. Computer simulations are presented to illustrate the error correction and fault tolerance properties of the optimized BAM.

DTIC

Neural Nets; Coding; Noise Tolerance; Error Analysis

20030102258 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Standard Spacecraft Interfaces and IP Network Architectures: Prototyping Activities at the GSFC

Schnurr, Richard; Marquart, Jane; Lin, Michael; May 2003; 10 pp.; In English; 2003 International Telementry Conference, 20-23 Oct. 2003, Las Vegas, NV, USA; No Copyright; Avail: CASI; A02, Hardcopy

Advancements in fright semiconductor technology have opened the door for IP-based networking in spacecraft architectures. The GSFC believes the same signlJicant cost savings gained using MIL-STD-1553/1773 as a standard low rate interface for spacecraft busses cun be realized for highspeed network interfaces. To that end, GSFC is developing hardware and software to support a seamless, space mission IP network based on Ethernet and MIL-STD-1553. The Ethernet network shall connect all fright computers and communications systems using interface standards defined by the CCSDS Standard Onboard InterFace (SOIF) Panel. This paper shall discuss the prototyping effort underway at GSFC and expected results.

Author

Prototypes; Space Missions; Architecture (Computers); Communication Networks; Aerospace Engineering

20030105742 Research and Technology Organization, Neuilly-sur-Seine, France

Intelligent Systems for Aeronautics

June 2003; 272 pp.; In English; Intelligent Systems for Aeronautics, 13-17 May 2002, Rhode-Saint-Genese, Belgium; See also 20030105743 - 20030105757; Original contains color and black and white illustrations

Report No.(s): RTO-EN-022; AC/323(AVT-095)TP/69; Copyright; Avail: CASI; C01, CD-ROM; A12, Hardcopy

Intelligent Systems (IS) are nature-inspired problem solving tools and methodologies that have recently become important in information technology applications. Artificially intelligent systems use computers to emulate various faculties of human intelligence, and biological metaphors. They use a combination of symbolic and sub-symbolic systems capable of developing human-like cognitive skills and intelligence, not just systems capable of doing things humans do not do well. Intelligent systems are ideally suited for tasks such as search and optimization, pattern recognition and matching, planning, uncertainty management, control and adaptation. These lecture notes approach IS from two perspectives: techniques and applications. The emphasis is on aeronautical and space applications of IS, rather than basic research or tool development.expertise. For this purpose, the following techniques commonly used in IS were reviewed: decision strategy tools based on game theory (Dr. J. P eriaux, MDBA, France), neural network techniques for fault identification (Prof. M. Innocenti, U. Pisa, Italy), genetic algorithms (Dr. M. Anderson, Sverdrup Technology, USA; Dr. D. Quagliarella, CIRA, Italy) and multi-agent theory (Dr. I. Degirmenciyan, MDBA, France) These techniques were illustrated by numerous applications: optimal air combat tactics (Dr. K. Krishnakumar, NASA Ames), control of unmanned air vehicles (Dr. M. Ricard, Draper Lab, USA), air combat simulation (Dr. I. Degirmenciyan, MDBA, France), space exploration (Dr. R. Doyle, JPL, USA), unmanned aircraft navigation and formation control (Prof. M. Innocenti, U. Pisa, Italy), missile design (Dr. M. Anderson, Sverdrup Technology, USA), airfoil design (Dr. D. Quagliarella, CIRA, Italy) and finally analysis of rocket plume data for condition monitoring (Prof. K. Whitaker, U. Alabama, USA). Most of these applications have a clear military aspect, whether at the system design level (missile design, control of unmanned air vehicles) or at operational level (optimal air combat tactics, unmanned aircraft formation control, air combat simulation), hence highlighting the relevance and importance of Intelligent Systems for military issues.

Author

Automatic Control; Aeronautics; Artificial Intelligence; Machine Learning

20030105746 NASA Ames Research Center, Moffett Field, CA, USA

Intelligent Systems For Aerospace Engineering: An Overview

KrishnaKumar, K.; Intelligent Systems for Aeronautics; June 2003, pp. O-1 - O-15; In English; See also 20030105742; Original contains color illustrations; Copyright; Avail: CASI; C01, CD-ROM; A03, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Intelligent systems are nature-inspired, mathematically sound, computationally intensive problem solving tools and methodologies that have become extremely important for advancing the current trends in information technology. Artificially intelligent systems currently utilize computers to emulate various faculties of human intelligence and biological metaphors. They use a combination of symbolic and sub-symbolic systems capable of evolving human cognitive skills and intelligence, not just systems capable of doing things humans do not do well. Intelligent systems are ideally suited for tasks such as search and optimization, pattern recognition and matching, planning, uncertainty management, control, and adaptation. In this paper, the intelligent system technologies and their application potential are highlighted via several examples.

Author

Aerospace Engineering; Information Systems; Artificial Intelligence; General Overviews; Mathematical Models

20030105747 Draper (Charles Stark) Lab., Inc., Cambridge, MA, USA

The ADEPT Framework for Intelligent Autonomy

Ricard, Michael; Kolitz, Stephan; Intelligent Systems for Aeronautics; June 2003, pp. 1-1 - 1-11; In English; See also 20030105742; Original contains color illustrations

Contract(s)/Grant(s): NAS3-00163; MDA972-94-C-0011; F30602-99-C-0206; Copyright; Avail: CASI; C01, CD-ROM; A03, Hardcopy

This paper describes the design and implementation of Draper Laboratory's All-Domain Execution and Planning Technology (ADEPT) architecture for intelligent autonomy. Intelligent autonomy is the ability to plan and execute complex activities in a manner that provides rapid, effective response to stochastic and dynamic mission events. Thus, intelligent autonomy enables the high-level reasoning and adaptive behavior for an unmanned vehicle that is provided by an operator in man-in-the-loop systems. Draper s intelligent autonomy has architecture evolved over a decade and a half beginning in the mid 1980's culminating in an operational experiment funded under DARPA's Autonomous Minehunting and Mapping Technologies (AMMT) unmanned undersea vehicle program. ADEPT continues to be refined through its application to current programs that involve air vehicles, satellites and higher-level planning used to direct multiple vehicles. The objective of ADEPT is to solidify a proven, dependable software approach that can be quickly applied to new vehicles and domains. The architecture can be viewed as a hierarchical extension of the sense-think-act paradigm of intelligence and has strong parallels with the military's Observe-Orient-Decide-Act (OODA) loop. The key elements of the architecture are planning and decision-making nodes comprising modules for situation assessment, plan generation, plan implementation and coordination. A reusable, object-oriented software framework has been developed that implements these functions. As the architecture is applied to new areas, only the application specific software needs to be developed. This paper describes the core architecture in detail and discusses how this has been applied in the undersea, air, ground and space domains.

Author

Autonomy; Technology Utilization; Artificial Intelligence; Architecture (Computers); Mission Planning

20030105756 NASA Ames Research Center, Moffett Field, CA, USA

Challenging Aerospace Problems for Intelligent Systems

KrishnaKumar, K.; Kanashige, J.; Satyadas, A.; Intelligent Systems for Aeronautics; June 2003, pp. 15-1 - 15-15; In English; See also 20030105742; Copyright; Avail: CASI; C01, CD-ROM; A03, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

In this paper we highlight four problem domains that are well suited and challenging for intelligent system technologies. The problems are defined and an outline of a probable approach is presented. No attempt is made to define the problems as test cases. In other words, no data or set of equations that a user can code and get results are provided. The main idea behind this paper is to motivate intelligent system researchers to examine problems that will elevate intelligent system technologies and applications to a higher level.

Author

Aerospace Systems; Artificial Intelligence; Knowledge Based Systems

20030105952 Naval War Coll., Newport, RI
Agent Based Computing and Effective Self-Synchronization in Netted Warfare
Macdonald, John S.; Feb. 3, 2003; 23 pp.; In English
Report No.(s): AD-A415987; No Copyright; Avail: CASI; A03, Hardcopy

Effective self-synchronization in netted warfare requires the employment of intelligent agents. This statement is supposed by a review of what intelligent agents are, what they show promise of becoming and also what they are not A discussion follows in potential psychological and cultural challenges to implementing agent based computing in a networked military environment. The existence of such challenges has in fact been born out through recent Fleet Battle Experiments. By reviewing the employment of artificial intelligent agents in recent Fleet Battle Experiments, namely FBE INDIA and FBE JULIET, one can also begin to discern a pattern of experimental intelligent agent effectiveness in promoting self-synchronization of disparate, netted forces.
DTIC
Synchronism; Electronic Warfare; Artificial Intelligence; Computer Networks; Warfare

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NUMERICAL ANALYSIS

Includes iteration, differential and difference equations, and numerical approximation.

20030093534 NASA Ames Research Center, Moffett Field, CA, USA
Second Law of Thermodynamics Applied to Metabolic Networks
Nigam, R.; Liang, S.; [2003]; 16 pp.; In English
Contract(s)/Grant(s): NCC2-5475; NASA Order H-5152; RTOP 704-05-40; No Copyright; Avail: CASI; A03, Hardcopy

We present a simple algorithm based on linear programming, that combines Kirchoff's flux and potential laws and applies them to metabolic networks to predict thermodynamically feasible reaction fluxes. These law's represent mass conservation and energy feasibility that are widely used in electrical circuit analysis. Formulating the Kirchoff's potential law around a reaction loop in terms of the null space of the stoichiometric matrix leads to a simple representation of the law of entropy that can be readily incorporated into the traditional flux balance analysis without resorting to non-linear optimization. Our technique is new as it can easily check the fluxes got by applying flux balance analysis for thermodynamic feasibility and modify them if they are infeasible so that they satisfy the law of entropy. We illustrate our method by applying it to the network dealing with the central metabolism of Escherichia coli. Due to its simplicity this algorithm will be useful in studying large scale complex metabolic networks in the cell of different organisms.
Author
Algorithms; Thermodynamics; Network Analysis; Linear Programming

20030093537 Taitech, Inc., Beavercreek, OH, USA
On a Non-Reflecting Boundary Condition for Hyperbolic Conservation Laws
Blech, Richard A., Technical Monitor; Loh, Ching Y.; August 2003; 33 pp.; In English; 16th Computational Fluid Dynamics Conference, 23-26 Jun. 2003, Orlando, FL, USA
Contract(s)/Grant(s): NAS3-03072; WBS 22-708-90-25
Report No.(s): NASA/CR-2003-212387; E-13964-1; NAS 1.26:212387; AIAA Paper 2003-3975; No Copyright; Avail: CASI; A03, Hardcopy

A non-reflecting boundary condition (NRBC) for practical computations in fluid dynamics and aeroacoustics is presented. The technique is based on the first principle of non-reflecting, plane wave propagation and the hyperbolicity of the Euler equation system. The NRBC is simple and effective, provided the numerical scheme maintains locally a C(sup 1) continuous solution at the boundary. Several numerical examples in 1D, 2D, and 3D space are illustrated to demonstrate its robustness in practical computations.
Author
Boundary Conditions; Plane Waves; Conservation Laws; Wave Propagation; Reflection

20030093600 Queensborough Community Coll., Bayside, NY, USA
Mathematical Investigation of Gamma Ray and Neutron Absorption Grid Patterns for Homeland Defense Related Fourier Imaging Systems
Boccio, Dona; The 2002 NASA Faculty Fellowship Program Research Reports; April 2003, pp. VII-1 - VII-5; In English; See also 20030093576; Original contains color illustrations
Contract(s)/Grant(s): NAG8-1859; No Copyright; Avail: CASI; C01, CD-ROM; A01, Hardcopy

Terrorist suitcase nuclear devices typically using converted Soviet tactical nuclear warheads contain several kilograms of plutonium. This quantity of plutonium emits a significant number of gamma rays and neutrons as it undergoes radioactive decay. These gamma rays and neutrons normally penetrate ordinary matter to a significant distance. Unfortunately this penetrating quality of the radiation makes imaging with classical optics impractical. However, this radiation signature emitted by the nuclear source may be sufficient to be imaged from low-flying aerial platforms carrying Fourier imaging systems. The Fourier imaging system uses a pair of co-aligned absorption grids to measure a selected range of spatial frequencies from an object. These grids typically measure the spatial frequency in only one direction at a time. A grid pair that looks in all directions simultaneously would be an improvement over existing technology. A number of grid pairs governed by various parameters were investigated to solve this problem. By examining numerous configurations, it became apparent that an appropriate spiral pattern could be made to work. A set of equations was found to describe a grid pattern that produces straight fringes. Straight fringes represent a Fourier transform of a point source at infinity. An inverse Fourier transform of this fringe pattern would provide an accurate image (location and intensity) of a point source.
Author
Gamma Ray Absorption; Gamma Rays; Nuclear Warheads; Penetration; Numerical Analysis; Neutrons

20030093641 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Attitude Estimation or Quaternion Estimation?
Markley, F. Landis; June 26, 2003; 15 pp.; In English; Flight Mechanics Symposium, 28-30 Oct. 2003, Greenbelt, MD, USA; No Copyright; Avail: CASI; A03, Hardcopy

The attitude of spacecraft is represented by a 3x3 orthogonal matrix with unity determinant, which belongs to the three-dimensional special orthogonal group SO(3). The fact that all three-parameter representations of SO(3) are singular or discontinuous for certain attitudes has led to the use of higher-dimensional nonsingular parameterizations, especially the four-component quaternion. In attitude estimation, we are faced with the alternatives of using an attitude representation that is either singular or redundant. Estimation procedures fall into three broad classes. The first estimates a three-dimensional representation of attitude deviations from a reference attitude parameterized by a higher-dimensional nonsingular parameterization. The deviations from the reference are assumed to be small enough to avoid any singularity or discontinuity of the three-dimensional parameterization. The second class, which estimates a higher-dimensional representation subject to enough constraints to leave only three degrees of freedom, is difficult to formulate and apply consistently. The third class estimates a representation of SO(3) with more than three dimensions, treating the parameters as independent. We refer to the most common member of this class as quaternion estimation, to contrast it with attitude estimation. We analyze the first and third of these approaches in the context of an extended Kalman filter with simplified kinematics and measurement models.
Author
Real Time Operation; Attitude (Inclination); Determinants; Estimating

20030102124
Odor Plume Tracing: Lobster Inspired Algorithms
Atema, Jelle; Sep. 2001; 5 pp.; In English
Contract(s)/Grant(s): N00014-98-1-0822
Report No.(s): AD-A415619; No Copyright; Avail: CASI; A01, Hardcopy

The objective was to discover and understand strategies for tracking chemical plumes to their source in environments characterized by turbulent flow. Two parallel approaches were used. We studied the behavior of plume-tracking lobsters in the laboratory. We also studied plume tracking by autonomous underwater robots under identical conditions to those under which the lobsters were studied. Lobster performance was used as a benchmark to set performance goals for the robots. Hypothesis testing with the robots was used to exclude unworkable strategies as explanations for lobster behavior.
DTIC
Algorithms; Autonomy; Odors; Plumes; Robotics

20030102182 NASA Ames Research Center, Moffett Field, CA, USA
A Parallel Multiblock Mesh Movement Scheme For Complex Aeroelastic Applications
Potsdam, Mark A.; Guruswamy, Guru P.; October 16, 2000; 1 pp.; In English; 39th AIAA Aerospace Sciences
Report No.(s): AIAA Paper 2001-0716; No Copyright; Avail: Other Sources; Abstract Only

A scheme has been developed for the movement of multiblock, structured grids due to surface deformation arising from aeroelastics, control surface movement, or design optimization. Elements of the method include a blending of a surface spline

approximation and nearest surface point movement for block boundaries. Transfinite interpolation is employed for volume grid deformation. The scheme is demonstrated on a range of simple and complex aeroelastic aircraft applications using Navier-Stokes computational fluid dynamics and modal structural analyses on parallel processors. Results are robust and accurate, requiring only minimal user input specification.
Author
Multiblock Grids; Grid Generation (Mathematics); Spline Functions

20030105598 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Monte Carlo Simulations and Generation of the SPI Response
Sturner, S. J.; Shrader, C. R.; Weidenspointner, G.; Teegarden, B. J.; Attie, D.; Diehl, R.; Ferguson, C.; Jean, P.; vonKienlin, A., et al.; [2003]; 5 pp.; In English; Copyright; Avail: CASI; A01, Hardcopy

In this paper we discuss the methods developed for the production of the INTEGRAL/SPI instrument response. The response files were produced using a suite of Monte Carlo simulation software developed at NASA/GSFC based on the GEANT-3 package available from CERN. The production of the INTEGRAL/SPI instrument response also required the development of a detailed computer mass model for SPI. We discuss our extensive investigations into methods to reduce both the computation time and storage requirements for the SPI response. We also discuss corrections to the simulated response based on our comparison of ground and inflight calibration data with MGEANT simulation.
Author
Monte Carlo Method; Spectrometers; Computer Programs; Computerized Simulation

20030105753 Italian Aerospace Research Center, Capua, Italy
Trends in Intelligent System Technologies for Airfoil Design: Computer Algebra Techniques for Gradient Computation through the Continuous Adjoint Approach; Use of Approximate Fitness Evaluators in Evolutionary Optimization
Quagliarella, Domenico; DAmbrosio, Domenic; Iollo, Angelo; Intelligent Systems for Aeronautics; June 2003, pp. 9-1 - 9-25; In English; See also 20030105742; Original contains color illustrations
Contract(s)/Grant(s): CEC-GRD1-1999-10752; Copyright; Avail: CASI; C01, CD-ROM; A03, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Aerodynamic shape design is a challenging application for modern computational fluid dynamic. This is, indeed, a very productive field, both in term of scientific publications and developed applications. Furthermore it is possible to find excellent analysis/design software released in the public domain (See for example [1, 2]). However, industry, in particular automotive and aerospace, but also emerging fields like wind and sea extracted energy, continuously needs increased product performance and competitiveness. This requires increasingly re- fined, advanced and complex computational models capable of describing flow behavior with higher and higher fidelity. Thus the design tools available to scientist and engineers are challenged by the growing complexity of simulation models. The increasing price to performance ratio of nowadays computers is a strong allied of designers in this though race, but often it is not enough. Objectives of this lecture is to explore and analyze some of the technologies that, together with the increasingly available computational power, may help to exploit the tremendous potential of high fidelity flow field models to aerodynamic shape design challenges. For the sake of simplicity we will concentrate on aerofoil design. Two aspects will be considered: the computer algebra assisted development of code related to gradient computation through adjoint techniques and the use of fitness approximation techniques to improve the performance of search procedures. The concern of this first lecture will be more methodological, while some applications will be illustrated in the next one. The outline of the first first part of this lecture is as follows: some short remarks on adjoint problems will introduce the framework in which the Computer Algebra techniques will be mainly used here. Then a brief outline of symbolic computation systems will be given, with particular reference to the features that are here used for adjoint equation derivation. The implemented algorithm will be described and illustrated with an example on a simple problem. The adjoint and the related boundary conditions for 3D Navier-Stokes are then reported, while an example of derivation is given in appendix A. The second part of this lecture will focus on the use of approximated fitness evaluators. The problem will be analyzed using the framework of multi-objective optimization, and some possible approaches to the problem of mixing exact and approximated evaluations will be discussed
Author
Shape Optimization; Aircraft Design; Adjoints; Genetic Algorithms; Computational Fluid Dynamics; Airfoil Profiles

65
STATISTICS AND PROBABILITY

Includes data sampling and smoothing; Monte Carlo method; time series analysis; and stochastic processes.

20030086331 Forest Products Lab., Madison, WI
Confidence Bounds for Normal and Lognormal Distribution Coefficients of Variation
Verrill, S.; May 2003; 20 pp.
Report No.(s): PB2003-105806; FPL-RP-609; No Copyright; Avail: CASI; A03, Hardcopy

This paper compares the so-called exact approach for obtaining confidence intervals on normal distribution coefficients of variation to approximate methods. Approximate approaches were found to perform less well than the exact approach for large coefficients of variation and small sample sizes. Web-based computer programs are described for calculating confidence intervals on coefficients of variation for normally and lognormally distributed data.
NTIS
Confidence; Variance (Statistics); Coefficients

20030102210 Brown Univ., Providence, RI
Wave Functions and Reaction Pathways of Energetic Molecules
Weber, Peter M.; Jun. 20, 2003; 9 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAAD19-00-1-0141
Report No.(s): AD-A415726; ARO-41030.6-CH; No Copyright; Avail: CASI; A02, Hardcopy

Specific aims of the project are to explore the observability and observation of quantum mechanical wave functions, and the reaction pathways of highly energetic molecules. The extent of the observability of vibrational wave functions in polyatomic molecules was determined. Using pump-probe diffraction methodologies, the effect of vibrational excitation was found to be on the order of 1%, well observable using current experimental methodologies. The signatures of the vibrational excitation are found to be specific to the vibrational state, even when the vibrations are isoenergetic. Therefore, the diffraction technique is amenable to deliver three-dimensional views of the probability density distributions of vibrating molecules, potentially extending the limits with which matter can be imaged to the picometer regime. On the study of reaction pathways of energetic molecules, we extended our work on the development of multi-photon ionization via Rydberg states to quite a few molecules. We showed that the Rydberg spectra can be used to fingerprint the shape of a molecule. This discovery will have significant ramifications for analytical chemistry, as it may be possible to combine the Rydberg fingerprint technology with mass spectrometry. The technique could be applied to identify explosives in the presence of other volatile compounds. A patent has been applied.
DTIC
Wave Functions; Polyatomic Molecules; Analytical Chemistry; Mass Spectroscopy

20030105772 Pittsburgh Univ., Pittsburgh, PA
Innovative Statistical Approaches to Modeling Multiple Outcome Data from the NSABP BCPT
Weissfeld, Lisa A.; Berhane, Kiros T.; Sep. 2002; 76 pp.; In English
Contract(s)/Grant(s): DAMD17-99-1-9356
Report No.(s): AD-A415786; No Copyright; Avail: CASI; A05, Hardcopy

The goals of this IDEA award are two-fold, namely, to develop and refine statistical methodology for the analysis of a data set where multiple outcomes or disease incidence endpoints are of interest and to apply these methods to the analysis of a data set in prevention such as the National Surgical Adjuvant Breast and Bowel Project's Breast Cancer Prevention Trial. The software for the fitting of the B-spline models, the first type of model that was proposed in this study is now being used to fit these models and the simulation studies are also complete. Software development for the pseudospline approach is nearly complete. Extensions to the analysis of recurrent event data outcomes are now being developed.
DTIC
Computerized Simulation; Statistical Analysis; Cancer; Mammary Glands

66
SYSTEMS ANALYSIS AND OPERATIONS RESEARCH

Includes mathematical modeling of systems; network analysis; mathematical programming; decision theory; and game theory.

20030093605 Alabama Univ., AL, USA
Standards Advisor-Advanced Information Technology for Advanced Information Delivery
Hawker, J. Scott; The 2002 NASA Faculty Fellowship Program Research Reports; April 2003, pp. XX-1 - XX-5; In English; See also 20030093576
Contract(s)/Grant(s): NAG8-1859; No Copyright; Avail: CASI; C01, CD-ROM; A01, Hardcopy

Developers of space systems must deal with an increasing amount of information in responding to extensive requirements and standards from numerous sources. Accessing these requirements and standards, understanding them, comparing them, negotiating them and responding to them is often an overwhelming task. There are resources to aid the space systems developer, such as lessons learned and best practices. Again, though, accessing, understanding, and using this information is often more difficult than helpful. This results in space systems that: 1. Do not meet all their requirements. 2. Do not incorporate prior engineering experience. 3. Cost more to develop. 4. Take longer to develop. The NASA Technical Standards Program (NTSP) web site at http://standards.nasa.gov has made significant improvements in making standards, lessons learned, and related material available to space systems developers agency-wide. The Standards Advisor was conceived to take the next steps beyond the current product, continuing to apply evolving information technology that continues to improve information delivery to space systems developers. This report describes the features of the Standards Advisor and suggests a technical approach to its development.
Author
Aerospace Systems; Information Systems; Systems Engineering

20030102209 Air Force Inst. of Tech., Wright-Patterson AFB, OH, USA
A Decision Support System for Effective Scheduling in an F-16 Pilot Training Squadron
Aslan, Davut; Mar. 26, 2003; 107 pp.; In English; Original contains color illustrations
Report No.(s): AD-A415710; AFIT/GOR/ENS/03-01; No Copyright; Avail: CASI; A06, Hardcopy

Scheduling of flights for a flight training squadron involves the coordination of time and resources in a dynamic environment. The generation of a daily flight schedule (DFS) requires the proper coordination of resources within established time windows, This research provides a decision support tool to assist in the generation of the DFS. Three different priority rules are investigated for determining an initial ordering of flights and a shifting bottleneck heuristic is used to establish a candidate DFS. A user interface allows a scheduler to interact with the decision support tool during the DFS generation process. Furthermore, the decision support tool provides the capability to produce a weekly schedule for short-term planning purposes as well as the entire flight training program schedule for long-term planning purposes.
DTIC
Decision Support Systems; F-16 Aircraft; Pilot Training; Scheduling

20030102269 Southern Methodist Univ., Dallas, TX
Optimization-Based Techniques for Designing Optical Networks
Kennington, Jeffrey L.; Jun. 2003; 14 pp.; In English
Contract(s)/Grant(s): N00014-96-1-0315
Report No.(s): AD-A416287; No Copyright; Avail: CASI; A03, Hardcopy

This document contains the summary of eleven- research projects performed under this contract. These projects concern developing models and special algorithms for a variety of operations research problems. Eleven of these investigations are summarized in this report.
DTIC
Algorithms; Operations Research; Navy

67
THEORETICAL MATHEMATICS

Includes algebra, functional analysis, geometry, topology, set theory, group theory and number theory.

20030105878 Rice Univ., Houston, TX
Pseudospectral Collocation Methods for the Direct Transcription of Optimal Control Problems
Pietz, Jesse A.; Apr. 2003; 141 pp.; In English; Original contains color illustrations
Report No.(s): AD-A416681; No Copyright; Avail: CASI; A07, Hardcopy

This thesis is concerned with the study of pseudospectral discretizations of optimal control problems governed by ordinary differential equations and with their application to the solution of the International Space Station (ISS) momentum dumping problem. Pseudospectral methods are used to transcribe a given optimal control problem into a nonlinear programming problem. Adjoint estimates are presented and analyzed that provide approximations of the original adjoint variables using Lagrange multipliers corresponding to the discretized optimal control problem. These adjoint estimations are derived for a broad class of pseudospectral discretizations and generalize the previously known adjoint estimation procedure for the Legendre pseudospectral discretization. The error between the desired solution to the infinite dimensional optimal control problem and the solution computed using pseudospectral collocation and nonlinear programming is estimated for linear-quadratic optimal control problems. Numerical results are given for both linear- quadratic and nonlinear optimal control problems. The Legendre pseudospectral method is applied to formulations of the ISS momentum dumping problem. Computed solutions are verified through simulations using adaptive higher order integration of the system dynamics.
DTIC
Optimization; Nonlinear Systems; Differential Equations; Nonlinear Programming; Optimal Control

70
PHYSICS (GENERAL)

Includes general research topics related to mechanics, kinetics, magnetism, and electrodynamics. For specific areas of physics see *categories 71 through 77*. For related instrumentation see *35 Instrumentation and Photography*; for geophysics, astrophysics, or solar physics see *46 Geophysics, 90 Astrophysics*, or *92 Solar Physics*.

20030086324 Argonne National Lab., IL, USA
Variable-Focus X-ray Compound Lens
Khounsary, A.; Shastri, S. D.; Macrander, A.; 2002; In English
Report No.(s): DE2003-805257; No Copyright; Avail: National Technical Information Service (NTIS)

Design and fabrication of an x-ray lens assembly for focusing x-ray beams is described. The assembly consists of a number of precisely stacked and aligned aluminum parts. These parts are cut from a long extruded section having sixteen parabolic cavities along its length. The thickness of the wall between adjacent cavities is 0.2 mm. By cutting the assembled parts diagonally as shown below, a variable-focus lens system can be made. Moving the lens horizontally allows the incident beam to pass through fewer or more cavities, collimating or focusing the emerging beam at a desired distance downstream. The variable focus aluminum lens has been used at the Advanced Photon Source to collimate a monochromatic, 81 keV undulator beam to increase downstream crystal monochromator throughput. Results indicate collimation consistent with theoretical expectations.
NTIS
X Rays; Lens Design

20030086325 Argonne National Lab., IL
Spontaneous and Amplified Raadiation at the Initial Stage of a SASE FEL
Huang, Z.; Kim, K. J.; 2002; 8 pp.; In English
Report No.(s): DE2003-805259; No Copyright; Avail: Department of Energy Information Bridge

At the initial stage of a self-amplified spontaneous emission (SASE) free-electron laser (FEL), spontaneous undulator radiation in certain experimental configurations can dominate the amplified signal over an extended undulator distance. In this paper we study both the spontaneous and the amplified radiation in the framework of the paraxial wave equation and determine

the transition from the dominance of spontaneous emission to exponential amplification. We compare theoretical expectations with SASE simulation codes GINER and GENESIS.
NTIS
Free Electron Lasers; Computerized Simulation

20030098024 Lawrence Livermore National Lab., Livermore, CA
Measuring Spherical Harmonic Coefficients on a Sphere
Pollaine, S. M.; May 16, 2003; 20 pp.; In English
Report No.(s): DE2003-15003912; UCRL-JC-152280; No Copyright; Avail: Department of Energy Information Bridge
The eigenfunctions of Rayleigh-Taylor modes on a spherical capsule are the spherical harmonics. These can be measured by measuring the surface perturbations along great circles and fitting them to the first few modes by a procedure described in this article. For higher mode numbers, it is more convenient to average the Fourier power spectra along the great circles, and then transform them to spherical harmonic modes by an algorithm derived here.
NTIS
Spherical Harmonics; Eigenvectors

20030098025 Lawrence Livermore National Lab., Livermore, CA
Analysis of Shock-Void Experiment
Woods, D. T.; Robey, H.; Stry, P.; May 02, 2003; In English
Report No.(s): DE2003-15003913; UCRL-ID-153417; No Copyright; Avail: National Technical Information Service (NTIS)
We compare CALE experiments with recent experimental results of a laser-induced shock traversing a spherical under-dense ('void'). In this report the experimental results are described, as well as several numerical attempts at explaining the observed radiographs. The conclusion is that the numerical simulations at this time cannot satisfactorily explain the experiment. The simulations also indicate that the introduction of air gaps between the under-dense sphere and the surrounding foam can greatly change the behavior of the shocked sphere. Thus fabrication details may play an important role in the detailed evolution of this experiment. Regardless of the simulations, analysis of the observed time sequence indicates that reproducibility of this experiment may be a factor. To settle this issue, further experiments of this kind will be required.
NTIS
Shock Tests; Spheres

20030102131
Waves and Energy in Chiral Nihility
Tretyakov, S.; Nefedov, I.; Sihvola, A.; Maslovski, S.; Simovski, C.; Oct. 2002; 20 pp.
Report No.(s): PB2003-107125; REPT-401; Copyright; Avail: National Technical Information Service (NTIS)
A model for a chiral material in which both the permittivity and permeability are equal to zero is discussed. Such a material is referred to us as a 'chiral nihility'. It is shown that this exotic material can be realized as a mixture of small helical inclusions. Wave solutions and energy in such a medium are analyzed. It is shown that an extraordinary wave in chiral nihility is a backwards wave. Wave reflection and refraction on a chiral nihility interface is also considered. It is shown that a linearly polarized wave normally incident onto this interface produces the wave of 'standing phase' and the same wave in the case of oblique incidence causes two refracted waves, one of them with an anomalous refraction.
NTIS
Chirality; Refracted Waves; Wave Reflection; Electromagnetic Radiation

20030102175 Massachusetts Inst. of Tech., Lexington, MA
Solid State Research
Shaver, David C.; Feb. 15, 2003; 69 pp.; In English
Contract(s)/Grant(s): F19628-00-C-0002
Report No.(s): AD-A415666; 2003:1; ESC-TR-2002-089; No Copyright; Avail: CASI; A04, Hardcopy
This report covers in detail the research work of the Solid State Division at Lincoln Laboratory for the period 1 November 2002 through 31 January 2003. The topics covered are Quantum Electronics, Electro-optical Materials and Devices, Submicrometer Technology, Biosensor and Molecular Technologies, Advanced Imaging Technology, Analog Device Technology, and Advanced Silicon Technology. Funding is provided by several DoD organizations- including the Air Force,

Army, DARPA, MDA, Navy, NSA, and OSD-and also by the DOE, NASA, and NIST.
DTIC
Quantum Electronics; Solid State Physics; Research And Development; Electro-Optics; Bioinstrumentation

20030105549 Air Force Research Lab., Hanscom AFB, MA, USA
Left-Handed Electrodynamics and Microwave Mesostructures
Derov, John S.; Turchinetz, Beverly; Nov. 2001; 6 pp.; In English
Contract(s)/Grant(s): Proj-2305
Report No.(s): AD-A416408; AFRL-SN-HS-TM-2003-003; AFRL-SN-HS-TM-2003-003; No Copyright; Avail: CASI; A02, Hardcopy

We have started to investigate the fundamental electromagnetic properties of left-handed mesostructures in order to establish a basic understanding of their electromagnetic properties. Simulations have been performed on left-handed structures using Agilent's high frequency structure simulator. The structures were fabricated and measured in X-band waveguide. They were found to have a passband near 10 GHz. This waveguide technique is less complex than previously published chamber techniques.
DTIC
Electromagnetic Properties; Waveguides; Simulation

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*.

20030095832 Nippon Telegraph and Telephone Public Corp., Atsugi, Japan
Timbre Synthesis Technology That Serves Communication
Osaka, Naotoshi; Sakakibara, Ken-Ichi; Hikichi, Takafumi; NTT Technical Review, Volume 1, No. 2; May 2003, pp. 45-49; In English; See also 20030095822; Original contains color illustrations; Copyright; Avail: Other Sources

Sounds other than spoken language play an important role in communication. Moreover, there are demands for high-quality timbre synthesis technology for creating multimedia contents. NTT Communication Science Laboratories is exploring technologies for synthesizing both musical instrument sounds and singing voices. This paper introduces three technologies: i) a physical model of the 'sho', a Japanese traditional music instrument, ii) a model for synthesizing throat singing, and iii) a sound synthesis system called O'kinshi as a tool for content creation.
Author
Music; Synthesis; Voice

20030098009 Brown Univ., Providence, RI
Electroacoustic Tissue Imaging
Diebold, Gerald J.; Apr. 2003; 12 pp.; In English
Contract(s)/Grant(s): DAMD17-02-1-0307
Report No.(s): AD-A415818; No Copyright; Avail: CASI; A03, Hardcopy

The primary objective of this research has been to develop a new method of imaging based on the ultrasonic vibration potential. The method has not been explored before for imaging. Research has focused on building radiofrequency amplifiers in the 0.5 to 10 MHz range that have the highest signal-to-noise ratios possible since extraction of the signal is the most critical part of the imaging system. Theoretical work has been done on modeling the signal generation which is unique to the vibration potential. Experiments have been carried out on colloidal suspensions to confirm some of the predictions of the theory. Experiments with phase contrast x-ray imaging have been carried out showing the highlighting of regions having large density gradients.
DTIC
Electroacoustics; Ultrasonics; Acoustic Imaging

20030105547 Naval Undersea Warfare Center, Newport, RI
Method and Apparatus for Active Sonar Detection Enhancement
Katz, Richard A., Inventor; Nuttall, Albert H., Inventor; Jul. 16, 2003; 22 pp.; In English
Patent Info.: Filed 8 Apr. 2003; US-Patent-Appl-SN-10409711
Report No.(s): AD-D020081; No Copyright; Avail: US Patent and Trademark Office

The present invention provides a method and apparatus for enhancing active sonar signal detection by estimating the channel/target response utilizing measured values of the excitation signals and received signals. A Wiener/ Volterra series expansion for the excitation and received signals is used as a model, wherein a time invariant environment is assumed, thereby disregarding all random noise contributions. The Wiener/Volterra kernels are then determined in a nonlinear processor using a method of correlations which is designed to produce the kernels utilizing only measured white Gaussian excitation signals and received signals. The kernels can be used to give an optimum correlation between the excitation signals and the received signals.
DTIC
Sound Transmission; Random Noise; Sonar

20030105701 Air Force Research Lab., Wright-Patterson AFB, OH
Sound Basics: A Primer in Psychoacoustics
Elias, Bartholomew; Aug. 1998; 199 pp.; In English
Contract(s)/Grant(s): Proj-7184
Report No.(s): AD-A416551; AFRL-HE-WP-TR-2002-0234; No Copyright; Avail: CASI; A09, Hardcopy

This report contains materials for human factors professionals who may on occasion be called upon to provide consultation on psychoacoustic problems such as the assessment of occupational and residential noise exposure, prediction of speech intelligibility in noisy environments, and the design and integration of auditory displays. Users of the materials are expected to have a basic understanding of algebraic notation and problem solving and logarithms, but need not have any formal background in psychoacoustics or hearing. Many human factors professionals lack formal training in psychoacoustics and can benefit from the materials presented in this report, which include the general principles of physical acoustics and the measurement of sound, as well as an overview of the physiology and psychology of hearing. The materials were compiled for a workshop conducted by the Air Force Research Laboratory's Aural Displays and Bioacoustics Branch. They provide a reference tool that can serve as a starting point for detailed research of specific applied psychoacoustic problems.
DTIC
Acoustic Measurement; Bioacoustics; Sound Waves; Sound Transmission; Display Devices; Noise (Sound)

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*.

20030093709 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Modeling of Iron K Lines: Radiative and Auger Decay Data for Fe II-Fe IX
Palmeri, P.; Mendoza, C.; Kallman, T. R.; Bautista, M. A.; Melendez, M.; [2003]; 6 pp.; In English
Contract(s)/Grant(s): FONACIT-S1-2001-100-0912; No Copyright; Avail: CASI; A02, Hardcopy

A detailed analysis of the radiative and Auger de-excitation channels of K-shell vacancy states in Fe II-Fe IX has been carried out. Level energies, wavelengths, A-values, Auger rates and fluorescence yields have been calculated for the lowest fine-structure levels populated by photoionization of the ground state of the parent ion. Different branching ratios, namely K alpha 2/K alpha 1, K beta/K alpha, KLM/KLL, KMM/KLL, and the total K-shell fluorescence yields, omega(sub k), obtained in the present work have been compared with other theoretical data and solid-state measurements, finding good general agreement with the latter. The Kalpha 2/K alpha l ratio is found to be sensitive to the excitation mechanism. From these comparisons it has been possible to estimate an accuracy of approx.10% for the present transition probabilities.
Author
K Lines; Iron; Decay Rates; Auger Spectroscopy; Mathematical Models; Radiative Transfer

20030093735 NASA Glenn Research Center, Cleveland, OH, USA
Use of Atomic Oxygen for the Determination of Document Alteration
Banks, Bruce A.; Klubnik, Larisa M.; September 2003; 27 pp.; In English; 34th Annual Education Seminar, 24-27 Sep. 2003, Earth City, MO, USA
Contract(s)/Grant(s): WBS 22-755-60-05
Report No.(s): NASA/TM-2003-212591; E-14148; NAS 1.15:212591; No Copyright; Avail: CASI; A03, Hardcopy

Atomic oxygen, which normally is found only the near Earth space environment, causes oxidation and erosion of polymers on spacecraft. The development of technology to prevent this degradation has required NASA to develop ground laboratory facilities that generate atomic oxygen. Atomic oxygen has also been found to be able to oxidize most types of ink from a variety of types of pens. The use of atomic oxygen to identify alteration of documents has been investigated and is reported. Results of testing indicates that for many types of ink, pen, and paper, identification of document alteration of pen and ink numbers and evidence of alteration can be made visible by exposing the questionable writing to atomic oxygen. Atomic oxygen provides discrimination because different inks may oxidize at different rates, the amount of time between delayed alteration may add to ink thickness at crossings, and the end of pen strokes tend to have much thicker ink deposits than the rest of the character. Examples and techniques of using atomic oxygen to identify document alteration indicate that the technology can, in many but not all cases, provide discrimination between original and altered documents.
Author
Oxygen Atoms; Documents; Inks; Paper (Material)

20030102250 Air Force Inst. of Tech., Wright-Patterson AFB, OH
The Production and Fate of Molecular Anions Formed by Electron Attachment to Low Electron Affinity Compounds
Salyards, Michael J.; Jun. 2003; 133 pp.; In English
Report No.(s): AD-A416263; AFIT-CI02-992; No Copyright; Avail: CASI; A07, Hardcopy

Resonance electron capture and thermal electron detachment rate constants have been determined for several low electron affinity (EA) compounds, including anthracene, benzophenone, quinoxaline. These measurements were taken by comparing the molecule of interest with SF(6) using pulsed high pressure mass spectrometry (PHPMS) to evaluate the time profiles for the relevant anions. These measurements were affected by recapture of detached electrons as well as loss of these electrons by diffusion to the walls of the ion source. This dissertation also explains why these low EA molecules are not seen at atmospheric conditions. Using the PHPMS, the reactions of the molecular anions of anthracene, quinazoline, benzophenone, quinoxaline and azulene with oxygen and water have been studied. In the simultaneous presence of oxygen and water, these molecular anions, M, are rapidly destroyed and the ion, (O2 - H2O), is rapidly formed. The high rate with which this transition occurs cannot be explained by the simplest model envisioned that is based on well-known ion molecule reactions. These results can be explained, however, by inclusion into the model of a previously uncharacterized reaction between the molecular ion-oxygen complex, (M-O(2)), and water. The results reported here explain why the molecular anions of compounds that have lower EA's than that of azulene are not readily observed in electron capture ion sources of one atmosphere buffer gas pressure. In addition, it is shown that the reactions characterized here lead to a state of chemical equilibrium between the M and (O2 -H(2)O) ions within the PHPMS ion source from which the EA values of the low-EA compounds can be determined. By this method the electron affinities of anthracene, quinazoline, benzophenone and quinoxaline are found to be 0.54, 0.56, 0.61 and 0.68 eV, respectively.
DTIC
Anions; Electron Capture; Electron Attachment; Cosmic Ray Showers

74
OPTICS

Includes light phenomena and the theory of optical devices; for specific optical devices see also *35 Instrumentation and Photography*. For lasers see *36 Lasers and Masers*.

20030093578 Alabama Univ., Huntsville, AL, USA
Partial Wave Analysis of Coupled Photonic Structures
Fuller, Kirk A.; The 2002 NASA Faculty Fellowship Program Research Reports; April 2003; 1 pp.; In English; See also 20030093576
Contract(s)/Grant(s): NAG8-1859; No Copyright; Avail: CASI; C01, CD-ROM; A01, Hardcopy

No abstract available
Electromagnetic Coupling; Photonics

20030093720 NASA Glenn Research Center, Cleveland, OH, USA

The Fluids Integrated Rack and Light Microscopy Module Integrated Capabilities

Motil, Susan M.; Gati, Frank; Snead, John H.; Hill, Myron E.; Griffin, DeVon W.; September 2003; 16 pp.; In English; 53rd International Astronautical Congress, 10-19 Oct. 2002, Houston, TX, USA

Contract(s)/Grant(s): WBS 22-400-32-30-03

Report No.(s): NASA/TM-2003-212606; E-13660; NAS 1.15:212606; IAC-02-J.5.06; No Copyright; Avail: CASI; A03, Hardcopy

The Fluids Integrated Rack (FIR), a facility class payload, and the Light Microscopy Module (LMM), a subrack payload, are scheduled to be launched in 2005. The LMM integrated into the FIR will provide a unique platform for conducting fluids and biological experiments on ISS. The FIR is a modular, multi-user scientific research facility that will fly in the U.S. laboratory module, Destiny, of the International Space Station (ISS). The first payload in the FIR will be the Light Microscopy Module (LMM). The LMM is planned as a remotely controllable, automated, on-orbit microscope subrack facility, allowing flexible scheduling and control of fluids and biology experiments within the FIR. Key diagnostic capabilities for meeting science requirements include video microscopy to observe microscopic phenomena and dynamic interactions, interferometry to make thin film measurements with nanometer resolution, laser tweezers for particle manipulation, confocal microscopy to provide enhanced three-dimensional visualization of structures, and spectrophotometry to measure photonic properties of materials. The LMM also provides experiment sample containment for frangibles and fluids. This paper will provide a description of the current FIR and LMM designs, planned capabilities and key features. In addition a brief description of the initial five experiments planned for LMM/FIR will be provided.

Author

Conducting Fluids; Microscopy; Spectrophotometry; Spacecraft Modules; Payloads; Optics; Structural Design; Light (Visible Radiation); Research Facilities

20030095914 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Development of Mirror Segments for the Constellation-X Observatory

Zhang, W.; Content, David; Henderson, Stephen; Petre, Robert; Saha, Timo; [2003]; 2 pp.; In English; SPIE Annual Meeting, 3-8 Aug. 2003, San Diego, CA, USA; Copyright; Avail: Other Sources; Abstract Only

As NASA's next major X-ray observatory, Constellation-X will have a photon collection area of 30,000 sq cm at 1 keV, which, after folding other instrumental responses, translates into an effective area of 15,000 sq cm. The observatory consists of four identical satellites each of which carries a spectroscopic X-ray telescope mirror assembly (SXT) that is 1.6 m in diameter and has a focal length of 10 m and a collection area of 7,500 sq cm at 1 keV and an angular resolution of 15 sec. HPD (half-power diameter) at the system level. Each mirror assembly consists of a large number of mirror segments precisely assembled together. Our development of the mirror segments is divided into two steps. The first one is to develop the basic approach and fabricate segments within the constraints of existing infrastructure to meet the angular resolution requirement, but not mirror segment size requirement. We have all but successfully completed this part of the development. We are now on the verge of going into the second step, that is to fabricate mirror segments of larger sizes to reduce the number of segments that have to be aligned and integrated. In this paper, we report on the requirements and the development status of the mirror segments. These assembly and other requirements of the SXT are reported elsewhere.

Author

Mirrors; X Ray Telescopes; Observatories; Photons; Fabrication

20030095917 NASA Goddard Space Flight Center, Greenbelt, MD, USA

New Examination of the Traditional Raman Lidar Technique II: Evaluating the Ratios for Water Vapor and Aerosols

Whiteman, David N.; [2003]; 45 pp.; In English; No Copyright; Avail: CASI; A03, Hardcopy

In a companion paper, the temperature dependence of Raman scattering and its influence on the Raman and Rayleigh-Mie lidar equations was examined. New forms of the lidar equation were developed to account for this temperature sensitivity. Here those results are used to derive the temperature dependent forms of the equations for the water vapor mixing ratio, aerosol scattering ratio, aerosol backscatter coefficient, and extinction to backscatter ratio (Sa). The error equations are developed, the influence of differential transmission is studied and different laser sources are considered in the analysis. The results indicate that the temperature functions become significant when using narrowband detection. Errors of 5% and more can be introduced in the water vapor mixing ratio calculation at high altitudes and errors larger than 10% are possible for calculations of aerosol scattering ratio and thus aerosol backscatter coefficient and extinction to backscatter ratio.

Author

Aerosols; Optical Radar; Raman Spectra; Water Vapor; Rayleigh Scattering

20030095969 Lawrence Livermore National Lab., Livermore, CA
Correlation Wave-Front Sensing Algorithms for Shack-Hartmann-based Adaptive Optics using a Point Source
Poyneer, L. A.; Mar. 03, 2003; In English
Report No.(s): DE2003-15003864; UCRL-JC-152975; No Copyright; Avail: National Technical Information Service (NTIS)

Shack-Hartmann based Adaptive Optics system with a point-source reference normally use a wave-front sensing algorithm that estimates the centroid (center of mass) of the point-source image spot to determine the wave-front slope. The centroiding algorithm suffers for several weaknesses. For a small number of pixels, the algorithm gain is dependent on spot size. The use of many pixels on the detector leads to significant propagation of read noise. Finally, background light or spot halo aberrations can skew results. In this paper an alternative that suffers from none of these problems is proposed: correlation of the spot with a ideal reference spot. The correlation method is derived and a theoretical analysis evaluates its performance in comparison with centroiding. Both simulation and data from real AO systems are used to illustrate the results. The correlation algorithm is more robust than centroiding, but requires more computation.
NTIS
Adaptive Optics; Algorithms; Point Sources; Statistical Correlation; Wave Fronts

20030096004 NASA Goddard Space Flight Center, Greenbelt, MD, USA
X-ray Polarimetry with an Active-Matrix Pixel Proportional Counter
Black, J. K.; Deines-Jones, P.; Ready, S. E.; Street, R. A.; [2003]; 4 pp.; In English
Contract(s)/Grant(s): NRA-01-01-HEA-021; No Copyright; Avail: CASI; A01, Hardcopy

We report the first results from an X-ray polarimeter with a micropattern gas proportional counter using an amorphous silicon active matrix readout. With 100% polarized X-rays at 4.5 keV, we obtain a modulation factor of 0.33+/- 0.03, confirming previous reports of the high polarization sensitivity of a finely segmented pixel proportional counter. The detector described here has a geometry suitable for the focal plane of an astronomical X-ray telescope. Amorphous silicon readout technology will enable additional extensions and improvements.
Author
Polarimetry; X Rays; Radiation Counters; Proportional Counters

20030102140 Rutherford Appleton Lab., Chilton
Transmissive Grating CPA System Design for the Vulcan Laser
Poulter, M. J.; Apr. 2002; In English
Report No.(s): PB2003-104810; RAL-TR-2001-028; Copyright; Avail: National Technical Information Service (NTIS)

In the report the physical and spectral properties of transmissive diffraction gratings are geometrically modeled. This leads to a study of how these gratings may be used to produce a pulse compression system that will operate optimally for pulse durations between 10-300 ps. It will be shown that this system can deliver a greater amount of energy compared to a reflective grating system of similar input beam diameter. A specific system is proposed for Vulcan glass laser that will offer efficient energy delivery, and operate without the need for vacuum beam compression. Finally, an investigation is carried out into the effects of using different grating line densities to stretch a pulse than in its subsequent recompression.
NTIS
Gratings (Spectra); Transmission

20030102166 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Algorithm Updates for the Fourth SeaWiFS Data Reprocessing
Hooker, Stanford, B., Editor; Firestone, Elaine R., Editor; Patt, Frederick S.; Barnes, Robert A.; Eplee, Robert E., Jr.; Franz, Bryan A.; Robinson, Wayne D.; Feldman, Gene Carl; Bailey, Sean W., et al.; May 2003; ISSN 1522-8789; 82 pp.; In English
Report No.(s): NASA/TM-2003-206892/VOL22; Rept-2003-01915-0/VOL22; NAS 1.15:206892/VOL22; No Copyright; Avail: CASI; A05, Hardcopy

The efforts to improve the data quality for the Sea-viewing Wide Field-of-view Sensor (SeaWiFS) data products have continued, following the third reprocessing of the global data set in May 2000. Analyses have been ongoing to address all aspects of the processing algorithms, particularly the calibration methodologies, atmospheric correction, and data flagging and masking. All proposed changes were subjected to rigorous testing, evaluation and validation. The results of these activities culminated in the fourth reprocessing, which was completed in July 2002. The algorithm changes, which were implemented for this reprocessing, are described in the chapters of this volume. Chapter 1 presents an overview of the activities leading up to the fourth reprocessing, and summarizes the effects of the changes. Chapter 2 describes the modifications to the on-orbit

calibration, specifically the focal plane temperature correction and the temporal dependence. Chapter 3 describes the changes to the vicarious calibration, including the stray light correction to the Marine Optical Buoy (MOBY) data and improved data screening procedures. Chapter 4 describes improvements to the near-infrared (NIR) band correction algorithm. Chapter 5 describes changes to the atmospheric correction and the oceanic property retrieval algorithms, including out-of-band corrections, NIR noise reduction, and handling of unusual conditions. Chapter 6 describes various changes to the flags and masks, to increase the number of valid retrievals, improve the detection of the flag conditions, and add new flags. Chapter 7 describes modifications to the level-la and level-3 algorithms, to improve the navigation accuracy, correct certain types of spacecraft time anomalies, and correct a binning logic error. Chapter 8 describes the algorithm used to generate the SeaWiFS photosynthetically available radiation (PAR) product. Chapter 9 describes a coupled ocean-atmosphere model, which is used in one of the changes described in Chapter 4. Finally, Chapter 10 describes a comparison of results from the third and fourth reprocessings along the US. Northeast coast.
Author
Air Water Interactions; Algorithms; Atmospheric Correction; Buoys; Ocean Models; Sea-Viewing Wide Field-Of-View Sensor

20030102197 Air Force Inst. of Tech., Wright-Patterson AFB, OH, USA
Redundant Discrete Wavelet Transform Based Super-Resolution Using Sub-Pixel Image Registration
Ward, Daniel L.; Mar. 2003; 72 pp.; In English
Report No.(s): AD-A415684; AFIT/GE/ENG/03-18; No Copyright; Avail: CASI; A04, Hardcopy

The limited resolution of video imagery taken by aircraft, over geographical areas of interest, hinders the accurate extraction of useful information. The frame resolution of the video is determined by the camera that created it. Information exists about the camera which can be used to increase frame resolution beyond the resolution capability of the camera. This is achieved by a process called super-resolution, which uses multiple low-resolution video frames to create one high-resolution image.
DTIC
High Resolution; Pattern Registration; Wavelet Analysis; Discrete Functions; Pixels; Redundancy

20030105555 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Overview of the MARS Laser Communications Demonstration Project
Edward, Bernard L.; Townes, Stephen A.; Bondurant, Roy S.; Scozzafava, Joseph J.; Boroson, Don M.; Parvin, Ben A.; Biswas, Abhijit; Pillsbury, Alan D.; Khatri, Farzana I.; Burnside, Jamie W., et al.; [2003]; 10 pp.; In English; Space 2003 Conference and Exposition, 23-25 Sep. 2003, USA; No Copyright; Avail: CASI; A02, Hardcopy

This paper provides an overview of the Mars Laser Communications Demonstration Project, a joint project between NASA s Goddard Space Flight Center (GSFC), the Jet Propulsion Laboratory, California Institute of Technology (JPL), and the Massachusetts Institute of Technology Lincoln Laboratory (MIT/LL). It reviews the strawman designs for the flight and ground segments, the critical technologies required, and the concept of operations. It reports preliminary conclusions from the Mars Lasercom Study conducted at MIT/LL and on additional work done at JPL and GSFC. The lasercom flight terminal will be flown on the Mars Telecom Orbiter (MTO) to be launched by NASA in 2009, and will demonstrate a technology which has the potential of vastly improving NASA s ability to communicate throughout the solar system.
Author
Optical Communication; Solar System

20030105558 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Combined Lidar-Radar Remote Sensing: Initial Results from CRYSTAL-FACE and Implications for Future Spaceflight Missions
McGill, Matthew J.; Li, Li-Hua; Hart, William D.; Heymsfield, Gerald M.; Hlavka, Dennis L.; Vaughan, Mark A.; Winker, David M.; [2003]; 35 pp.; In English; No Copyright; Avail: CASI; A03, Hardcopy

In the near future NASA plans to fly satellites carrying a multi-wavelength backscatter lidar and a 94-GHz cloud profiling radar in formation to provide complete global profiling of cloud and aerosol properties. The CRYSTAL-FACE field campaign, conducted during July 2002, provided the first high-altitude colocated measurements from lidar and cloud profiling radar to simulate these spaceborne sensors. The lidar and radar provide complementary measurements with varying degrees of measurement overlap. This paper presents initial results of the combined airborne lidar-radar measurements during CRYSTAL-FACE. The overlap of instrument sensitivity is presented, within the context of particular CRYSTAL-FACE

conditions. Results are presented to quantify the portion of atmospheric profiles sensed independently by each instrument and the portion sensed simultaneously by the two instruments.
Author
Optical Radar; Aerosols; Cloud Physics

20030105882 Army Research Lab., Adelphi, MD
Image Segmentation of Hyperspectral Imagery
Wellman, Mark; Nasrabadi, Nassar; Jul. 2003; 47 pp.; In English
Report No.(s): AD-A416758; ARL-TR-2926; No Copyright; Avail: CASI; A03, Hardcopy

Hyperspectral imagery (HSI), a passive technique creating a large collection of images of fine resolution across the infrared spectrum is currently being considered for U.S. Army tactical applications. An important tactical application of infrared (IR) hyperspectral imagery is the detection of low-contrast targets, including those targets that may employ camouflage, concealment, and deception (CCD) techniques 1, 2. Spectral reflectivity characteristics were used for efficient segmentation between different materials such as painted metal, vegetation, and soil for visible to near IR bands in the range of 0.46-1.0 microns as shown previously by Kwon et al. 3. We are currently investigating the HSI region spanning the wavelengths from 7.5 to 13.7 %m. The energy in this range of wavelengths is almost entirely emitted rather than reflected; therefore, the gray level of a pixel is a function of the temperature and emissivity of the object. This is beneficial because light level and reflection will not need to be considered in the segmentation. We will present results of segmentation analysis on the long-wave infrared (LWIR) hyperspectrum using a simple distance metric applied to full-band and sub-band HSI data sets, neural network-based classification approaches, and principal component analysis (PCA) applied to relative temperature profiles derived from the Spatially Enhanced Broadband Array Spectrograph System (SEBASS) database. A stepwise segmentation will be demonstrated using a back-propagation neural network, which outlines some of the difficulties in the multi-class case. Overall, these results should give an early indication of the added capability hyperspectral imagery and algorithms will bring to bear on the target acquisition problem.
DTIC
Algorithms; Target Acquisition; Imaging Techniques; Detection

20030105905
General Theory of a Quantitative Method of Optical Patternation
Sep. 2003; 127 pp.; In English
Contract(s)/Grant(s): Proj-3058
Report No.(s): AD-A416703; AFRL-PR-ED-TR-2002-0011; No Copyright; Avail: CASI; A07, Hardcopy

A general theory of a method to quantitatively perform optical patternation in a particle field is developed. The general equations of optical radiation are considered, along with general methods of probing the particle field with illuminating light and general methods of performing the required measurements, in order to determine the assumptions, approximations, and conditions under which various kinds of measurements can be performed. Under conditions which exist in many practical applications, it is found that the capabilities of modern optical instrumentation allow the spatial distribution of various properties of a particle field such as particle volume or surface area concentrations to be measured, even when the measurement is complicated by attenuation of the illuminating light, attenuation of the signal light, and secondary emission. The measurements can be performed in fully three dimensional form or within a single two dimensional plane, and under certain conditions can be performed even when the particles are not spherical.
DTIC
Optical Properties; Particles; Spatial Distribution

75
PLASMA PHYSICS

Includes magnetohydrodynamics and plasma fusion. For ionospheric plasmas see *46 Geophysics*. For space plasmas see *90 Astrophysics*.

20030095855 Lawrence Livermore National Lab., Livermore, CA
Collaboration of DIII-D Five Year Plan
Allen, S.; Apr. 2003; In English
Report No.(s): DE2003-15003858; UCRL-ID-152860; No Copyright; Avail: National Technical Information Service (NTIS)

This document summarizes Lawrence Livermore National Laboratory's (LLNL) plan for fusion research on the DIIID Tokamak, located at General Atomics (GA) in San Diego, California, in the time period FY04-FY08. This document is a companion document to the DIIID Five-Year Program Plan; which hereafter will be referred to as the D3DPP. The LLNL Collaboration on DIIID is a task-driven program in which we bring to bear the full range of expertise needed to complete specific goals of plasma science research on the DIIID facility. This document specifies our plasma performance and physics understanding goals and gives detailed plans to achieve those goals in terms of experimental leadership, code development and analysis, and diagnostic development. Our program is designed to be consistent with the long-term mission of the DIIID program as documented in the D3DPP.
NTIS
Tokamak Devices; Plasma Diagnostics

20030095856 Lawrence Livermore National Lab., Livermore, CA
Study of the Ionization Dynamics and Equation of State of a Strongly Coupled Plasma
Shepherd, R.; Audebert, R.; Geindre, J. P.; Iglesias, C.; Foord, M.; Feb. 06, 2003; In English
Report No.(s): DE2003-15003859; UCRL-ID-152601; No Copyright; Avail: National Technical Information Service (NTIS)
Preliminary experiments to study the ionization dynamics and equation of state of a strongly coupled plasma have been performed at the LLNL COMET laser facility. In these experiment, a 1.0 J, 500 fs, 532 nm laser was used to create a uniform, warm dense plasma. The primary diagnostic, Fourier Domain Interferometry (FDI), was used to provide information about the position of the critical density of the target and thus the expansion hydrodynamics, laying the ground work for the plasma characterization. The plasmas were determined to be strongly coupled. In addition work was performed characterizing the back-lighter. A von Hamos spectrograph coupled to a 500 fs X-ray streak camera (TREX-VHS) developed at LLNL was used for these measurements. This diagnostic combines high collection efficiency with fast temporal response, allowing resolution of extremely transient spectral variations.
NTIS
Plasma Density; Equations Of State

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*.

20030093644 NASA Goddard Space Flight Center, Greenbelt, MD, USA
The Simulation of Damage Tracks in Silicon
Messenger, S. R.; Burke, E. A.; Xapsos, M. A.; Summers, G. P.; Walters, R. J.; [2003]; 4 pp.; In English; Radiation and Its Effects on Components and Systems, 15-19 Sep. 2003, Noordwijk, Netherlands; No Copyright; Avail: CASI; A01, Hardcopy
We describe a model for deriving heavy ion damage tracks using NIEL and the projected range. NIEL is directly calculated using screened Coulomb potentials. The model is applied to energetic ions incident on silicon.
Author
Silicon; Computerized Simulation; Heavy Ions; Damage; Mathematical Models

20030095854 Lawrence Livermore National Lab., Livermore, CA
Stability and Thermal Equilibrium in CICC
Martovetsky, N. N.; Apr. 02, 2003; In English
Report No.(s): DE2003-15003855; UCRL-JC-152955; No Copyright; Avail: National Technical Information Service (NTIS)
The stability of modern superconductors depends not only on the cooling and the amount of copper in the cross section of the strands but also on the smoothness of the transition from the superconducting into the normal state. Frequently the latter factor is much more important than the cooling and the copper content. Superconductors with a broad transition are more stable and easier to control than the superconductors with a sharp transition, although the price for better stability might be somewhat lower operating current. The paper gives thermal equilibrium equations and stability criteria against small perturbations and determines the ultimate current that could be reached by a CICC depending on operating conditions.
NTIS
Superconducting Devices; Cables; Conductors

77
PHYSICS OF ELEMENTARY PARTICLES AND FIELDS

Includes quantum mechanics; theoretical physics; and statistical mechanics. For related information see also *72 Atomic and Molecular Physics, 73 Nuclear Physics*, and *25 Inorganic, Organic and Physical Chemistry*.

20030093610 Spelman Coll., Atlanta, GA, USA
Development of Low-Density Silica Particles for SHIVA
Karangu, Njeri T.; The 2002 NASA Faculty Fellowship Program Research Reports; April 2003, pp. XXIII-1 - XXIII-7; In English; See also 20030093576
Contract(s)/Grant(s): NAG8-1859; No Copyright; Avail: CASI; C01, CD-ROM; A02, Hardcopy

The objective of this work is the syntheses of low-density spherical silica particles, which will be used to further enhance our knowledge of the fundamental physics of the particle movements in fluids. The equations describing the particle/fluid motions have being under development and investigation over the last 100 years, yet the complete solution to this equation remained elusive, yielding only approximations and numerical solutions. Recently however, the first analytical solution to the general equation was produced by the joint efforts of NASA and NRA (Coimbra and Rangel, 1998). These particles will be used as a part of the various studies conducted to support SHIVA (Spaceflight Holography Investigation in Virtual Apparatus), the flight experiment proposed to validate this new analytical solution to the Stokes equation. The SHIVA project is designed to investigate the movement of particles in fluid and to understand and quantify the phenomena of microgravity, as well as allow the expansion of the limits associated with this analytical solution (Trolinger, J. D. 2001). The experiment proposes to use state-of-the-art holography, to precisely record the position of the particle and to allow the electronic downloading of these holograms, so that they are available on earth in real time.
Derived from text
Microgravity; Silicon Dioxide; Numerical Analysis; Real Time Operation; Holography; Particle Motion

20030102139 Argonne National Lab., IL, Columbia Univ., New York, NY, USA, Nantes Univ., France
Hadron Production at RHIC-Chemical Freeze-out, Effective Masses and Expanding Matter
Zshieshce, D.; Schramm, S.; Schaffner-Bielich, J.; Stoecker, H.; Greiner, W.; Sep. 19, 2002; In English
Report No.(s): DE2003-44447; No Copyright; Avail: National Technical Information Service (NTIS)

The properties of the strongly interacting matter produced at RHIC are investigated within a chemical and thermal equilibrium chiral SU(3) sigma - omega approach. The focus is on the freeze-out conditions, the effective masses of the produced hadrons and the expansion of the system. For the freeze-out conditions the commonly adopted noninteracting gas calculations yield temperatures and chemical potentials close to or above the critical temperature for the chiral phase transition, but without taking into account any interactions. Contrary, the chiral SU(3) model predicts temperature and density dependent effective hadron masses and effective chemical potentials in the medium and a transition to a chirally restored phase at high temperatures or chemical potentials.
NTIS
Hadrons; Chirality; Strong Interactions (Field Theory)

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*.

20030095837 Old Dominion Univ., Hampton, VA, USA
Advanced Learning Technologies and Learning Networks and Their Impact on Future Aerospace Workforce
Noor, Ahmed K., Compiler; September 2003; 423 pp.; In English; Advanced Learning Technologies and Learning Networks and Their Impact on Future Aerospace Workforce, 2-3 Apr. 2003, Hampton, VA, USA; See also 20030095838 - 20030095853; Original contains color and black and white illustrations
Contract(s)/Grant(s): 755-80-00-01
Report No.(s): NASA/CP-2003-212437; L-18317; NAS 1.55:212437; No Copyright; Avail: CASI; A18, Hardcopy

This document contains the proceedings of the training workshop on Advanced Learning Technologies and Learning Networks and their impact on Future Aerospace Workforce. The workshop was held at the Peninsula Workforce Development Center, Hampton, Virginia, April 2 3, 2003. The workshop was jointly sponsored by Old Dominion University and NASA.

Workshop attendees came from NASA, other government agencies, industry, and universities. The objectives of the workshop were to: 1) provide broad overviews of the diverse activities related to advanced learning technologies and learning environments, and 2) identify future directions for research that have high potential for aerospace workforce development. Eighteen half-hour overviewtype presentations were made at the workshop.
Author
Conferences; Education; Aerospace Industry

20030095838 Georgia Inst. of Tech., Atlanta, GA, USA
Lessons from a Resource for Learning across Disciplines: The Aerospace Digital Library
Komerath, Narayanan; Smith, Marilyn; Advanced Learning Technologies and Learning Networks and Their Impact on Future Aerospace Workforce; September 2003, pp. 101-132; In English; See also 20030095837; No Copyright; Avail: CASI; A03, Hardcopy

Our aim is to develop an environment where aerospace engineers can integrate knowledge efficiently, bridging other disciplines as new knowledge is integrated into the knowledge base. We hope users from other disciplines will generate similar resources centered on their own disciplines. Here we list issues faced in developing such resources, then go on to describe our approach, experience with its growth, evolution and usage, the lessons learned, and guidance for the future.
Author
Libraries; Information Systems; Technology Utilization

20030095839 Florida State Univ., Tallahassee, FL, USA
Systematically Designing Pedagogical Agents: Effects of Image, Animation and Agent Role on Learner Performance and Motivation
Baylor, Amy L.; Advanced Learning Technologies and Learning Networks and Their Impact on Future Aerospace Workforce; September 2003, pp. 239-250; In English; See also 20030095837
Contract(s)/Grant(s): NSF CISE-IIS-0218692; No Copyright; Avail: CASI; A03, Hardcopy

This presentation provides an overview of the PALS (Pedagogical Agent Learning Systems) research agenda regarding pedagogical agent features: image, animation, and role. Each of these three areas is investigated using controlled experimental studies with large sample sizes. Our recent work in each of these areas, as well as our immediate future plans, will be discussed.
Author
Learning; Images; Animation

20030095840 Memphis Univ., Memphis, TN, USA
Language Use in Intelligent Tutoring Systems: Mixed Initiative Dialog in AutoTutor
Louwerse, Max; Graesser, Art; Advanced Learning Technologies and Learning Networks and Their Impact on Future Aerospace Workforce; September 2003, pp. 251-276; In English; See also 20030095837
Contract(s)/Grant(s): N00014-00-I-0600; NSF SBR-97-20314; NSF REC-01-06965; No Copyright; Avail: CASI; A03, Hardcopy

One such intelligent conversational tutoring system is AutoTutor. AutoTutor is a conversational agent that assists students in actively constructing knowledge by holding a conversation in natural language. AutoTutor has currently been developed for the domains of computer literacy and physics with the possibilities of development for a range of other domains. The system is web-based allowing to be used on any standard PC. Because AutoTutor is a client based application, the user only has to download a small number of files to be able to run the system, thus allowing for optimal use in educational environments (Graesser et al., 1999; 2001). The system, its components and its effectiveness have been discussed in over 70 book chapters, journal articles and conference proceedings chapters (see http://www.autotutor.org). This presentation will summarize some of the main components of the system and focus on some of the natural language processing aspects of the system.
Author
Education; Computer Assisted Instruction

20030095843 Advanced Distributed Learning Co-Lab., Alexandria, VA, USA
Standards-Based Approach for E-Learning Technologies
West, Jerry; Advanced Learning Technologies and Learning Networks and Their Impact on Future Aerospace Workforce;

September 2003, pp. 353-373; In English; See also 20030095837; Original contains color illustrations; No Copyright; Avail: CASI; A03, Hardcopy

Advanced Distributed Learning (ADL) is discussed.Three views on run-time environment are presented.The need for standards for learning objects are included in the presentation.

Derived from text

On-Line Systems; Computer Assisted Instruction; Education

20030095844 Pennsylvania State Univ., York, PA, USA

The Scalability and Usability of Asynchronous Learning Networks

Foley, Shawn; Advanced Learning Technologies and Learning Networks and Their Impact on Future Aerospace Workforce; September 2003, pp. 375-390; In English; See also 20030095837; Original contains color illustrations; No Copyright; Avail: CASI; A03, Hardcopy

This objectives of this discussion are to examine technology tools and services that allow the course to be administered;examine some methods in which our course was designed and developed;and to provide recommendations.

Derived from text

Education; On-Line Systems

20030095845 Federation of American Scientists, Washington, DC, USA

A Systematic Approach to Research: Roadmapping Activities by the Learning Federation

Bakia, Marianne; Advanced Learning Technologies and Learning Networks and Their Impact on Future Aerospace Workforce; September 2003, pp. 187-200; In English; See also 20030095837; No Copyright; Avail: CASI; A03, Hardcopy

This talk will discuss why it is necessary to conduct an inter-industry roadmapping exercise to encourage greater innovation in educational technology development.

Author

Education; Computer Programs

20030095848 Rensselaer Polytechnic Inst., Troy, NY, USA

Lessons Learned from the Program in Course Redesign

Jarmon, Carolyn G.; Advanced Learning Technologies and Learning Networks and Their Impact on Future Aerospace Workforce; September 2003, pp. 73-100; In English; See also 20030095837; No Copyright; Avail: CASI; A03, Hardcopy

Today using information technology has become an integral part of the life of colleges and universities across the USA to provide access for new students and in the teaching and learning mission. Most institutions, however, are finding the use of technology has become a costly addition as they have bolted it on to the traditional, class room based method of instruction. Thus information technology has added to the problem of rising costs in higher education. In addition, some research has shown that the use of information technology produces learning outcomes that are only as good as those in more traditional classes, rather than improving the quality of the learning experience; these findings are sometimes called the no significant difference phenomenon. Managed by the Center for Academic Transformation at Rensselaer Polytechnic Institute and funded by a grant from the Pew Charitable Trusts, the Program in Course Redesign is designed to address these problems of the growing cost of information technology and the need to improve the quality of learning simultaneously. This talk is an overview of this program including a brief review of the process, the institutions involved and the lessons learned.

Author

Education; Information Systems

20030095849 Mississippi Univ., University, MS, USA

Institute for Advanced Education in Geospatial Sciences Educating the Next Generation of Scientists

Lawhead, Pamela; Johnson, Jay; Advanced Learning Technologies and Learning Networks and Their Impact on Future Aerospace Workforce; September 2003, pp. 133-160; In English; See also 20030095837; No Copyright; Avail: CASI; A03, Hardcopy

The project, as stated earlier is sponsored by NASA and is located at the University of Mississippi in Oxford, MS. It has two principal investigators with one of them, Pam Lawhead, serving as the Director of the Institute. The goal of the project is to create fifty online courses in Remote Sensing over the five year life of the project. Each year ten courses are put out for bid and the best ten submissions are accepted. This request for proposals insures that the course creators are content experts. Equivalence of product drives the online hosting of the courses. That is, we want the online presentation and delivery of each

course to be as multi-media intensive as is effective. The goal is not to replace existing courses but, to provide courses created by content experts to as many colleges and universities as possible. This effort to create and host online courses has as its final goal the creation of a very large college educated workforce prepared to use the vast stores of information gathers by NASA and other remote sensing industries to enhance life on this planet.
Author
Education; Remote Sensing

20030095850 Mitre Corp., Bedford, MA, USA
Reading, Learning, Teaching
Ferro, Lisa; Greiff, Waren; Hirschman, Lynette; Wellner, Benjamin; Advanced Learning Technologies and Learning Networks and Their Impact on Future Aerospace Workforce; September 2003, pp. 161-184; In English; See also 20030095837; No Copyright; Avail: CASI; A03, Hardcopy

The project described in this presentation is part of MITRE s larger ongoing research program in natural language processing (NLP) technologies, to include information extraction, information retrieval, question answering, speech, and dialogue. For the past several years, a handful of us have been working on developing a research paradigm in which we evaluate a computer s understanding of language using the same tools and techniques used to evaluate a human student s understanding of language. We have divided this project into three parts: Reading, Learning, and Teaching.
Author
Education; Natural Language Processing; Reading

20030095851 Mitre Corp., Bedford, MA, USA
Intelligent Agents for Distance Learning
Goodman, Brad; Advanced Learning Technologies and Learning Networks and Their Impact on Future Aerospace Workforce; September 2003, pp. 201-238; In English; See also 20030095837; No Copyright; Avail: CASI; A03, Hardcopy

Our research project is exploring techniques for providing stimulating peer learning experiences in web-based, collaborative distance-learning environments. We are leveraging intelligent tutoring system and collaborative learning technologies to develop an artificial learning agent to collaborate with human peers. The agent will follow the discussion and interact with the participants when it detects learning trouble of some sort, such as confusion about the problem they are working on or a participant who is dominating the discussion or not interacting with the other participants. In order to recognize problems in the dialogue, we are first examining the role that a participant is playing as the dialogue progresses. This simulated peer will play supportive roles based on the instructional needs of the human learners. This talk describes our pursuit of indicators for effective and ineffective collaborative learning. Potential indicators such as communicative acts, participant roles, and other conversational elements will be discussed. This project builds on a collaborative-learning infrastructure developed in a previous MITRE research project to bridge distance and time barriers between on-line learners [8, 19, 21].
Author
Learning; Education; On-Line Systems; Computer Assisted Instruction

20030095852 Virginia Polytechnic Inst. and State Univ., Blacksburg, VA, USA
Coming to Terms with Social Constructivism
Carroll, John M.; Advanced Learning Technologies and Learning Networks and Their Impact on Future Aerospace Workforce; September 2003, pp. 277-307; In English; See also 20030095837; Original contains color illustrations; No Copyright; Avail: CASI; A03, Hardcopy

Throughout this workshop, social constructivism - the idea that people construct what they learn through social interaction with other people (Palincsar, 1998; Wilson, 1996) - has been lurking in the background of our discussions. I want to talk today about how I have begun to come to terms with the ideas of social constructivism in my own work. It has been a process, one that is still underway. Coming to terms with Coming to terms with. Learning occurs when people carry out authentic tasks, in realistic contexts - including committing, diagnosing, and recovering from errors, when they are able to explore and discover on their own initiative, reflect upon and draw lessons from their activity, when they are able to work with others, socially model the practices of others, and share meaning with others.
Author
Learning; Education; Computer Assisted Instruction

20030095853 International Business Machines Corp., Yorktown Heights, USA

Addressing Learning Challenges with Advanced Technologies

Gordin, Douglas N.; Fairweather, Peter G.; Farrell, Robert G.; Advanced Learning Technologies and Learning Networks and Their Impact on Future Aerospace Workforce; September 2003, pp. 391-410; In English; See also 20030095837; Original contains color illustrations; No Copyright; Avail: CASI; A03, Hardcopy

In framing the question, How can advanced technologies transform learning , we take a broad perspective, looking not only at how learning technologies can be improved but also asking how advanced technologies might change what we need to know, how we access knowledge, and how we work together. Given this broad perspective, we choose a number of technologies being developed at IBM that, we believe, have the potential to powerfully impact learning. The technologies we discuss are organized by how they might address important learning challenges (listed below in Figure 1). These include the challenges of transforming tasks to better fit our competencies; better situating knowledge so that what we need to know is ready to hand ; reducing language as a barrier in cases such as illiteracy or when translation is required; finding and indexing relevant information for the solution of problems, including video and other rich media; gainfully collaborating with others; and reflecting and learning from our experiences. This list is not meant to be exhaustive (e.g., numeracy is missing), but to be broad and representative. Further, it highlights areas where IBM and others have made significant recent advances. 1. Transform Revise how a task is performed. 2. Situate / Transfer Recall and place in context the knowledge needed for the problem at hand. 3. Language Literacy. Translation. 4 Reflect Learn from experience. Formalize what you know so it can be shared with others. 5 Search / Index Ability to find the information you need. Create indices so rich media can be retrieved. 6 Collaborate Find people to work with to solve a problem. Devise mechanisms that enable people to work together. Revise social systems for improved performance.

Author

Education; Reading; Computer Assisted Instruction

20030099673 NASA, Washington, DC, USA

The NASA Education Enterprise: Inspiring the Next Generation of Explorers

Spinoff 2003: 100 Years of Powered Flight; 2003, pp. 117-129; In English; See also 20030099639; Original contains color illustrations; No Copyright; Avail: National Technology Transfer Center (NTTC), Wheeling, WV

On April 12, 2002, NASA Administrator Sean O Keefe opened a new window to the future of space exploration with these words in his Pioneering the Future address. Thus began the conceptual framework for structuring the new Education Enterprise. The Agency s mission is to understand and protect our home planet; to explore the universe in search for life; and to inspire the next generation of explorers as only NASA can. In adopting this mission, education became a core element and is now a vital part of every major NASA research and development mission. NASA s call to inspire the next generation of explorers is now resounding throughout the NASA community and schools of all levels all around the country. The goal is to capture student interest, nurture their natural curiosities, and intrigue their minds with new and exciting scientific research; as well as to provide educators with the creative tools they need to improve America s scientific literacy. The future of NASA begins with America s youngest scholars. According to Administrator O Keefe s address, if NASA does not motivate the youngest generation now, there is little prospect this generation will choose to pursue scientific disciplines later. Since embracing Administrator O Keefe s educational mandate over a year ago, NASA has been fully devoted to broadening its roadmap to motivation. The efforts have generated a whole new showcase of thoughtprovoking and fun learning opportunities, through printed material, Web sites and Webcasts, robotics, rocketry, aerospace design contests, and various other resources as only NASA can.

Derived from text

Education; NASA Programs

81
ADMINISTRATION AND MANAGEMENT

Includes management planning and research.

20030086431 NASA Dryden Flight Research Center, Edwards, CA, USA
A Powerful Friendship: Theodore von Karman and Hugh L. Dryden
Gorn, Michael; September 2003; 16 pp.; In English; 41st AIAA Aerospace Sciences Meeting Exhibit, 6-9 Jan. 2003, Reno, NV, USA
Contract(s)/Grant(s): 953-20-00-GA-TT
Report No.(s): NASA/TM-2003-212031; H-2545; NAS 1.15:212031; AIAA Paper 2003-0289; No Copyright; Avail: CASI; A03, Hardcopy

During their long personal friendship and professional association, Theodore von Karman (1882-1963) and Hugh L. Dryden (1898-1965) exercised a pivotal if somewhat elusive influence over American aeronautics and spaceflight. Both decisive figures in organizing scientists and engineers at home and abroad, both men of undisputed eminence in their technical fields, their range of contacts in government, academia, the armed forces, industry, and professional societies spanned the globe to an extent unparalleled then as now. Moreover, because they coordinated their activities closely, their combined influence far exceeded the sum of each one s individual contributions. This paper illustrates their personal origins as well as the foundations of their friendship, how their relationship became a professional alliance, and their joint impact on the world of aeronautics and astronautics during the twentieth century.
Author
Scientists; Human Beings; Space Flight

20030093581 Alabama Univ., Huntsville, AL, USA
Measuring Organizational Communication Health
Rogers, Edward W.; The 2002 NASA Faculty Fellowship Program Research Reports; April 2003, pp. XXXIX-1 - XXXIX-5; In English; See also 20030093576
Contract(s)/Grant(s): NAG8-1859; No Copyright; Avail: CASI; C01, CD-ROM; A01, Hardcopy

This paper studies the effectiveness of interpersonal communication among internal (NASA) customers of the Transportation Directorate (TD-60) at Marshall Space Flight Center (MSFC).
CASI
Organizations; Personnel Management; Communication; Personnel

20030093606 Motlow State Community Coll., Tullahoma, TN, USA
Creation and Implementation of a Workforce Development Pipeline Program at MSFC
Hix, Billy; The 2002 NASA Faculty Fellowship Program Research Reports; April 2003, pp. XXI-1 - XXI-5; In English; See also 20030093576
Contract(s)/Grant(s): NAG8-1859; No Copyright; Avail: CASI; C01, CD-ROM; A01, Hardcopy

Within the context of NASA's Education Programs, this Workforce Development Pipeline guide describes the goals and objectives of MSFC's Workforce Development Pipeline Program as well as the principles and strategies for guiding implementation. It is designed to support the initiatives described in the NASA Implementation Plan for Education, 1999-2003 (EP-1998-12-383-HQ) and represents the vision of the members of the Education Programs office at MSFC. This document: 1) Outlines NASA s Contribution to National Priorities; 2) Sets the context for the Workforce Development Pipeline Program; 3) Describes Workforce Development Pipeline Program Strategies; 4) Articulates the Workforce Development Pipeline Program Goals and Aims; 5) List the actions to build a unified approach; 6) Outlines the Workforce Development Pipeline Programs guiding Principles; and 7) The results of implementation.
Derived from text
Education; NASA Programs; Workloads (Psychophysiology); Project Planning

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*.

20030095822 Nippon Telegraph and Telephone Public Corp., Japan
NTT Technical Review, Volume 1, No. 2

May 2003; 94 pp.; In English; See also 20030095823 - 20030095836; Original contains color illustrations; Copyright; Avail: Other Sources

The selected papers in this issue of NTT Technical Review cover human senses and communication. The issue's special feature is on data distribution systems for farms, including applying Information Technology (IT) and Local Area Networks (LANs) to farms. Two of the letters in this issue address wireless access systems, and two articles are on research and development.

CASI

Information Theory; Speech; Efferent Nervous Systems; Auditory Perception; Visual Perception; Voice Communication; Data Systems; Agriculture

20030095827 Nippon Telegraph and Telephone Public Corp., Atsugi, Japan

Human Information Science: Opening up Communication Possibilities for the Future

Hirahara, Tatsuya; Murase, Hiroshi; NTT Technical Review, Volume 1, No. 2; May 2003, pp. 10-12; In English; See also 20030095822; Original contains color illustrations; Copyright; Avail: Other Sources

NTT Communication Science Laboratories conducts scientific research aimed at understanding human information-processing mechanisms and technological research aimed at realizing human-friendly interfaces in computer environments. The ultimate goal of our work is to enrich communications among people as well as between people and computers. This special feature presents the leading edge of our research activities.

Author

Information Theory; Human-Computer Interface; Psychological Effects

20030095834 Nippon Telegraph and Telephone Public Corp., Japan

Approximate Query Reformulation for Multiple Ontologies in the Semantic Web

Akahani, Jun-Ichi; Hiramatsu, Kaoru; Satoh, Tatsuji; NTT Technical Review, Volume 1, No. 2; May 2003, pp. 83-87; In English; See also 20030095822; Original contains color illustrations; Copyright; Avail: Other Sources

The Semantic Web has been attracting a great deal of interest as the next-generation Web. It enables intelligent processing of Web information based on semantic structures called 'ontologies'. The decentralized nature of the Web requires integration of multiple ontologies. Ontology integration requires approximation mechanisms, since there is often no perfectly corresponding ontology. However, most previous research efforts on ontology integration have not provided clear semantics for approximation. Therefore, we propose an approximate query reformulation framework with clear semantics for integrating multiple ontologies. In this article, we provide a brief overview of the Semantic Web and present an approximate query reformulation framework.

Author

World Wide Web; Semantics; Query Languages

20030098034

Communicative Arts: A Selected Bibliography

Shope, Virginia C.; Jun. 2003; 23 pp.; In English

Report No.(s): AD-A415667; No Copyright; Avail: CASI; A03, Hardcopy

The U.S. Army War College Library presents Communicative Arts: A Selected Bibliography, now in its seventeenth revised edition, as an invitation for you to enjoy the wealth of resources available in our library which will help you improve your ability to communicate. Like the earlier versions, this annual bibliography lists references for materials that will provide skills, techniques, and approaches you may need to effectively express your ideas. The bibliography's categories reflect the four major communication behaviors reading, writing, listening, and speaking as well as an additional section on critical thinking and research methods.

DTIC

Bibliographies; Communication

20030098039 Air Force Academy, CO, USA

The Development of a Data Archive and Analysis Tools for WIRE

Buzasi, D.; June 2002; 21 pp.; In English; No Copyright; Avail: CASI; A03, Hardcopy

Contents include the following: mission description and system identification; environment description; system

architectural description; system security requirements; organization and resources; and ditscap plan. Appendix A, acronym list. Appendix B, definitions. Appendix C, references.
CASI
System Identification; Security

20030102119 General Accounting Office, Washington, DC
Records Management: National Archives and Records Administration's Acquisition of Major System Faces Risks
Aug. 2003; 58 pp.
Report No.(s): PB2003-107330; GAO-03-880; No Copyright; Avail: CASI; A04, Hardcopy

Increasingly, government records involve documents that are electronically created and stored. In support of its mission to manage and archive these records and ensure access to the 'essential evidence' that they contain, the National Archives and Records Administration (NARA) is acquiring an advanced Electronic Records Archives (ERA). GAO was asked to determine, among other things, how the ERA program's system acquisition policies, plans, and practices conform to industry standards and how well NARA is meeting the ERA program's cost and schedule.
NTIS
Records Management; Information Management

20030102127
Laser Eye Protection Groupware Application Information System
Hoke, Landa; Nakashima, Masato; Decristofano, Barry; Nov. 1998; 52 pp.; In English; Original contains color illustrations
Report No.(s): AD-A415651; NATICK/TR-99/008; No Copyright; Avail: CASI; A04, Hardcopy

Information systems are becoming increasingly more important for effective functioning and competitiveness of scientific research groups, such as our laser eye protection (LEP) team. The Lotus Notes(copyright) application software has been used as part of an information system pertaining to LEP research at Natick. This system was created to provide an interactive information resource for our team. Establishing an information system (IS) was motivated by a February 1997 review of the LEP program by Natick's Senior Technical Advisory Council (STAC). The STAC identified a need for an increased accessibility of in-house LEP information to assess the effectiveness of the current program and also provide a resource to facilitate planning future directions of the research. Consistent with this requirement, this database emphasizes in-house work and collaborations associated with this work. This report describes this LEP information system and demonstrates the capabilities of this system to facilitate LEP research efforts.
DTIC
Military Technology; Information Systems; Research Management

20030102132 Research and Technology Development Services, Washington, DC, USA
Treatment Decision Making in Early-Stage Prostate Cancer: Evaluation of Computer-Based Patient Education and an Interactive Decision Aid
Taylor, Kathryn L.; Feb. 2003; 67 pp.; In English
Contract(s)/Grant(s): DAMD17-02-1-0062
Report No.(s): AD-A415639; No Copyright; Avail: CASI; A04, Hardcopy

This study aims to examine a method of patient education for men who are seeking treatment for management of localized prostate cancer. The primary goal is to evaluate a recently developed computer-based educational tool (CD-ROM) that is designed to provide treatment-related information and to assist men in making an informed treatment decision. Men are accrued pre-biopsy for a baseline interview, and those who are diagnosed with localized cancer are randomized to receive a CD-ROM with a decision aid, or a CD-ROM with information only. To date, we have accessioned 97 patients. Of the 97, 36 were ineligible and 15 are pending (either pending initial contact or biopsy result). Of the remaining 46, 28 either declined or were unreachable, 2 dropped out and 16 are active with a CD-ROM. This results in a 35% participation rate (16/46). Because of the number of men who are ineligible, and who were unreachable prior to biopsy, we are seeking to expand the study to invite those already diagnosed with prostate cancer to consider participation. To that end, we aim to contact the Georgetown University Radiation Department and Georgetown University Medical Center Referral Center for accrual expansion.
DTIC
Decision Support Systems; Prostate Gland; Cancer

20030102205 Office of Naval Research, Arlington, VA

Science and Technology Text Mining: Pervasive Research Thrusts in the Former Soviet Union (FSU)

Kostoff, Ronald N.; Jan. 1995; 26 pp.; In English

Report No.(s): AD-A415717; No Copyright; Avail: CASI; A03, Hardcopy

A revolutionary approach to identifying pervasive thrust areas (and their relationships) in large textual databases was applied to a compendium of assessments of applied research areas in the Former Soviet Union (FSU) generated by the Foreign Applied Sciences Assessment Center (FASAC). Related thrust areas were combined to yield the following major thrust groupings: IONOSPHERIC HEATING/ MODIFICATION; IMAGE/ OPTICAL PROCESSING; AIR-SEA INTERFACE; LOW OBSERVABLE; EXPLOSIVE COMBUSTION; PARTICLE BEAMS; AUTOMATIC/REMOTE CONTROL; FREQUENCY STANDARDS; RADAR CROSS SECTION. These represent a subset of FSU science of military and strategic interest to the USA.

DTIC

Research And Development; Thrust; U.s.s.r.; Data Bases

20030102208

Text Manipulation Judgment Accuracy: An Exploratory Study

Wardak, Randy S.; Mar. 25, 2003; 69 pp.; In English; Original contains color illustrations

Report No.(s): AD-A415712; AFIT/GIR/ENV/03-18; No Copyright; Avail: CASI; A04, Hardcopy

Deception aims to affect a decision-making process in a way that somehow benefits the deceiver. More knowledge is desired in the area of purely text-based scenarios. Thirty-seven graduate students at the Air Force Institute of Technology participated in an experiment in order to gain an initial understanding of how people determine whether text has been manipulated, and to identify specific areas that may be more closely investigated in future research. Excerpts were drawn from editions of a current-events newsletter that the participants receive on a weekly basis as part of their enrollment in the graduate program. Some of the excerpts were manipulated, and others were not. Participants were shown a set of these excerpts and were asked to give ratings of their perceived familiarity with the subject of the excerpt, their perception of the relevance of that subject to themselves, and their perception of whether they believed that the excerpt had been manipulated. As part of their manipulation answers, participants were allowed to indicate heightened confidence in their answers by selecting a version of the answer that included the word 'definitely.' Analysis of the responses showed support for associations between familiarity, relevance, and definite answers. Analysis further showed support for an association between definite answers and increased rate of accuracy in determining whether an excerpt was manipulated. The analysis did not show support for an association between similiarity and accuracy, nor did it show support for an association between relevance and accuracy.

DTIC

Decision Making; Judgments

20030102218 Army Command and General Staff Coll., Fort Leavenworth, KS

Information Management: Is the U.S. Army prepared for Information Superiority?

Norton, Timothy P.; May 22, 2003; 52 pp.; In English; Original contains color illustrations

Report No.(s): AD-A416242; No Copyright; Avail: CASI; A04, Hardcopy

Although the Army Vision 2010 states that one of the keys to success on the modern battlefield is to achieve information superiority, the current U.S. Army doctrine in this area does not support it. Specifically, the topic of information management, one of the fundamentals in information superiority, is lacking in the clarity and depth required to meet this lofty goal. Operational advantages of information superiority are obtained through the systematic provision of clear, accurate, and useable information. Under the current doctrine, the discussion is limited to the products and ignores the process. If a product focus is not addressed the U.S. Army will not reach the stated goal of information superiority.To understand this serious deficiency, this study examines current doctrinal definitions and concepts of information management and compared them with business and academic writings on the subject. The intent was to assess if the Army s concepts are sufficient to manage the information that we strive to create. The researched revealed that the Army is not prepared. Doctrine does not provide guidance on the concept of information management as a system. The doctrinal definitions identify products and qualities of information but fail to discuss frameworks and principles that are essential to information management. This gap in information management doctrine makes it nearly impossible to achieve the goal of information superiority. The Army must address these weaknesses in current doctrine. To improve information management, the Army must redefine the term information management in a manner that supports a systems approach, produce a conceptual framework for its application, publish principles of

information management, and produce a single source document for information management doctrine.
DTIC
Data Management; Management Information Systems; Armed Forces

20030102253 Office of Naval Research, Arlington, VA
Science and Technology Text Mining: Origins of Database Tomography and Multi-Word Phrase Clustering
Kostoff, Ronald N.; Aug. 15, 2003; 87 pp.; In English
Report No.(s): AD-A416268; No Copyright; Avail: CASI; A05, Hardcopy

This report initially describes the motivations for co-word analysis in support of research policy formulation and research implementation evaluation. It compares co-word analysis in relation to other co-occurrence techniques such as co-citation and co-nomination analyses. It then traces the origins of co-word analysis in computational linguistics, describes in detail the development of co-word analysis for research evaluation, and concludes by presenting a new approach to co-word analysis for research evaluation (Database Tomography). The report shows that this new approach to co- word analysis, which requires no index or key words but deals with text directly, is a useful tool for scanning large bodies of text. It can identify pervasive thrust areas and their interrelationships, and serves as a starting point for further in-depth analysis of the text. Its value increases as the size of text increases and the breadth of topical areas covered by the text increases beyond the expertise of a moderate number of expert panels. A single link clustering example is shown that represents the first use of multi-word technical phrases in modern clustering.
DTIC
Information Retrieval; Pattern Recognition; Tomography; Research And Development; Clusters

20030105444
The Global Course of the Information Revolution. Recurring Themes and Regional Variations
Hundley, Richard O.; Anderson, Robert H.; Bikson, Tora K.; Neu, C. R.; Jan. 2003; 209 pp.; In English
Contract(s)/Grant(s): DASW01-01-C-0004
Report No.(s): AD-A416293; RAND-MR-1680-NIC; No Copyright; Avail: CASI; A10, Hardcopy

RAND has just completed a multiyear effort, sponsored by the National Intelligence Council (NIC), to explore the future of the information revolution throughout the world. This was a multi-disciplinary effort with a broad range of participants from both inside and outside RAND, with an overarching goal of mapping the likely future of the global information revolution over the next one to two decades. This report focuses on the many findings of this study. This effort included a series of international conferences on specific aspects of the information revolution, involving experts in various relevant areas.
DTIC
Evolution (Development); Information Systems

20030105573 Universities Space Research Association, Columbia, MD, USA
Cooperative Program In Space Science
Black, David; [2003]; 36 pp.; In English
Contract(s)/Grant(s): NCC5-637; No Copyright; Avail: CASI; A03, Hardcopy

The mission of this activity, know as the Cooperative Program in Space Sciences (CPSS), is to conduct space science research and leading-edge instrumentation and technology development, enable research by the space sciences communities, and to expedite the effective dissemination of space science research, technology, data, and information to the educational community and the general public. To fulfill this mission, USRA recruits and maintains a staff of scientific researchers, operates a series of guest investigator facilities, organizes scientific meetings and workshops, and encourages various interactions with students and university faculty members.
Author
Aerospace Engineering; Research And Development; Space Missions; Technologies

20030105902
Accession Medical Standards Analysis and Research Activity Annual Report 2002
Niebuhr, David W.; Li, Yuanzhang; Powers, Timothy E.; Krauss, Margot R.; Aug. 2003; 102 pp.; In English
Report No.(s): AD-A416695; No Copyright; Avail: CASI; A06, Hardcopy

The Accession Medical Standards Analysis and Research Activity annual Report 2002 summarizes work done to support the development of evidence-based medical accession standards contained in DoD Instruction 6130.4 'Criteria and Procedure

Requirements for Physical Standards for Appointment, Enlistment, or Induction in the Armed Forces.' Studies in this report include: (1) Attrition Among Enlistees Waived for Hearing Deficiency. (2) Loss of Recruits to Serious Injury. (3) Detecting Meaningful Changes in Short-term Military Attrition. (4) Psychiatric Hospitalization Rates in New Accessions and Subsequent 6-month Attrition. (5) Effects of Attrition Predictors According to MEPS Through Which an Individual is Processed. (6) Case Series Review of Recruits Discharged for Hearing Loss. and (7) Case Series Review of Recruits Discharged for Scoliosis. Over 1,400,000 enlisted military applicants and 886,000 military accessions were analyzed. Applicants and accessions from 1996 to 2000 (aggregate) were compared to 2001 with attention to medical disqualifications, medical waivers, hospitalizations, existed prior to service medical discharges, and disability discharges. Future deliverable research efforts described include: exhaled nitric oxide as an assist in identifying asthma, initial entry training discharge classification, existed prior to service reporting, detection of young adults with major psychiatric disorders, and the retention of mild asthmatics in the Navy.
DTIC
Information Systems; Medical Science; Navy; Biomedical Data

83
ECONOMICS AND COST ANALYSIS

Includes cost effectiveness studies.

20030097998 Rolls-Royce Ltd., Bristol, UK
Cost Effective Use of Materials for Military Systems from Design to Disposal
Price, P.; Rugg, D.; Low Cost Composite Structures and Cost Effective Application of Titanium Alloys in Military Platforms; March 2003, pp. KN1-1 - KN1-9; In English; See also 20030097962; Original contains color illustrations; Copyright; Avail: CASI; C01, CD-ROM; A02, Hardcopy

For optimised cost effective use of these materials, consideration of the total life cycle is vital. This paper will review design, manufacture, use, repair and disposal. The theme of minimising financial burden for supplier and operator is generic for land, sea and air. Use of integrated product development teams to reduce R+D lead times is integral to meeting the requirements of the military customer in terms of performance and entry into service. Similarly the move to 'Power by the Hour contracts imposes strict requirements on the supplier for quantification of any factors which impact on component life or the ability to repair. This necessitates comprehensive understanding of customers operations and has the potential to significantly change factors associated with the cost / benefit analysis at the design stage. Mechanisms for evolution of the close working relationship between supplier and operator will be explored in the context of materials application and use.
Author
Cost Analysis; Product Development; Systems Engineering; Design To Cost; Cost Effectiveness

20030098005 Rolls-Royce Ltd., Derby, UK
Ti Component Design and Production for Reduced Life Cycle Costs
Rugg, D.; Low Cost Composite Structures and Cost Effective Application of Titanium Alloys in Military Platforms; March 2003, pp. 6-1 - 6-7; In English; See also 20030097962; Copyright; Avail: CASI; C01, CD-ROM; A02, Hardcopy

The ongoing drive to reduce propulsion system and life cycle costs places many demands on the Material Engineer. Some of the key factors required to facilitate cost reduction will be examined for both new designs and existing parts. Selection of new materials or changes to process routes to reduce cost requires a detailed knowledge of titanium alloy process / property relationships. Critical aspects of the relationship with the material supply chain, and academia, to develop this understanding will be highlighted. Compositional definition and manufacturing routes for gamma titanium aluminides and burn resistant titanium alloys will be contrasted with conventional titanium alloys.
Author
Cost Reduction; Life Cycle Costs; Propulsion; Manufacturing

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.

20030086421 Illinois Univ. at Urbana-Champaign, Chicago, IL, USA
Building a Collaborative Bridge: Technology Research, Education and Commercialization Center
Talandis, Jonas; Emerging and Future Computing Paradigms and Their Impact on the Research, Training, and Design Environments of the Aerospace Workforce; August 2003, pp. 243-286; In English; See also 20030086406; Original contains color illustrations; No Copyright; Avail: CASI; A03, Hardcopy

The Technology Research, Education, and Commercialization Center (TRECC) is a research facility at Dupage Airport in Illinois. It is a cooperative effort involving the University of Illinois at Urbana-Champaign, the National Computational Science Alliance (NSCA), the Office of Naval Research, and the Batelle Memorial Institute. This viewgraph presentation profiles TRECC, addressing its three main areas of activity: Technology Research, Tech Transfer and Commercialization, and Education/Training. Various communications and networking technologies and display devices being developed at TRECC are covered by the presentation.
CASI
Research Facilities; Technology Transfer; Commercialization; Cooperation

20030099639 NASA, Washington, DC, USA
Spinoff 2003: 100 Years of Powered Flight
2003; 144 pp.; In English; See also 20030099640 - 20030099696
Report No.(s): NASA/NP-2003-080307-HQ; NAS 1.83:080307-HQ; No Copyright; Avail: National Technology Transfer Center (NTTC), Wheeling, WV

Today, NASA continues to reach milestones in space exploration with the Hubble Telescope, Earth-observing systems, the Space Shuttle, the Stardust spacecraft, the Chandra X-Ray Observatory, the International Space Station, the Mars rovers, and experimental research aircraft these are only a few of the many initiatives that have grown out of NASA engineering know-how to drive the Agency s missions. The technical expertise gained from these programs has transferred into partnerships with academia, industry, and other Federal agencies, ensuring America stays capable and competitive. With Spinoff 2003, we once again highlight the many partnerships with U.S. companies that are fulfilling the 1958 Space Act stipulation that NASA s vast body of scientific and technical knowledge also benefit mankind. This year's issue showcases innovations such as the cochlear implant in health and medicine, a cockpit weather system in transportation, and a smoke mask benefiting public safety; many other products are featured in these disciplines, as well as in the additional fields of consumer/home/recreation, environment and resources management, computer technology, and industrial productivity/manufactacturing technology. Also in this issue, we devote an entire section to NASA s history in the field of flight and showcase NASA s newest enterprise dedicated to education. The Education Enterprise will provide unique teaching and learning experiences for students and teachers at all levels in science, technology, engineering, and mathematics. The Agency also is committed, as never before, to engaging parents and families through NASA s educational resources, content, and opportunities. NASA s catalyst to intensify its focus on teaching and learning springs from our mission statement: to inspire the next generation of explorers as only NASA can.
Derived from text
NASA Programs; Medicine; Weather; Safety; Computers; Manufacturing; Environmental Quality; Resources Management; Technology Transfer

20030099640 Enhanced Vision, Huntington Beach, CA, USA
Improving Vision
Spinoff 2003: 100 Years of Powered Flight; 2003, pp. 22-23; In English; See also 20030099639; Original contains color illustrations; No Copyright; Avail: National Technology Transfer Center (NTTC), Wheeling, WV

Many people are familiar with the popular science fiction series Star Trek: The Next Generation, a show featuring a blind character named Geordi La Forge, whose visor-like glasses enable him to see. What many people do not know is that a product very similar to Geordi's glasses is available to assist people with vision conditions, and a NASA engineer's expertise contributed to its development. The JORDY(trademark) (Joint Optical Reflective Display) device, designed and manufactured by a privately-held medical device company known as Enhanced Vision, enables people with low vision to read, write, and

watch television. Low vision, which includes macular degeneration, diabetic retinopathy, and glaucoma, describes eyesight that is 20/70 or worse, and cannot be fully corrected with conventional glasses.
Author
Technology Utilization; Aerospace Technology Transfer; Enhanced Vision; Display Devices; Visors

20030099641 Luna Technologies International, Inc., Kent, WA, USA
A Brighter Choice for Safety
Spinoff 2003: 100 Years of Powered Flight; 2003, pp. 36-37; In English; See also 20030099639; Original contains color illustrations; No Copyright; Avail: CASI; A01, Hardcopy

Emergency exit signs can be lifesavers, but only if they remain visible when people need them. All too often, power losses or poor visibility can render the signs ineffective. Luna Technologies International, Inc., of Kent, Washington, is shining new light on this safety issue. The company s LUNAplast(trademark) product line illuminates without the need for electricity, maintenance, or a power connection. LUNAplast, which benefited from tests conducted at Johnson Space Center, is so successful that NASA engineers selected it for the emergency exit pathway indicators on the International Space Station (ISS).
Author
Product Development; Symbols; Emergencies; Safety; Photoluminescence; Lighting Equipment

20030099642 Walt Disney World Co., Lake Buena Vista, FL, USA
Blast-Off on Mission: SPACE
Spinoff 2003: 100 Years of Powered Flight; 2003, pp. 40-41; In English; See also 20030099639; Original contains color illustrations; No Copyright; Avail: National Technology Transfer Center (NTTC), Wheeling, WV

Part of NASA's mission is to inspire the next generation of explorers. NASA often reaches children - the inventors of tomorrow - through teachers, reporters, exhibit designers, and other third-party entities. Therefore, when Walt Disney Imagineering, the creative force behind the planning, design, and construction of Disney parks and resorts around the world, approached NASA with the desire to put realism into its Mission: SPACE project, the Agency was happy to offer its insight.
Author
Children; Games; Aerospace Technology Transfer; Cooperation; Space Exploration

20030099643 SunDanze Refrigeration, Inc., Sparks, NV, USA
Keeping Cool With Solar-Powered Refrigeration
Spinoff 2003: 100 Years of Powered Flight; 2003, pp. 42-43; In English; See also 20030099639; Original contains color illustrations; No Copyright; Avail: National Technology Transfer Center (NTTC), Wheeling, WV

In the midst of developing battery-free, solar-powered refrigeration and air conditioning systems for habitats in space, David Bergeron, the team leader for NASA's Advanced Refrigerator Technology Team at Johnson Space Center, acknowledged the need for a comparable solar refrigerator that could operate in conjunction with the simple lighting systems already in place on Earth. Bergeron, a 20-year veteran in the aerospace industry, founded the company Solus Refrigeration, Inc., in 1999 to take the patented advanced refrigeration technology he co-developed with his teammate, Johnson engineer Michael Ewert, to commercial markets. Now known as SunDanzer Refrigeration, Inc., Bergeron's company is producing battery-free, photovoltaic (PV) refrigeration systems under license to NASA, and selling them globally.
Derived from text
Refrigerators; Solar Cooling; Aerospace Technology Transfer

20030099645 NASA, Washington, DC, USA
Partnership Successes
Spinoff 2003: 100 Years of Powered Flight; 2003, pp. 130-134; In English; See also 20030099639; Original contains color illustrations; No Copyright; Avail: National Technology Transfer Center (NTTC), Wheeling, WV

Through partnerships with industry and academia, NASA s space-age technology improves all aspects of society. While not every technology transfer activity results in commercialization, these partnerships offer far-reaching benefits to U.S. citizens. The following examples are just a few of the ways NASA is applying its technology and resources to improve the quality of life on Earth.
Derived from text
Technology Transfer; NASA Programs

20030099649 SciMeasure Analytical Systems, Inc., USA

New Modular Camera No Ordinary Joe

Spinoff 2003: 100 Years of Powered Flight; 2003, pp. 26-27; In English; See also 20030099639; Original contains color illustrations; No Copyright; Avail: National Technology Transfer Center (NTTC), Wheeling, WV

Although dubbed 'Little Joe' for its small-format characteristics, a new wavefront sensor camera has proved that it is far from coming up short when paired with high-speed, low-noise applications. SciMeasure Analytical Systems, Inc., a provider of cameras and imaging accessories for use in biomedical research and industrial inspection and quality control, is the eye behind Little Joe's shutter, manufacturing and selling the modular, multi-purpose camera worldwide to advance fields such as astronomy, neurobiology, and cardiology.

Author

CCD Cameras; Wave Front Reconstruction; Aerospace Technology Transfer; Product Development; Adaptive Optics

20030099657 Alcon, Inc., USA, Autonomous Technologies, USA

The Right Track for Vision Correction

SPINOFF 2003: 100 Years of Powered Flight; 2003, pp. 10-11; In English; See also 20030099639; Original contains color illustrations; No Copyright; Avail: National Technology Transfer Center (NTTC), Wheeling, WV

More and more people are putting away their eyeglasses and contact lenses as a result of laser vision correction surgery. LASIK, the most widely performed version of this surgical procedure, improves vision by reshaping the cornea, the clear front surface of the eye, using an excimer laser. One excimer laser system, Alcon s LADARVision 4000, utilizes a laser radar (LADAR) eye tracking device that gives it unmatched precision. During LASIK surgery, laser During LASIK surgery, laser pulses must be accurately placed to reshape the cornea. A challenge to this procedure is the patient s constant eye movement. A person s eyes make small, involuntary movements known as saccadic movements about 100 times per second. Since the saccadic movements will not stop during LASIK surgery, most excimer laser systems use an eye tracking device that measures the movements and guides the placement of the laser beam. LADARVision s eye tracking device stems from the LADAR technology originally developed through several Small Business Innovation Research (SBIR) contracts with NASA s Johnson Space Center and the U.S. Department of Defense s Ballistic Missile Defense Office (BMDO). In the 1980s, Johnson awarded Autonomous Technologies Corporation a Phase I SBIR contract to develop technology for autonomous rendezvous and docking of space vehicles to service satellites. During Phase II of the Johnson SBIR contract, Autonomous Technologies developed a prototype range and velocity imaging LADAR to demonstrate technology that could be used for this purpose.

Derived from text

Excimer Lasers; Surgery; Cornea; Laser Applications; Technology Transfer

20030099660 Diversified Scientific, Inc., USA

Protein Crystal Growth

Spinoff 2003: 100 Years of Powered Flight; 2003, pp. 18-19; In English; See also 20030099639; Original contains color illustrations; No Copyright; Avail: National Technology Transfer Center (NTTC), Wheeling, WV

In order to rapidly and efficiently grow crystals, tools were needed to automatically identify and analyze the growing process of protein crystals. To meet this need, Diversified Scientific, Inc. (DSI), with the support of a Small Business Innovation Research (SBIR) contract from NASA s Marshall Space Flight Center, developed CrystalScore(trademark), the first automated image acquisition, analysis, and archiving system designed specifically for the macromolecular crystal growing community. It offers automated hardware control, image and data archiving, image processing, a searchable database, and surface plotting of experimental data. CrystalScore is currently being used by numerous pharmaceutical companies and academic and nonprofit research centers. DSI, located in Birmingham, Alabama, was awarded the patent Method for acquiring, storing, and analyzing crystal images on March 4, 2003. Another DSI product made possible by Marshall SBIR funding is VaporPro(trademark), a unique, comprehensive system that allows for the automated control of vapor diffusion for crystallization experiments.

Derived from text

Protein Crystal Growth; Image Analysis; Crystallization; Vapors; Diffusion; Pharmacology; Aerospace Technology Transfer

20030099662 Vigyan Research Associates, Inc., Hampton, VA, USA, WSI Corp., Billerica, MA, USA

InFlight Weather Forecasts at Your Fingertips

SPINOFF 2003 100 Years of Powered Flight; January 2003; 2 pp.; In English; See also 20030099639; Original contains color illustrations; No Copyright; Avail: National Technology Transfer Center (NTTC), Wheeling, WV

A new information system is delivering real-time weather reports to pilots where they need it the most - inside their aircraft cockpits. Codeveloped by NASA and ViGYAN, Inc., the WSI InFlight(trademark) Cockpit Weather System provides a continuous, satellite-based broadcast of weather information to a portable or panel-mounted display inside the cockpit. With complete coverage and content for the continental USA at any altitude, the system is specifically designed for inflight use.
Author
Cockpit Weather Information Systems; Product Development; Aerospace Technology Transfer; Technology Utilization; Display Devices

20030099674 ProVision Technologies, Inc., Hilo, HI, USA
Images Revealing More Than a Thousand Words
Spinoff 2003: 100 Years of Powered Flight; 2003, pp. 35; In English; See also 20030099639; Original contains color illustrations; No Copyright; Avail: National Technology Transfer Center (NTTC), Wheeling, WV

A unique sensor developed by ProVision Technologies, a NASA Commercial Space Center housed by the Institute for Technology Development, produces hyperspectral images with cutting-edge applications in food safety, skin health, forensics, and anti-terrorism activities. While hyperspectral imaging technology continues to make advances with ProVision Technologies, it has also been transferred to the commercial sector through a spinoff company, Photon Industries, Inc.
Author
Aerospace Technology Transfer; Technology Utilization; Imaging Techniques; Imaging Spectrometers

20030099675 PROSystems, Inc., USA
A Gold Medal Finish
Spinoff 2003: 100 Years of Powered Flight; 2003, pp. 38-39; In English; See also 20030099639; Original contains color illustrations; No Copyright; Avail: National Technology Transfer Center (NTTC), Wheeling, WV

During the summer of 1999, Darryl Mitchell of Goddard Space Flight Center's Technology Commercialization Office (TCO) met with the U.S. Olympic Committee at the official training facility in Colorado Springs, Colorado, to offer assistance in transferring NASA technologies applicable to Olympic sports. Following the meeting with the Olympic committee, Mitchell was approached by U.S. Speedskating Long Track Program Director Finn Halvorsen, who eagerly voiced his interest in working with NASA to identify a means of improving performance for his team. According to Halvorsen, 'If (NASA) can put a man on the moon, surely they can help our skaters.' Mitchell and Halvorsen went to work uncovering NASA technologies that could boost the U.S. team's skating capabilities. Mitchell received a crash course in speedskating, and as a result, generated a lengthy list of promising NASA developments that could benefit the sport. From this list, he and his Goddard TCO partner, Joe Famiglietti, deliberated over whether a NASA mirror-polishing technique could possibly be adapted to the athletes speedskates. The polishing technique, developed by Jim Lyons, a 16-year optical engineering veteran of Goddard, was derived from the same principles used to create the optics for NASA's science observatories, such as the Hubble Space Telescope (highly polished optics are required by NASA to obtain sharp, clear images in space).
Derived from text
Aerospace Technology Transfer; Technology Utilization; Athletes; Competition; Polishing

20030099676 Smoke Mask, Inc., Myrtle Beach, SC, USA
Smoke Mask
Spinoff 2003: 100 Years of Powered Flight; 2003, pp. 34; In English; See also 20030099639; Original contains color illustrations; No Copyright; Avail: National Technology Transfer Center (NTTC), Wheeling, WV

Smoke inhalation injury from the noxious products of fire combustion accounts for as much as 80 percent of fire-related deaths in the USA. Many of these deaths are preventable. Smoke Mask, Inc. (SMI), of Myrtle Beach, South Carolina, is working to decrease these casualties with its line of life safety devices. The SMI personal escape hood and the Guardian Filtration System provide respiratory protection that enables people to escape from hazardous and unsafe conditions. The breathing filter technology utilized in the products is specifically designed to supply breathable air for 20 minutes. In emergencies, 20 minutes can mean the difference between life and death.
Derived from text
Air Filters; Breathing Apparatus; Masks; Safety Devices; Protective Clothing; Product Development

20030099687 NASA, Washington, DC, USA
Technology Transfer Network and Affiliations

Spinoff 2003: 100 Years of Powered Flight; 2003, pp. 135-139; In English; See also 20030099639; No Copyright; Avail: National Technology Transfer Center (NTTC), Wheeling, WV

The NASA Technology Transfer Partnership program sponsors a number of organizations around the country that are designed to assist U.S. businesses in accessing, utilizing, and commercializing NASA-funded research and technology. These organizations work closely with the Technology Transfer Offices, located at each of the 10 NASA field centers, providing a full range of technology transfer and commercialization services and assistance.

Derived from text

Aerospace Technology Transfer; NASA Programs; Commercialization; Research And Development

20030099688 VESTRA Resources, Inc., Redding, CA, USA

Mapping a Better Vintage

Spinoff 2003: 100 Years of Powered Flight; 2003, pp. 44-45; In English; See also 20030099639; Original contains color illustrations; No Copyright; Avail: National Technology Transfer Center (NTTC), Wheeling, WV

Vineyards such as those located in California's Napa Valley tend to be subdivided into relatively large fields or blocks that often encompass heterogeneous physical conditions. Since growers typically treat the entire block as a single minimum management unit for cultivation and harvest, mapping and monitoring the variability within a block is a concern. Over the last decade, an increasing number of vineyard managers have utilized digital remote sensing and geographic information systems (GIS) to visualize the variability within their blocks. With computer software designed to overlay remotely sensed imagery with environmental and agronomic geographic data on a map, GIS helps growers recognize and explain patterns that might not have been obvious otherwise. GIS can also serve as a valuable archiving mechanism for future reference. To further develop the use of image technology and GIS for vineyard management support, NASA's Earth Science Enterprise partnered with the U.S. wine and commercial remote sensing industries for a project known as the Viticultural Integration of NASA Technologies for Assessment of the Grapevine Environment (VINTAGE). With project investigators from NASA's Ames Research Center, the California State University at Monterey Bay, and the University of Montana, several prototype products have been developed to support agricultural decisions concerning canopy management and irrigation practice. One key VINTAGE aspect involved the evaluation of satellite and airborne multispectral imagery for delineation of sub-block management zones within a vineyard.

Derived from text

Vineyards; Geographic Information Systems; Remote Sensing; Satellite Imagery; Crops; Cooperation; Space Commercialization; Technology Utilization

20030099689 Positive Systems, Inc., Whitefish, MT, USA, Tobin International Ltd., Houston, TX, USA

Digital Images on the DIME

Spinoff 2003: 100 Years of Powered Flight; 2003, pp. 46-47; In English; See also 20030099639; Original contains color illustrations; No Copyright; Avail: National Technology Transfer Center (NTTC), Wheeling, WV

With NASA on its side, Positive Systems, Inc., of Whitefish, Montana, is veering away from the industry standards defined for producing and processing remotely sensed images. A top developer of imaging products for geographic information system (GIS) and computer-aided design (CAD) applications, Positive Systems is bucking traditional imaging concepts with a cost-effective and time-saving software tool called Digital Images Made Easy (DIME(trademark)). Like piecing a jigsaw puzzle together, DIME can integrate a series of raw aerial or satellite snapshots into a single, seamless panoramic image, known as a 'mosaic.' The 'mosaicked' images serve as useful backdrops to GIS maps - which typically consist of line drawings called 'vectors' - by allowing users to view a multidimensional map that provides substantially more geographic information.

Author

Space Commercialization; Technology Utilization; Aerospace Technology Transfer; Geographic Information Systems; Image Processing; Remote Sensing

20030099691 Hy-Tech Thermal Solutions, LLC, Melbourne, FL, USA

Home Insulation With the Stroke of a Brush

Spinoff 2003: 100 Years of Powered Flight; 2003, pp. 48-49; In English; See also 20030099639; Original contains color illustrations; No Copyright; Avail: National Technology Transfer Center (NTTC), Wheeling, WV

Hy-Tech Thermal Solutions, LLC, of Melbourne, Florida, is producing a very complex blend of ceramic vacuum-filled refractory products designed to minimize the path of hot air transfer through ceilings, walls, and roofs. The insulating ceramic

technology blocks the transfer of heat outward when applied to paint on interior walls and ceilings, and prevents the transfer of heat inward when used to paint exterior walls and roofs, effectively providing year-round comfort in the home. As a manufacturer and marketer of thermal solutions for residential, commercial, and industrial applications, Hy-Tech Thermal Solutions attributes its success to the high performance insulating ceramic microsphere originally developed from NASA thermal research at Ames Research Center. Shaped like a hollow ball so small that it looks as if it is a single grain of flour to the naked eye (slightly thicker than a human hair), the microsphere is noncombustible and fairly chemical-resistant, and has a wall thickness about 1/10 of the sphere diameter, a compressive strength of about 4,000 pounds per square inch, and a softening point of about 1,800 C. Hy-Tech Thermal Solutions improved upon these properties by removing all of the gas inside and creating a vacuum. In effect, a 'mini thermos bottle' is produced, acting as a barrier to heat by reflecting it away from the protected surface. When these microspheres are combined with other materials, they enhance the thermal resistance of those materials. In bulk, the tiny ceramic 'beads' have the appearance of a fine talcum powder. Their inert, nontoxic properties allow them to mix easily into any type of paint, coating, adhesive, masonry, or drywall finish. Additionally, their roundness causes them to behave like ball bearings, rolling upon each other, and letting the coatings flow smoothly. When applied like paint to a wall or roof, the microsphere coating shrinks down tight and creates a dense film of the vacuum cells. The resulting ceramic layer improves fire resistance, protects from ultraviolet rays, repels insects such as termites, and shields from the destructive forces of nature.
Derived from text
Insulation; Protective Coatings; Aerospace Technology Transfer; Product Development; Technology Utilization; Ceramics

20030099695 Visual Learning Systems, Inc., Missoula, MT, USA
Supporting the Growing Needs of the GIS Industry
Spinoff 2003: 100 Years of Powered Flight; 2003, pp. 50-51; In English; See also 20030099639; Original contains color and black and white illustrations; No Copyright; Avail: National Technology Transfer Center (NTTC), Wheeling, WV

Visual Learning Systems, Inc. (VLS), of Missoula, Montana, has developed a commercial software application called Feature Analyst. Feature Analyst was conceived under a Small Business Innovation Research (SBIR) contract with NASA's Stennis Space Center, and through the Montana State University TechLink Center, an organization funded by NASA and the U.S. Department of Defense to link regional companies with Federal laboratories for joint research and technology transfer. The software provides a paradigm shift to automated feature extraction, as it utilizes spectral, spatial, temporal, and ancillary information to model the feature extraction process; presents the ability to remove clutter; incorporates advanced machine learning techniques to supply unparalleled levels of accuracy; and includes an exceedingly simple interface for feature extraction.
Derived from text
Geographic Information Systems; Computer Programs; Image Analysis; Aerospace Technology Transfer

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*.

20030093598 State Univ. of New York, Saratoga Springs, NY, USA
Our Space Future: A Challenge to the Conceptual Artist Concept Art for Presentation and Education
Bangs, Mary C.; The 2002 NASA Faculty Fellowship Program Research Reports; April 2003, pp. V-1 - V-6; In English; See also 20030093576; Original contains color and black and white illustrations
Contract(s)/Grant(s): NAG8-1859; No Copyright; Avail: CASI; C01, CD-ROM; A02, Hardcopy

The history of visual representation is as old as the history of humankind. The Paleolithic drawings that are found in caves present our collective need for recording our dependence on the life-sustaining animal populations. Our wishes for their fertility (and for our own) comprise much of the art we find in these prehistoric drawings. As well, the cycles of the Moon are recorded in Paleolithic art relating to women's estrus cycles that link the perpetuation of our species with the cosmos. Art became our initial way of description and a way of envisioning our future goals. At the time when pictograms began to form humanity s first written languages, we also started to use art to invoke favorable forces and ward off devastation. Another important application of visual art became the conceptualization of tools, buildings and ideas that were impossible to describe by other means. Humans have a historical tradition of considering visual images as vehicles to inspire us to pursue a different way of thinking through our ability of envisioning. Complex concepts can be described visually and have the ability to convey

information on many different levels. Conceptual art is a tool that can describe wide-ranging ideas from religious insights to currently unfeasible engineering projects and visionary dreams for humankind.
Derived from text
Drawings; Images; Histories; Aerospace Sciences; Education

89
ASTRONOMY

Includes observations of celestial bodies; astronomical instruments and techniques; radio, gamma-ray, x-ray, ultraviolet, and infrared astronomy; and astrometry.

20030093531 Smithsonian Astrophysical Observatory, Cambridge, MA, USA
Doppler Imaging with FUSE: The Partially Eclipsing Binary VW Cep
Sonneborn, George, Technical Monitor; Brickhouse, Nancy; September 2003; 2 pp.; In English
Contract(s)/Grant(s): NAG5-12386; No Copyright; Avail: CASI; A01, Hardcopy

This report covers the FUSE Guest Observer program. This project involves the study of emission line profiles for the partially eclipsing, rapidly rotating binary system VW Cep. Active regions on the surface of the star(s) produce observable line shifts as the stars move with respect to the observer. By studying the time-dependence of the line profile changes and centroid shifts, one can determine the location of the activity. FUSE spectra were obtained by the P.I. 27 Sept 2002 and data reduction is in progress. Since we are interested in line profile analysis, we are now investigating the wavelength scale calibration in some detail. We have also obtained and are analyzing Chandra data in order to compare the X-ray velocities with the FUV velocities. A complementary project comparing X-ray and Far UltraViolet (FUV) emission for the similar system 44i Boo is also underway. Postdoctoral fellow Ronnie Hoogerwerf has joined the investigation team and will perform the data analysis, once the calibration is optimized.
Author
Doppler Radar; Imaging Techniques; Emission Spectra; Eclipsing Binary Stars

20030093618 Georgia Coll. and State Univ., Milledgeville, GA, USA
Low-Energy Study of Gamma-Ray Bursts Having Spectral Line Features
Pangia, Michael J.; The 2002 NASA Faculty Fellowship Program Research Reports; April 2003, pp. XXXIII-1 - XXXIII-5; In English; See also 20030093576
Contract(s)/Grant(s): NAG8-1859; No Copyright; Avail: CASI; C01, CD-ROM; A01, Hardcopy

Gamma-ray bursts (GRBs) are energetic, short-duration emissions of gamma-rays. The Burst and Transient Source Experiment (BATSE) that was onboard NASA s Compton Gamma-Ray Observatory has done much to advance our understanding of GRBs. Perhaps foremost is to establish that GRBs originate from astronomical sources that exist well beyond our galaxy. Another area in which BATSE has been instrumental is to provide high-resolution data that can be used in spectral studies. Before BATSE, there were many reports of GRB spectra containing what appeared to be spectral absorption lines, whereas Briggs, after an extensive computer search of 117 bright BATSE GRBs, reported finding only one case that might be an absorption line and ten cases that might be emission lines. None of the eleven BATSE cases were definitively identified as spectral lines, and Briggs indicated reasons as to why the pre-BATSE reports should not be taken as conclusive. It remains an open question as to what these spectral-like features are, or if they are even real. The purpose of this work is, for the subset of the eleven BATSE GRBs for which low-energy data are available from two BATSE's Spectroscopy Detectors (SDs), to include these data in the spectral analysis. Such a study will provide additional constraints on the model spectral functions to better ascertain the reality of the line features. The spectral analysis program used was RMFIT. Of the six GRBs that met the selection criteria, the analysis was performed on only three of them due to a lack of time.
Derived from text
Gamma Ray Bursts; Gamma Ray Observatory; Line Spectra; Spectroscopy; Mathematical Models; Energy Distribution; Detectors

20030093746 NASA Goddard Space Flight Center, Greenbelt, MD, USA
XMM-Newton Observation of Fe K(alpha) Emission from a BAL QSO: Mrk 231
Turner, T. J.; Kraemer, S. B.; [2003]; 6 pp.; In English; Copyright; Avail: CASI; A02, Hardcopy

We present results from a 20 ksec XMM-Newton observation of Mrk 231. EPIC spectral data reveal strong line emission due to Fe K alpha, which has rarely been detected in this class, as BAL QSOs are very faint in the X-ray band. The line energy

is consistent with an origin in neutral Fe. The width of the line is equivalent to a velocity dispersion approximately 18,000 kilometers per second and thus the line may be attributed to transmission and/or reflection from a distribution of emitting clouds. If, instead, the line originates in the accretion disk then the line strength and flat X-ray continuum support some contribution from a reflected component, although the data disfavor a model where the hard X-ray band is purely reflected X-rays. The line parameters are similar to those obtained for the Fe Ka line detected in another BAL QSO, H1413 + 117.
Author
Xmm-Newton Telescope; K Lines; Active Galactic Nuclei; Emission Spectra; Quasars; Absorption Spectra

20030093750 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Equal-Curvature X-ray Telescope Designs for Constellation-X Mission
Saha, Timo T.; Content, David A.; Zhang, William W.; [2003]; 6 pp.; In English; SPIE Optical Science and Technology Annual Meeting, 3-8 Aug. 2003, San Diego, CA, USA; No Copyright; Avail: CASI; A02, Hardcopy

We study grazing incidence Equal-Curvature telescope designs for the Constellation-X mission. These telescopes have nearly spherical axial surfaces. The telescopes are designed so that the axial curvature is the same on the primary and secondary. The optical performance of these telescopes is for all practical purposes identical to the equivalent Wolter telescopes.
Author
Constellations; Space Missions; Curvature; Grazing Incidence Telescopes

20030093755 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Elemental Abundances in NGC 3516
Turner, T. J.; Kraemer, S. B.; Mushotzky, R. F.; George, I. M.; Gabel, J. R.; [2003]; 19 pp.; In English
Contract(s)/Grant(s): NAG5-7538; No Copyright; Avail: CASI; A03, Hardcopy

We present Reflection Grating Spectrometer data from an XMM-Newton observation of the Seyfert 1 galaxy NGC 3516, taken while the continuum source was in an extremely low flux state. This observation offers a rare opportunity for a detailed study of emission from a Seyfert 1 galaxy as these are usually dominated by high nuclear continuum levels and heavy absorption. The spectrum shows numerous narrow emission lines (FWHM approximately less than 1300 kilometers per second) in the 0.3 - 2 keV range, including the H-like lines of C, N, and O and the He-like lines of N, O and Ne. The emission-line ratios and the narrow width of the radiative recombination continuum of CVI indicate that the gas is photoionized and of fairly low temperature (kT approximately less than 0.01 keV). The availability of emission lines from different elements for two iso-electronic sequences allows us to constrain the element abundances. These data show that the N lines are far stronger than would be expected from gas of solar abundances. Based on our photoionization models we find that nitrogen is overabundant in the central regions of the galaxy, compared to carbon, oxygen and neon by at least a factor of 2.5. We suggest that this is the result of secondary production of nitrogen in intermediate mass stars, and indicative of the history of star formation in NGC 3516.
Author
Spectrometers; Abundance; Reflection; Seyfert Galaxies; Emission Spectra

20030095916 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Cubic Calorimeter for High-Energy Electrons in Ultra-Long Ballooning
Moiseev, Alexander A.; Mitchell, John W.; Ormes, Jonathan F.; Streitmatter, Robert E.; May 15, 2003; 4 pp.; In English; 28th International Cosmic Ray Conference, 30 Jul. - 7 Aug. 2003, Tsukuba,, Japan; No Copyright; Avail: CASI; A01, Hardcopy

The concept and optimization study of a balloon-borne instrument to study high-energy (from 100 GeV to 5 TeV) cosmic ray electrons will be presented. This energy range of electrons is very interesting for the study of cosmic ray propagation and the search for the nearby sources of high-energy electrons. The instrument is based on a cubic design that allows the detection from all sides. Proton rejection is provided by stringent track analysis, which allows defining when an electron shower is exhausted while the hadron shower continues development. The collecting power of a nominal balloon-borne instrument using this concept will be over 2 square meters sr. This will provide approximately 3,000 electron events above 500 GeV for 3-month long ULDB flight. This instrument will also be capable of detecting sharp features in the high energy gamma-ray spectrum such as gamma-ray lines originating from the dark matter annihilation.
Author
Balloon-Borne Instruments; Calorimeters; High Energy Electrons; Cosmic Rays; Energy Spectra

20030095920 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Chandra Detection of a Pulsar Wind Nebula Associated With Supernova Remnant 3C 396
Olbert, C. M.; Keohane, J. W.; Arnaud, K. A.; Dyer, K. K.; Reynolds, S. P.; Safi-Harb, S.; [2003]; 12 pp.; In English
Contract(s)/Grant(s): NAS8-39073; SAO-2500834; Copyright; Avail: CASI; A03, Hardcopy

We present a 100 ks observation of the Galactic supernova remnant 3C396 (G39.2-0.3) with the Chandra X-Ray Observatory that we compare to a 20cm map of the remnant from the Very Large Array. In the Chandra images, a nonthermal nebula containing an embedded pointlike source is apparent near the center of the remnant which we interpret as a synchrotron pulsar wind nebula surrounding a yet undetected pulsar. From the 2-10 keV spectrum for the nebula (N(sub H) = 5.3 plus or minus 0.9 x 10(exp 22) per square centimeter, GAMMA =1.5 plus or minus 0.3) we derive an unabsorbed x-ray flux of S(sub z)=1.62 x 10(exp -12) erg per square centimeter per second, and from this we estimate the spin-down power of the neutron star to be E(sup dot) = 7.2 x 10(exp 36) ergs per second. The central nebula is morphologically complex, showing bent, extended structure. The radio and X-ray shells of the remnant correlate poorly on large scales, particularly on the eastern half of the remnant, which appears very faint in X-ray images. At both radio and X-ray wavelengths the western half of the remnant is substantially brighter than the east.
Author
Nebulae; Supernova Remnants; Detection; Pulsars; Stellar Winds; X Ray Astrophysics Facility

20030095962 NASA Goddard Space Flight Center, Greenbelt, MD, USA
An Isolated 55.7-ms Pulsar in the Galactic Anti-centre
Lorimer, d. R.; McLaughlin, M. A.; Arzoumanian, Z.; Xilouris, K. M.; Cordes, J. M.; Lommen, A. N.; Fruchter, A. S.; Chandler, A. M.; Backer, D. C.; [2003]; 4 pp.; In English; Copyright; Avail: Other Sources

We report the discovery and initial timing observations of a 55.7-ms pulsar, JO609+2130, found during a 430-MHz drift-scan survey with the Arecibo radio telescope. With a spin-down rate of 3.1 x 10(exp -19) s per second and an inferred surface dipole magnetic field of only 4.2 x 10(exp 9) G, J0609+2130 has very similar spin parameters to their isolated pulsar J2235+1506 found by Camilo et al. (1993). A likely formation scenario for these weakly magnetized isolated pulsars, is the disruption of a high-mass X-ray binary system after the supernova explosion of the secondary star.
Author
Pulsars; Radio Telescopes; Radio Sources (Astronomy); Galactic Structure

20030098038 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Chandra Observation of the Core of the Galaxy Cluster AWM 7
Furusho, T.; Yanasaki, N. Y.; Ohashi, T.; [2003]; 21 pp.; In English
Contract(s)/Grant(s): JSPS-12304009; JSPS-12440067; Copyright; Avail: CASI; A03, Hardcopy

We present results from a Chandra observation of the core region of the nearby X-ray bright galaxy cluster AWM 7. There are blob-like substructures, which are seen in the energy band 2-10 keV, within 10 kpc (20') of the cD galaxy NGC 1129, and the brightest sub-peak has a spatial extent more than 4 kpc. We also notice that the central soft X-ray peak is offset from the optical center by 1.3 kpc. These structures have no correlated features in optical, infrared, or radio band. Energy spectrum of the hard sub-peak indicates a temperature higher than 3 keV with a metallicity less than 0.3 solar, or a power-law spectrum with photon index approximately 1.2. A hardness ratio map and a narrow Fe-K band image jointly indicate two Fe-rich blobs symmetrically located around the cD galaxy, with the direction perpendicular to the sub-peak direction. In larger scales (r less than 60 kpc), the temperature gradually drops from 4 keV to 2 keV toward the cluster center and the metal abundance rises steeply to a peak of 1.5 solar at r approximately equal to 7 kpc. These results indicate that a dynamical process is going on in the central region of AWM 7, which probably creates heated gas blobs and drives metal injection.
Author
X Ray Astrophysics Facility; Galactic Clusters; X Ray Imagery; Galactic Structure

20030102157 NASA Goddard Space Flight Center, Greenbelt, MD, USA
The ISM From the Soft X-ray Background Perspective
Snowden, S. L.; [2003]; 8 pp.; In English; Soft X-ray Emissions from Clusters of Galaxies and Related Phenomena Meeting, 11-13 Dec. 2002, Huntsville, AL, USA; No Copyright; Avail: CASI; A02, Hardcopy

In the past few years progress in understanding the local and Galactic ISM in terms of the diffuse X-ray background has been as much about what hasn't been seen as it has been about detections. High resolution spectra of the local SXRB have been observed, but are inconsistent with current thermal emission models. An excess over the extrapolation of the high-energy

(most clearly visible at E greater than 1.5 keV) extragalactic power law down to 3/4 keV has been observed but only at the level consistent with cosmological models, implying the absence of at least a bright hot Galactic halo. A very recent FUSE result indicates that O VI emission from the Local Hot Bubble is insignificant, if it exists at all, a result which is also inconsistent with current thermal emission models. A short review of the current status of our (well, at least my) understanding of the Galactic SXRB and ISM is presented here.
Author
Background Radiation; Cosmology; Active Galactic Nuclei; Interstellar Matter; X Ray Astronomy; Mathematical Models

20030102172 Air Force Academy, CO, USA
The Development of a Data Archive and Analysis Tools for WIRE
Buzasi, Derek L.; June 2002; 10 pp.; In English; No Copyright; Avail: CASI; A02, Hardcopy

Although a number of missions to perform asteroseismology from orbit are planned, such as the French COROT (currently scheduled for launch in 2004), the Canadian MOST (2002), and the Danish MONS (2003), none has yet been successfully flown. However, from May 1999 through September 2000, the PI of this proposal initiated a program using the star camera on board the WIRE spacecraft to perform high-precision photometry of solar-like and giant stars. This program relied on the on-board star camera, which consists of a 50mm f/1.75 telescope feeding a 512(sup 2) SITe CCD, which can be read out at rates as high as 10 Hz. The high cadence of observations available with this star camera is made possible by software that locates the 5 brightest stars in the field and reads only an 8x8 pixel box around one selected image. An additional mode of operation, available since November 1999, makes count rate data available on all five stellar images, with a consequent loss of read rate (to 2 Hz for 5 stars). Stellar images are defocused (to allow for more accurate image centroiding), but the entire stellar image lies within the 64-pixel box. we note that in many ways, this instrument is similar to the French instrument EVRIS, which was intended to perform asteroseismology with a 90 mm telescope, but which unfortunately flew as part of the failed Russian MARS 96 spacecraft.
Derived from text
Asteroseismology; Spaceborne Telescopes; CCD Cameras; Photometry

20030102180 Colorado Univ., Boulder, CO, USA
A Unified Analysis of Non-Radiative Heating and Wind Acceleration in Late-Type Stellar Atmospheres
Harper, Graham M.; October 08, 2003; 5 pp.; In English
Contract(s)/Grant(s): NAG5-4804; CU Proj. 1534545; No Copyright; Avail: CASI; A01, Hardcopy

This is the final report for LTSA NAG5-4804 (CU Project #1534545) and is a summary of the significant results and developments from research performed in Graham Harper's (GMH) Junior LTSA. The period of performance is: 08/01/97 - 07/31/03. Joornal papers, conference proceedings and poster abstracts relating to research during this period are listed at the end. Additional references to other work are given within the text.
Author
Stellar Atmospheres; Heating; Stellar Winds; Ultraviolet Astronomy; Bibliographies

20030102244 NASA Goddard Space Flight Center, Greenbelt, MD, USA
The Swift Project Contamination Control Program: A Case study of Balancing Cost, Schedule and Risk
Hansen, Patricia A.; Day, Diane; Secunda, Mark; [2003]; 15 pp.; In English; 21st Aerospace Testing Seminar, 21-23 Oct. 2003, Manhattan Beach, CA, USA; Copyright; Avail: CASI; A03, Hardcopy

The Swift Observatory will be launched in early 2004 to examine the dynamic process of gamma ray burst (GRB) events. The multi-wavelength Observatory will study the GRB afterglow characteristics, which will help to answer fundamental questions about both the structure and the evolution of the universe. The Swift Observatory Contamination Control Program has been developed to aid in ensuring the success of the on-orbit performance of two of the primary instruments: the Ultraviolet and Optical Telescope (UVOT) and the X-Ray Telescope (XRT). During the design phase of the Observatory, the contamination control program evolved and trade studies were performed to assess the risk of contaminating the sensitive UVOT and XRT optics during both pre-launch testing and on-orbit operations, within the constraints of the overall program cost and schedule.
Author
Contamination; Costs; Observatories; Telescopes; Gamma Ray Bursts

90
ASTROPHYSICS

Includes cosmology; celestial mechanics; space plasmas; and interstellar and interplanetary gases and dust.

20030086432 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Probing The Invisible Universe: The Case for Far-IR/Submillimeter Interferometry
Leisawitz, D.; Armstrong, T; Benford, D.; Blain, A.; Borne, K.; Danchi, W.; Evans, N.; Gardner, J.; Gezari, D.; Harwit, M., et al.; [2003]; 11 pp.; In English; Original contains black and white illustrations; No Copyright; Avail: CASI; A03, Hardcopy

The question 'How did we get here and what will the future bring? captures the human imagination and the attention of the National Academy of Science s Astronomy and Astrophysics Survey Committee (AASC). Fulfillment of this fundamental goal requires astronomers to have sensitive, high angular and spectral resolution observations in the far-infrared submillimeter (far-IR-sub-mm) spectral region. With half the luminosity of the universe and vital information about galaxy, star and planet formation, observations in this spectral region require capabilities similar to those currently available or planned at shorter wavelengths. The scientific motivation, some mission concepts and technology requirements for far-IR-sub-mm space interferometers that can be developed in the 2010-2020 timeframe are summarized.
Author
Infrared Interferometers; Planetary Evolution; Star Formation; Galactic Evolution

20030093570 NASA Langley Research Center, Hampton, VA, USA
Observations of Solar Spectral Irradiance Change During Cycle 22 from NOAA-9 SBUV/2
DeLand, Matthew T.; Cebula, Richard P.; Hilsenrath, Ernest; [2003]; 23 pp.; In English; Original contains color illustrations Contract(s)/Grant(s): NAS1-98106; No Copyright; Avail: CASI; A03, Hardcopy

The NOM-9 Solar Backscatter Ultraviolet, model 2 (SBUV/2) instrument is one of a series of instruments providing daily solar spectral irradiance measurements in the middle and near ultraviolet since 1978. The SBUV/2 instruments are primarily designed to measure stratospheric profile and total column ozone, using the directional albedo as the input to the ozone processing algorithm. As a result, the SBUV/2 instrument does not have onboard monitoring of all time-dependent response changes. We have applied internal comparisons and vicarious (external) comparisons to determine the long-term instrument characterization for NOAA-9 SBUV/2 to derive accurate solar spectral irradiances from March 1985 to May 1997 spanning two solar cycle minima with a single instrument. The NOAA-9 data show an amplitude of 9.3(+/- 2.3)% (81-day averaged) at 200-205 nm for solar cycle 22. This is consistent with the result of (Delta)F(sub 200-205) = 8.3(+/- 2.6)% for cycle 21 from Nimbus-7 SBUV and (Delta)F(sub 200-205) = 10(+/- 2)% (daily values) for cycle 23 from UARS SUSIM. NOAA-9 data at 245-250 nm show a solar cycle amplitude of (Delta)F(sub 245-250) = 5.7(+/- 1.8)%. NOAA-9 SBUV/2 data can be combined with other instruments to create a 25-year record of solar UV irradiance.
Author
Albedo; Irradiance; Light (Visible Radiation); Solar Backscatter UV Spectrometer; Solar Radiation

20030093647 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Phase Coherent Timing of RX J0806.3+1527 with ROSAT and CHANDRA
Strohmayer, Tod E.; [2003]; 13 pp.; In English; No Copyright; Avail: CASI; A03, Hardcopy

RX 50806.3+1527 is an ultra-compact, double degenerate binary with the shortest known orbital period (321.5 s). Hakala et.al., have recently reported new optical measurements of the orbital frequency of the source which indicate that the frequency has increased over the approx.= 9 years since the earliest ROSAT observations. They find two candidate solutions for the long term change in the frequency; nu approx. = 3 or 6 x 10(exp -16)Hz/s. Here we present the results of a phase coherent timing study of the archival ROSAT and Chandra data for RX 50806.3+1527 in the light of these new constraints. We find that the ROSAT - Chandra timing data are consistent with both of the solutions reported by Hakala et al., but that the higher nu = 6.1 x 10(exp -16)Hz/s solution is favored at the approx. 97% level. This large a nu can be accomodated by an approx. = 1 solar mass detached double degenerate system powered in the X-ray by electrical energy. With such a large nu the system provides a unique opportunity to explore the interaction of gravitational radiation and electromagnetic torques on the evolution of an ultracompact binary.
Author
Frequency Shift; Optical Measurement; Stellar Mass; Time Measurement; X Ray Binaries; White Dwarf Stars; Cataclysmic Variables

20030093727 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Mass Loss from the Nuclei of Active Galaxies
Crenshaw, Michael; Kraemer, Steven B.; George, Ian M.; [2003]; 86 pp.; In English; No Copyright; Avail: CASI; A05, Hardcopy

Blueshifted absorption lines in the UV and X-ray spectra of active galaxies reveal the presence of massive outflows of ionized gas from their nuclei. The intrinsic UV and X-ray absorbers show large global covering factors of the central continuum source, and the inferred mass loss rates are comparable to the mass accretion rates. Many absorbers show variable ionic column densities which are attributed to a combination of variable ionizing flux and motion of gas into and out of the line of sight . Detailed studies of the intrinsic absorbers. with the assistance of monitoring observations and photoionization models. provide constraints on their kinematics] physical conditions. and locations relative to the central continuum source. which range from the inner nucleus (approx.0.01 pc) to the galactic disk or halo (approx.10 kpc) . Dynamical models that make use of thermal winds. radiation pressure. and/or hydromagnetic flows have reached a level of sophistication that permits comparisons with the observational constraints .
Author
Active Galaxies; Ultraviolet Absorption; X Ray Absorption

20030093745 NASA Goddard Space Flight Center, Greenbelt, MD, USA
An Understanding of the Non-thermal Radiation from the Crab Nebula
Stephens, S. A.; 2003; 4 pp.; In English; The 28th International Cosmic Ray Conference, 31 Jul. - 7 Aug. 2003, Tskuba, Japan; Copyright; Avail: Other Sources

The Crab nebula is the most extensively studied supernova remnant, which is powered by its pulsar. The remnant radiation is non-thermal in nature measured over 20 decades in energy from radio to high-energy gamma rays. The propagation of electrons in the remnant has been studied in detail and the electrons in the present epoch could explain the observed radiation over the entire energy domain. It is found that there are two kinds of accelerated spectrum that are required and we discuss some the consequences.
Author
Crab Nebula; Supernova Remnants; Electron Emission; Electron Radiation

20030093824 California Univ., Lawrence Berkeley National Lab., Berkeley, CA, USA
Institute of Geophysics and Planetary Physics 1999-2000 Annual Report
2003; 170 pp.; In English
Report No.(s): DE2003-15003851; UCRL-53809-99/00; No Copyright; Avail: Department of Energy Information Bridge

Contents include the following: Section I. Overview. Section II. Highlights of Fiscal Year 1999-2000. Astrophysics Research Center; Center for Geosciences. Section III: Research Summaries of Selected Projects: Astrophysics - (Partial list) Detection of Occultations; Collective Absorption Properties of Neutrinos in Supernovae; Frist Extragalactic Astronomy with Laser Guide Star Adaptive Optics; Direct Detection of Massive Planetary Companions to Young Stars; and Optical and Infrared Photon-Counting Nanobolometry with Potential On-Chip Refrigeration. Geosciences - (Partial list) Timing of Late Quaternary Slaciation in the Hunza Valley, Karakoram Mountains, Northern Pakistan; High-Resolution Study of Inner-Core Rotation; Cosmogenic Nuclide Systematics in Olivine and Calcite; Collaborative Seismic Investigation of South American Tectosphere; Modeling of Complex Structure in the Earths Core; and Hyperspectral Remote Sensing in an Active Caldera, Long Valley, Califonia. Section IV. IGPP-LLNL Seminars. Section V. Bibliography. Section VI. Fiscal Year 2000-2001 IGPP-LLNL University Collaborative Research Program.
NTIS
Geophysics; Astrophysics; Research Projects

20030095918 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Near-Relativistic Solar Electrons and Type III Radio Bursts
Cane, H. V.; [2003]; 14 pp.; In English; No Copyright; Avail: CASI; A03, Hardcopy

Recently it has been found that the inferred injection times of greater than 25 keV electrons are up to 30 minutes later than the start times of the associated type III radio bursts at the Sun. Thus it has been suggested that the electrons that produce type III bursts do not belong to the same population as those observed above 25 keV. This paper examines the characteristics and circumstances of 79 solar electron beam events measured on the ACE spacecraft. Particular attention is paid to the very low frequency emissions of the associated radio bursts and the ambient conditions at the arrival times of the electrons at the

spacecraft. It is found that the inferred greater than 25 keV electron injection delays are correlated with the times required for the associated radio bursts to drift to the lowest frequencies. This suggests that the electrons responsible for the radio emission and those observed above 25 keV are part of a single population, and that the electrons both above and below 25 keV are delayed in the interplanetary medium. Further evidence for a single population is the general correspondence between electron and local radio intensities and temporal profiles. It is found that the delays increase with the ambient solar wind density consistent with the propagation times of the electrons being determined by the characteristics of the interplanetary medium. However it is known that particle arrival times at 1 AU are a linear function of inverse particle speed. Conventionally such a relationship is taken to indicate scatter-free propagation when inferred path lengths lie close to 1.2 AU, as they do for the electron events studied here. These conflicting interpretations require further investigation.
Author
Solar Electrons; Astrophysics; Relativistic Electron Beams; Type 3 Bursts; Radio Astronomy

20030095919 NASA Goddard Space Flight Center, Greenbelt, MD, USA
The Bursting Behavior of 4U 1728-34: Parameters of a Neutron Star and Geometry of a NS-disk system
Shaposhnikov, Nickolai; Titarchuk, Lev; Haber, Frank; [2003]; 12 pp.; In English
Report No.(s): astro-ph/0307215v1; Copyright; Avail: CASI; A03, Hardcopy

We analyze a set of Type I X-ray bursts from the low mass X-ray binary 4U 1728-34, observed with Rossi X-ray Timing Explorer (RXTE). We infer the dependence of the neutron star (NS) mass and radius with respect to the assumed distance to the system using an analytical model of X-ray burst spectral formation. The model behavior clearly indicates that the burster atmosphere is helium-dominated. Our results strongly favor the soft equation of state (EOS) of NS for 4U 1728-34. We find that distance to the source should be within 4.5-5.0 kpc range. We obtain rather narrow constrains for the NS radius in 8.7-9.7 km range and interval 1.2-1.6 Ma for NS mass for this particular distance range. We uncover a temporal behavior of red-shift corrected burst flux for the radial expansion episodes and we put forth a dynamical evolution scenario for the NS accretion disk geometry during which an expanded envelope affects the accretion disk and increases the area of the neutron star exposed to the Earth observer. In the framework of this scenario we provide a new method for the estimation of the inclination angle which leads to the value of approximately 50 degrees for 4U 1728-34.
Author
Accretion Disks; Mathematical Models; Neutron Stars; Star Formation; X Ray Binaries

20030095924 Charleston Coll., Charleston, SC, USA
Beta Pic-like Circumstellar Gas Disk Around 2 And
Cheng, Patricia; [2003]; 9 pp.; In English
Contract(s)/Grant(s): NAG5-10313; NAG5-32985; NAG5-7584; NAG5-10312; NSF-AST-98-19737; No Copyright; Avail: CASI; A02, Hardcopy

This grant was awarded to support the data analysis and publication of results from our project entitled P Pic-like Circumstellar Gas Disk Around 2 And . We proposed to obtain FUSE observations of 2 And and study the characteristics and origin of its circumstellar gas. We observed 2 Andromedae with FUSE on 3-4 July 2001 in 11 exposures with a total exposure time of 21,289 seconds through the LWRS aperture. Our data were calibrated with Version 1.8.7 of the CALFUSE pipeline processing software. We corrected the wavelength scale for the heliocentric velocity error in this version of the CALFUSE software. The relative accuracy of the calibrated wavelength scale is +/- 9 km/s . We produced a co-added spectrum in the LiF 1B and LiF 2A channels (covering the 1100 to 1180 A region) by cross-correlating the 11 individual exposures and doing an exposure-time weighted average flux. The final co-added spectra have a signal-to-noise ratio in the stellar continuum near 1150 A of about 20. To obtain an absolute wavelength calibration, we cross-correlated our observed spectra with a model spectrum to obtain the best fit for the photospheric C I lines. Because the photospheric lines are very broad, this yields an absolute accuracy for the wavelength scale of approx.+/- 15 km/s. We then rebinned 5 original pixels to yield the optimal sampling of .033 A for each new pixel, because the calibrated spectra oversample the spectral resolution for FUSE+LWRS (R = 20,000 +/- 2,000).
Author
Andromeda Constellation; Spectral Resolution; Data Processing; Stellar Envelopes; Gas Analysis

20030095936 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Possible Class of Nearby Gamma-Ray Burst/Gravitational Wave Sources
Norris, Jay P.; [2003]; 10 pp.; In English; No Copyright; Avail: CASI; A02, Hardcopy

A possible subclass of gamma-ray bursts - those with few, wide pulses, spectral lags of order one to several seconds, and soft spectra - has been identified. Their Log[N]-Log[Fp] distribution approximates a -3/2 power-law, suggesting homogeneity and relatively nearby sources. These mostly dim bursts account for approximately 50% of the BATSE sample of long bursts near that instrument s trigger threshold, suggesting that this subluminous class constitutes a more common variety than the more familiar burst sources which lie at truly cosmological distances. Theoretical scenarios predicted such a class, motivated by their exemplar GRB 980425 (SN 1998bw) lying at a distance of approximately 38 Mpc. The observations are explained by invoking off-axis viewing of the GRB jet and/or bulk Lorentz factors of order a few. Long-lag bursts show a tendency to concentrate near the Supergalactic Plane with a quadrupole moment of -0.10 plus or minus 0.04, similar to that for SNe type Ib/c within the same volume. The rate of the observed subluminous bursts is of order 1/4 that of SNe Ib/c. Evidence for a sequential relationship between SNe Ib/c and GRBs is critiqued for two cases, as simultaneity of the SN and GRB events may be important for detection of the expected gravitational wave signal; at most, SN to GRB delays appear to be a few days. SN asymmetries and ultrarelativistic GRB jets suggest the possibility of rapid rotation in the pre-collapse objects, a primary condition required for highly nonaxisymmetric SN collapse to produce strong gravitational waves.
Author
Gamma Ray Bursts; Gravitational Waves; Supernovae; Cosmology

20030095963 NASA Goddard Space Flight Center, Greenbelt, MD, USA
X-ray Bursts from the Accreting Millisecond Pulsar XTEJ1814-338
Strohmayer, Tod E.; Markwardt, Craig B.; Swank, Jean H.; in'tZand, Jean; [2003]; 14 pp.; In English; Copyright; Avail: Other Sources

In the first few weeks after the discovery of the millisecond pulsar XTE J1814- 338 more than a dozen thermonuclear bursts have been observed from the source with the Proportional Counter Array (PCA) onboard the Rossi X-ray Timing Explorer (RXTE). Spectroscopy of the bursts, as well as the presence of burst oscillations during the burst peaks, suggests all the bursts are sub-Eddington. Four bursts have peak bolometric fluxes between 1.3 and 1.5 x 10(exp -8) erg/s sq cm, translating into an upper limit on the distance of approx. = 11 kpc. All the bursts show coherent oscillations (burst oscillations) at the 314.4 Hz spin frequency. The burst oscillations are strongly frequency and phase locked to the persistent pulsations. There is little or no frequency drift during most of the bursts. One burst, however, shows evidence for modest frequency drift in the first few seconds following burst onset. The large amplitude of oscillations during the bursts confirms that the burst flux is modulated at the spin frequency. Interestingly, the burst oscillations have significant harmonic content. This represents the first detection of harmonics in burst oscillations. The harmonic content, expressed as the ratio of countrate in the first harmonic to that in the fundamental, can be larger than 0.25 and is, on average, less than the harmonic content of the persistent pulsations. If the pulsations result from a single bright region on the surface, the large harmonic content suggests that the burst emission is beamed, perhaps due to a magnetic field strength higher than in non-pulsing LMXBs. Alternatively, the observed harmonic content could result from a geometry with two bright regions.
Author
Pulsars; Spectroscopy; Bursts; Phase Locked Systems

20030098040 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Calculating Gravitational Wave Signature from Binary Black Hole Mergers
Centrella, Joan M.; July 4, 2003; 12 pp.; In English; No Copyright; Avail: CASI; A03, Hardcopy

Calculations of the final merger stage of binary black hole evolution can only be carried out using full scale numerical relativity simulations. We review the status of these calculations, highlighting recent progress and current challenges.
Author
Black Holes (Astronomy); Gravitational Waves; Binary Stars; Mathematical Models

20030102151 NASA Goddard Space Flight Center, Greenbelt, MD, USA
The Ionized Gas and Nuclear Environment in NGC 3783, IV, Variability and Modeling of the 900 ks CHANDRA Spectrum
Netzer, Hagai; Kaspi, Shai; Behar, Ehud; Brandt, W. N.; Chelouche, Doron; George, Ian M.; Crenshaw, D. Michael; Gabel, Jack R.; Hamann, Frederick W.; George, Steven B., et al.; [2003]; 40 pp.; In English; Copyright; Avail: CASI; A03, Hardcopy

We present a detailed analysis of the 900 ks spectrum of NGC3783 obtained by Chandra in 2000-2001 (Kaspi et al. 2002). We split the data in various ways to look for time dependent and luminosity dependent spectral variations. This analysis, the measured equivalent widths of a large number of X-ray lines, and our photoionization calculations, lead us to the following

conclusions: 1) NGC 3783 fluctuated in luminosity, by a factor N 1.5, during individual 170 ks observations. The fluctuations were not associated with significant spectral variations. 2) On a longer time scale, of 20-120 days, we discovered two very different spectral shapes that are noted the high state and the low state spectra. The observed changes between the two can be described as the appearance and disappearance of a soft continuum component. The spectral variations are not related, in a simple way, to the brightening or the fading of the short wavelength continuum, as observed in other objects. NGC3783 seems to be the first AGN to show this unusual behavior. 3) The appearance of the soft continuum component is consistent with beeing the only spectral variation and there is no need to invoke changes in the absorber s opacity. In particular, all absorption lines with reliable measurements show the same equivalent width, within the observational uncertainties, during high and low states. 4) Photoionization model calculations show that a combination of three ionization components, each split into two kinematic components, explain very well the intensity of almost all absorption lines and the bound-free absorption. The components span a large range of ionization and a total column of about 3 x 10(exp 22) per square centimeter Moreover, all components are thermally stable and are situated on the vertical branch of the stability curve.. This means that they are in pressure equilibrium and perhaps occupy the same volume of space. This is the first detection of such a multi-component equilibrium gas in AGN. 5) The only real discrepancy between the model and the observations is the wavelength of the iron M-shell UTA feature. This is most likely due to an underestimation of the dielectronic recombination O VI and discuss its possible origin. 6) The lower limit on the distance of the absorbing gas in NGC3783 is between 0.2 and 3.2 pc, depending of the specific ionization component. The constant pressure assumption imposes an upper limit of about 25 pc on the distance of the least ionized gas from the central sourec.
Author
Ionized Gases; X Ray Spectra; Active Galactic Nuclei; Astrophysics; Mathematical Models; X Ray Astrophysics Facility

20030102161 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Fe XXV and Fe XXVI Diagnostics of the Black Hole and Accretion Disk in Active Galaxies: Chandra Time-Resolved Spectroscopy of NGC 7314
Yaqoob, Tahir; George, Ian M.; Kallman, Timothy R.; Padmanabhan, Urmila; Weaver, Kimberly A.; Turner, T. Jane; [2003]; 30 pp.; In English
Contract(s)/Grant(s): NAS8-39073; NCC5-447; GO2-3133X; NAG5-10769; NAG5-7385; Copyright; Avail: CASI; A03, Hardcopy

We report the detection of Fe xxv and Fe XXVI Ka emission lines from a Chandra High Energy Grating Spectrometer (HETGS) observation of the narrow-line Seyfert 1 galaxy NGC 7314, made simultaneously with RXTE. The lines are redshifted (cz approximately 1500 kilometers per second) relative to the systemic velocity and unresolved by the gratings. We argue that the lines originate in a near face-on (less than 7 deg) disk having a radial line emissivity flatter than r(exp -2). Line emission from ionization states of Fe in the range approximately Fe I a up to Fe XXVI is observed. The ionization balance of Fe responds to continuum variations on timescales less than 12.5 ks, supporting an origin of the lines close to the X-ray source. We present additional, detailed diagnostics from this rich data set. These results identify NGC 7314 as a key source to study in the future if we are to pursue reverberation mapping of space-time near black-hole event horizons. This is because it is first necessary to understand the ionization structure of accretion disks and the relation between the X-ray continuum and Fe Ka line emission. However, we also describe how our results are suggestive of a means of measuring black-hole spin without a knowledge of the relation between the continuum and line emission. Finally, these data emphasize that one can study strong gravity with narrow (as opposed to very broad) disk lines. In fact narrow lines offer higher precision, given sufficient energy resolution.
Author
Accretion Disks; Black Holes (Astronomy); X Ray Timing Explorer; Active Galactic Nuclei; Astrophysics; Spectroscopy

20030102162 NASA Goddard Space Flight Center, Greenbelt, MD, USA
A Massive X-ray Outflow From The Quasar PDS 456
Reeves, J. N.; O'Brien, P. T.; Ward, M. J.; [2003]; 12 pp.; In English; Copyright; Avail: CASI; A03, Hardcopy

We report on XMM-Newton spectroscopic observations of the luminous, radio-quiet quasar PDS 456. The hard X-ray spectrum of PDS 456 shows a deep absorption trough (constituting 50% of the continuum) at energies above 7 keV in the quasar rest frame, which can be attributed to a series of blue-shifted K-shell absorption edges due to highly ionized iron. The higher resolution soft X-ray grating RGS spectrum exhibits a broad absorption line feature near 1 keV, which can be modeled by a blend of L-shell transitions from highly ionized iron (Fe XVII - XXIV). An extreme outflow velocity of approx. 50000 km/s is required to model the K and L shell iron absorption present in the XMM-Newton data. Overall, a large column density (N(sub H) = 5 x 10(exp 23)/sq cm) of highly ionized gas (log xi = 2.5) is required in PDS 456. A large mass outflow rate of

approx. 10 solar mass/year (assuming a conservative outflow covering factor of 0.1 steradian) is derived, which is of the same order as the overall mass accretion rate in PDS 456. This represents a substantial fraction (approx. 10%) of the quasar energy budget, whilst the large column and outflow velocity place PDS 456 towards the extreme end of the broad absorption line quasar population.
Author
X Rays; Quasars; Ionized Gases; Line Spectra

20030102163 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Iron K Lines from Gamma Ray Bursts
Kallman, T. R.; Meszaros, P.; Rees, M. J.; [2003]; 37 pp.; In English
Contract(s)/Grant(s): NAG5-9192; Copyright; Avail: CASI; A03, Hardcopy

We present models for reprocessing of an intense flux of X-rays and gamma rays expected in the vicinity of gamma ray burst sources. We consider the transfer and reprocessing of the energetic photons into observable features in the X-ray band, notably the K lines of iron. Our models are based on the assumption that the gas is sufficiently dense to allow the microphysical processes to be in a steady state, thus allowing efficient line emission with modest reprocessing mass and elemental abundances ranging from solar to moderately enriched. We show that the reprocessing is enhanced by down-Comptonization of photons whose energy would otherwise be too high to absorb on iron, and that pair production can have an effect on enhancing the line production. Both 'distant' reprocessors such as supernova or wind remnants and 'nearby' reprocessors such as outer stellar envelopes can reproduce the observed line fluxes with Fe abundances 30-100 times above solar, depending on the incidence angle. The high incidence angles required arise naturally only in nearby models, which for plausible values can reach Fe line to continuum ratios close to the reported values.
Author
Iron; K Lines; Gamma Ray Bursts; Mathematical Models; Energetic Particles

20030102171 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Two-Pole Caustic Model for High-Energy Lightcurves of Pulsars
Dyks, J.; Rudak, B.; [2003]; 18 pp.; In English
Contract(s)/Grant(s): PBZ-KBN-054/P03/2001; Copyright; Avail: CASI; A03, Hardcopy

We present a new model of high-energy lightcurves from rotation powered pulsars. The key ingredient of the model is the gap region (i.e. the region where particle acceleration is taking place and high-energy photons originate) which satisfies the following assumptions: i) the gap region extends from each polar cap to the light cylinder; ii) the gap is thin and confined to the surface of last open magnetic-field lines; iii) photon emissivity is uniform within the gap region. The model lightcurves are dominated by strong peaks (either double or single) of caustic origin. Unlike in other pulsar models with caustic effects, the double peaks arise due to crossing two caustics, each of which is associated with a different magnetic pole. The generic features of the lightcurves are consistent with the observed characteristics of pulsar lightcurves: 1) the most natural (in terms of probability) shape consists of two peaks (separated by 0.4 to 0.5 in phase for large viewing angles); 2) the peaks possess well developed wings; 3) there is a bridge (inter-peak) emission component; 4) there is a non-vanishing off-pulse emission level; 5) the radio pulse occurs before the leading high-energy peak. The model is well suited for four gamma-ray pulsars - Crab, Vela, Geminga and B1951+32 - with double-peak lightcurves exhibiting the peak separation of 0.4 to 0.5 in phase. Hereby, we apply the model to the Vela pulsar. Moreover, we indicate the limitation of the model in accurate reproducing of the lightcurves with single pulses and narrowly separated (about 0.2 in phase) pulse peaks. We also discuss the optical polarization properties for the Crab pulsar in the context of the two-pole caustic model.
Author
Pulsars; Light Curve; Stellar Models; Stellar Rotation; High Energy Electrons; Particle Acceleration

20030105574 Utah Univ., Salt Lake City, UT, USA
Accretion Onto Supermassive Black Holes: Observational Signals from 3-Dimensional Disk Models
Bromley, Benjamin C.; Miller, Warner A.; [2003]; 2 pp.; In English
Contract(s)/Grant(s): NAGS-8277; No Copyright; Avail: CASI; A01, Hardcopy

Our project was to model accretion flows onto supermassive black holes which reside in the centers of many galaxies. In this report we summarize the results which we obtained with the support of our NASA ATP grant. The scientific results

associated with the grant are given in approximately chronological order. We also provide a list of references which acknowledge funding from this grant.
Derived from text
Black Holes (Astronomy); Astrophysics; NASA Programs; Accretion Disks; Three Dimensional Models

20030105579 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Single Event Effects: Space and Atmospheric Environments
Barth, Janet L.; [2003]; 18 pp.; In English; JPL Single Event Upset in Future Computing Systems Workshop, 20 May 2003, Pasadena, CA, USA; No Copyright; Avail: CASI; A03, Hardcopy

The paper discusses the following: 1. Sun-Earth connections. 2. Heavy ions: galactic cosmic rays; solar particle events. 3. Protons: solar particle events; trapped. 4. Atmospheric neutrons. 5. Summary.
CASI
Atmospheric Composition; Single Event Upsets; Neutrons

20030105634 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Model-Data Assimilation of Internal Waves during ASIAEX-2001
Liu, Antony; Zhao, Yun-He; Tang, T. Y.; Ramp, Steven R.; [2003]; 36 pp.; In English; Copyright; Avail: CASI; A03, Hardcopy

In recent Asian Seas International Acoustics Experiment (ASIAEX), extensive moorings have been deployed around the continental shelf break area in the northeast of South China Sea in May 2001. Simultaneous RADARSAT SAR images have been collected during the field test to integrate with the in-situ measurements from moorings, ship-board sensors, and CTD casts. Besides it provides synoptic information, satellite imagery is very useful for tracking the internal waves, and locating surface fronts and mesoscale features. During ASIAEX in May 2001, many large internal waves were observed at the test area and were the major oceanic features for acoustic volume interaction. Based on the internal wave distribution maps compiled from satellite data, the wave crest can be as long as 200 km with amplitude of 100 m. Environmental parameters have been calculated based on extensive CTD casts data near the ASIAEX area. Nonlinear internal wave models have been applied to integrate and assimilate both SAR and mooring data. Using SAR data in deep water as an initial condition, numerical simulations produce the wave evolution on the continental shelf and compared reasonably well with the mooring measurements at the downstream station. The shoaling, turning, and dissipation of large internal waves on the shelf break, elevation solitons, and wave-wave interaction have been studied and are very important issues for acoustic propagation. The internal wave effects on acoustic modal coupling has been implicated and discussed.
Author
Acoustic Propagation; In Situ Measurement; Internal Waves; Mathematical Models

20030105655 NASA Goddard Space Flight Center, Greenbelt, MD, USA
XMM Observations of an IXO in NGC 2276
Davis, David S.; Mushotzky, Richard F.; [2003]; 22 pp.; In English; No Copyright; Avail: CASI; A03, Hardcopy

We present the results from a approx. 53 ksec XMM observation of NGC 2276. This galaxy has an unusual optical morphology with the disk of this spiral appearing to be truncated along the western edge. This XMM observation shows that the X-ray source at the western edge is a bright Intermediate X-ray Object (IXO). Its spectrum is well fit by a multi-color disk blackbody model used to fit optically thick standard accretion disks around black holes. The luminosity derived for this IXO is 1.1 x 10(exp 41) erg/s in the 0.5 - 10 keV band making it one of the most luminous discovered to date. The large source luminosity implies a large mass black hole if the source is radiating at the Eddington rate. On the other hand, the inner disk temperature determined here is too high for such a massive object given the standard accretion disk model. In addition to the IXO we find that the nuclear source in this galaxy has dimmed by at least a factor of several thousand in the eight years since the ROSAT HRI observations.
Author
Galaxies; Luminosity; X Rays; Spectra; Data Acquisition

20030105660 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Chandra Observations of Point Sources in Abell 2255
Davis, David S.; Miller, Neal A.; Mushotzky, Richard F.; [2003]; 22 pp.; In English; No Copyright; Avail: CASI; A03, Hardcopy

In our search for 'hidden' AGN we present results from a Chandra observation of the nearby cluster Abell 2255. Eight

cluster galaxies are associated with point-like X-ray emission, and we classify these galaxies based on their X-ray, radio, and optical properties. At least three are associated with active galactic nuclei (AGN) with no optical signatures of nuclear activity, with a further two being potential AGN. Of the potential AGN, one corresponds to a galaxy with a post-starburst optical spectrum. The remaining three X-ray detected cluster galaxies consist of two starbursts and an elliptical with luminous hot gas. Of the eight cluster galaxies five are associated with luminous (massive) galaxies and the remaining three lie in much lower luminosity systems. We note that the use of X-ray to optical flux ratios for classification of X-ray sources is often misleading, and strengthen the claim that the fraction of cluster galaxies hosting an AGN based on optical data is significantly lower than the fraction based on X-ray and radio data.
Author
Galactic Clusters; Active Galactic Nuclei; Optical Activity; X Ray Optics; Starburst Galaxies

20030105834 Montana State Univ., Bozeman, MT
Initiation of Coronal Mass Ejections
Canfield, Richard C.; Jun. 19, 2003; 6 pp.; In English
Contract(s)/Grant(s): F49620-00-1-0128; Proj-2311
Report No.(s): AD-A416566; Rept-428483/Z0920; AFRL-SR-AR-TR-03-0295; No Copyright; Avail: CASI; A02, Hardcopy

The over-arching objective of this research was to improve the quantitative basis for prediction of the occurrence of Coronal Mass Ejections (CMEs) and their impact on space weather. The most directly useful discovery, from the point of view of Space Weather forecasting, is that a CME associated with an erupting X-ray sigmoid is more likely to have flux rope ('magnetic cloud') structure at 1 AU than an arbitrarily-selected CME. On impacting the magnetosphere, the sigmoid-associated flux ropes in our database all produced at least 'moderate' (Dst greater than 50 nT) geomagnetic storms, and several produced major storms. Hence, not only are sigmoidal active regions more likely to erupt, as we showed in earlier work, they are more likely to cause significant storms when they do. Also discovered was a signature of impending eruption in H-alpha imaging spectra of active regions, which could be used to predict the occurrence of eruptions a few hours in advance, whereas the sigmoid signature is more useful on time scales of days. These discoveries have been documented in 11 publications and 26 presentations.
DTIC
Coronal Mass Ejection; Weather Forecasting; X Rays

91
LUNAR AND PLANETARY SCIENCE AND EXPLORATION

Includes planetology; selenology; meteorites; comets; and manned and unmanned planetary and lunar flights. For spacecraft design or space stations see *18 Spacecraft Design, Testing and Performance*.

20030093539 Arizona State Univ., Tempe, AZ, USA
Geologic Mapping of the Chaac-Camaxtli Region of Io from Galileo Imaging Data
Williams, David A.; Radebaugh, Jani; Keszthelyi, Laszlo P.; McEwen, Alfred S.; Lopes, Rosaly M. C.; Doute, Sylvain; Greekely, Ronald; Journal of Geophysical Research; [2003]; Volume 107, No. E9, pp. 5068; In English
Contract(s)/Grant(s): NAG5-11787; Copyright; Avail: Other Sources; Abstract Only

We produced a geologic/geomorphologic map of the Chaac-Camaxtli region of Io's leading anti-Jovian hemisphere using regional resolution (186 m/pixel) Galileo imaging data collected during orbit I27 (February 2000) integrated with lower resolution (1.4 km/pixel) color data, along with other Galileo imaging and spectral data. This is the first regional map of Io made from Galileo data. Nine color and geomorphologic units have been mapped, and the close proximity of dark and various colored bright materials suggests that there is an intimate interaction between (presumably) silicate magmas and sulfur-bearing volatile materials that produced a variety of explosive and effusive deposits in the recent geologic past. This region of Io is dominated by 11 volcanic centers, most of which are paterae that are analogous in morphology to terrestrial calderas but larger in size. Mapping of structural features indicates that most of the active regions occur in topographic lows, and less active or inactive paterae are associated with topographic highs. This indicates that crustal thickness variations influence magma access to the surface. Surface changes in this region since the Voyager flybys are relatively minor (additional bright and dark flows, color changes), although several active vents have migrated within paterae. This observation, along with the identification of the relatively regular spacing of paterae (approx. 100 - 150 km) along a line, may indicate there are multiple interlacing fractures in the crust that serve as magma conduits from the interior. This connection between volcanism and tectonism may have implications for tidal heating mechanisms and their effect on Io's lithosphere. Some inactive patera floors may be

evolving into bright plains material, which, if composed of silicates, might explain the strength of Io's crust to support steep patera walls and tall mountains.
Author
Geological Surveys; Mapping; Io; Geomorphology; Fractures (Materials); Emission Spectra

20030093577 Middle Tennessee State Univ., Murfreesboro, TN, USA
The Potential of Microwave Radiation for Processing Martian Soil
Boles, Walter; The 2002 NASA Faculty Fellowship Program Research Reports; April 2003, pp. VIII-1 - VIII-5; In English; See also 20030093576; Original contains black and white illustrations
Contract(s)/Grant(s): NAG8-1859; No Copyright; Avail: CASI; C01, CD-ROM; A01, Hardcopy

For extended or permanent stay operations on Mars, in situ resource utilization is necessary due to the high cost of space transportation. Using the soil and atmosphere of Mars for the extraction of important materials is essential. This work investigates the potential use of microwave radiation on a Martian soil analog to aid in beneficiation. The work is both exploratory and experimental. Results of experiments are presented and discussed.
Author
Mars Surface; Microwaves; Soils

20030093623 Alabama Univ., Huntsville, AL, USA
Potential of Sintered Regolith Materials for Derivation of In-Situ Resource Utilization
Schwarz, Lois G.; The 2002 NASA Faculty Fellowship Program Research Reports; April 2003, pp. 1-5; In English; See also 20030093576; No Copyright; Avail: CASI; C01, CD-ROM; A01, Hardcopy

Practical interplanetary exploration leading to sustained human habitation on Mars will need to rely on in-situ resource utilization (ISRU). Material processing and fabrication using indigenous resources to produce metal alloys and ceramics would be economically beneficial rather than transporting necessary materials from Earth. ISRU is constrained, however, by resource availability, mining, and processing methods. Desirable materials will be dependent on manufacturing and construction processes, as well as, performance in uniquely hostile environments. A specifically developed Martian soil simulant, JSC Mars-1, that is spectrally similar to the ubiquitous Martian regolith, is used in research since only a limited amount of Martian soil has been retrieved from the planet. Sintering involves shrinkage of a body as particles pull closer together and porosity decreases. Dominant in the sintering process is atomic motion, governed by diffusion mechanics, occurring at a rate that increases as temperature increases as described by the Arrhenius equation. Distinct stages of densification are defined by solid state atomic diffusion, the formation of a liquid (oftentimes glassy) phase between the particles, and by reactions at the grain boundaries. The transport of thermal energy by sintering can be categorized into the mechanisms of conduction, convection, and radiation; the latter is usually dominant from the furnace heating elements. The most influential parameter in sintering is temperature, other variables include time held at peak temperature or soak period, rates of heating and cooling, atmosphere type, particle surface area, compaction or density, and additives to increase particle bonding, softening, and flexibility. The objectives of are to investigate the potential of using a sintering process method on JSC Mars-1 to (a) isolate raw metals and/or compounds and (b) develop a material suitable for structural products that may manifest enhanced engineering properties. These materials could be used for construction purposes of storage facilities, habitat facilities, launch platforms, shielding, etc.
Derived from text
In Situ Resource Utilization; Regolith; Sintering; Soil Science; Manufacturing; Planetary Geology

20030093626 Alabama Univ., Huntsville, AL, USA
Probable Disastrous Consequences of Collision Between Unknown Small (100 m) Asteroids with Known (Approximately 1 km) Near Earth Orbiting (NEO) Asteroids
Smalley, Larry; The 2002 NASA Faculty Fellowship Program Research Reports; April 2003, pp. XLVI-1 - XLVI-5; In English; See also 20030093576
Contract(s)/Grant(s): NAG8-1859; No Copyright; Avail: CASI; C01, CD-ROM; A01, Hardcopy

The long-term stability of the Solar System is not well understood. Ironically its stability is taken for granted even though our knowledge of all the constituents [comets, asteroids. (The Asteroid Belt between Mars and Jupiter, Trojan Asteroids, Kuiper belt, Ort Cloud), planetoids, planets, moons, etc], and its long-term dynamics cannot be easily computed. At best one might say that the solar system is chaotic, but much of the time it seems to exists near a quasi-stationary state. An asteroid that passes near the Earth regularly returns with clock-like precision. Taking into account every known detail of its path

through the solar system, its orbit is calculated forward thousands of years with no untoward calamity on the horizon. And then one day, this passive visitor slams into the Earth during a sunny afternoon picnic! Can this happen? Unfortunately, this is a real possibility in the ordinary history of the solar system. In fact our knowledge of the solar system in the small is sketchy, as will be pointed out. Events, which lie outside our awareness, can precipitate disasters that we may perceive when it's too late to launch effective counter measures. In this work, one such scenario is described and the direct consequences for the Earth are calculated.
Derived from text
Near Earth Objects; Asteroid Collisions; Solar System; Mars (Planet); Jupiter (Planet)

20030105575 Massachusetts Inst. of Tech., Cambridge, MA, USA
Origin of Lunar Ultramafic Green Glasses: Constraints from Phase Equilibrium Studies
Boyce, Joseph, Technical Monitor; Elkins, L. T.; Fernandes, V. A.; Delano, J. W.; Grove, T. L.; Geochimica et Cosmochimica Acta; 2000; ISSN 0016-7037; Volume 64, No. 13, pp. 2339-2350; In English
Contract(s)/Grant(s): NAG5-4768; NAG5-9525; Copyright; Avail: Other Sources

Phase equilibria experiments on an Apollo 14B green glass composition are used to develop a petrogenetic model for the Apollo 14B green glasses. New compositional data for the Apollo 14B green glasses are presented, which replace the original data set of Delano (1986). Near-liquidus phase relations of the 14B green glass are determined from 1.3 to 2.7 GPa and 1380 to 1570 C. The liquidus is saturated with olivine to 2.4 GPa and orthopyroxene above 2.4 GPa. A multiple saturation point with olivine and orthopyroxene occurs at 1560 C and 2.4 GPa. Crystallization of the ol + opx saturation boundary involves 40 wt% ol and 60 wt% opx, and occurs over a 140 C interval before cpx appears at a reaction boundary. Crystallization/melting models are developed to reproduce the compositional variations displayed by the Apollo 14B glasses using these phase equilibrium constraints. Fractional crystallization alone cannot account for the observed variation in the major element abundance of the Apollo 14B green glasses. Assimilation is also necessary, in particular, to fit variations in TiO2, FeO, Na2O and Al2O3. The 14B glasses show evidence of simultaneous high-Ti assimilation and fractional crystallization of olivine, followed by simultaneous KREEP assimilation and olivine fractionation. The data requires the high-Ti assimilant to be at a greater depth than the KREEP assimilant, but only constrains the total assimilation/fractional crystallization process to occur between approximately 2.3 and 0.5 GPa. Assimilation of a high-Ti cumulate within this depth range is consistent with an overturn/hybrid mantle remelting model. Highlands crust assimilation is precluded for the Apollo 14B green glasses.
Author
Glass; Phase Transformations; Crystallization

20030105594 Lunar and Planetary Inst., Houston, TX, USA
Lunar and Planetary Information Bulletin, No. 95
Schenk, Paul M., Editor; Fall 2003; 15 pp.; In English; No Copyright; Avail: CASI; A03, Hardcopy

The articles in this issue cover the end of the Galileo mission to Jupiter, educational outreach programs, and news on planetary science, including discoveries and updates on Mars missions. This issue also features brief book reviews, and a calender listing conferences for 2003.
CASI
Galileo Project; NASA Programs; Education

20030105595 NASA Goddard Space Flight Center, Greenbelt, MD, USA
The Space Environment from LEO to Deep Space
Barth, Janet L.; [2003]; 24 pp.; In English; 9th International Symposium on Materials in a Space Environment, 16-20 Jun. 2003, Noordwijk, Netherlands; No Copyright; Avail: CASI; A03, Hardcopy

This viewgraph presentation reviews several space environments, and the hazards they pose to spacecraft operations. The presentation covers solar activity effects, galactic cosmic rays, near Earth environments including the magnetosphere, thermosphere, ionsophere, and plasmasphere, single event upsets, micrometeoroids, space debris, and an overview of conditions on other planets, especially Jupiter.
CASI
Aerospace Environments; Hazards; Space Missions

20030105637 Massachusetts Inst. of Tech., Cambridge, MA, USA

Origin of Lunar High-Titanium Ultramafic Glasses: Constraints from Phase Relations and Dissolution Kinetics of Clinopyroxene-Ilmenite Cumulates

Boyce, Joseph, Technical Monitor; VanOrman, James A.; Grove, Timothy L.; Meteoritics and Planetary Science; 2000; Volume 35, pp. 783-794; In English

Contract(s)/Grant(s): NAG5-9525; NAG5-4768; Copyright; Avail: Other Sources

Phase equilibrium and dissolution kinetics experiments on synthetic late-stage magma ocean cumulates are used to place constraints on hypotheses for the origin of lunar high-Ti ultramafic glasses. Models for the production of high-Ti lunar magmas have called for either (1) assimilation of late-stage clinopyroxene-ilmenite cumulates at shallow levels or (2) sinking of clinopyroxene-ilmenite cumulates to form a hybrid mantle source. To satisfy the constraints of our experiments, we propose an alternative model that involves shallow-level reaction and mixing of cumulates, followed by sinking of hybrid high-Ti materials. This model can hlfill compositional requirements imposed by the pristine lunar glass suite that are difficult to satisfy in assimilation models. It also avoids difficulties that arise in overturn models from the low solidus temperatures of clinopyroxene-ilmenite cumulates. Partially molten clinopyroxene-ilmenite cumulates become gravitationally unstable with respect to underlying mafic cumulates only when they have cooled to within -30 ’C of their solidus (-1 125 ‘C at 100 km depth). At these temperatures, the viscosity of mafic cumulates is too high to allow for growth and descent of clinopyroxene-ilmenite diapirs on the appropriate time scale. Reaction and mixing between late-stage liquids and mafic cumulates at shallow levels would produce a refractory hybrid material that is negatively buoyant at higher temperatures and could sink more efficiently to the depths inferred for production of high-Ti ultramafic glasses.

Author

Glass; Phase Transformations; Mineralogy; Assimilation

20030105748 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

Autonomy Needs and Trends in Deep Space Exploration

Doyle, Richard J.; Intelligent Systems for Aeronautics; June 2003, pp. 4-1 - 4-12; In English; See also 20030105742; Original contains color illustrations; Copyright; Avail: CASI; C01, CD-ROM; A03, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The development of onboard autonomy capability is the key to a set of vastly important strategic technical challenges facing NASA: increased efficiency in the return of quality science products, reduction of mission costs, and the launching of a new era of solar system exploration characterized by sustained presence, in-situ science investigations and missions accomplished via multiple, coordinated space platforms. Autonomy is a central capability for enabling missions that inherently must be accomplished without the benefit of ongoing ground support. This constraint may arise due to control challenges, e.g., small-body rendezvous and precision landing, or may arise due to mission planning challenges based in the difficulty of modeling the planetary environment coupled with the difficulty or impossibility of communications during critical or extended periods. A sophisticated Mars rover, a comet lander, a Europan under-ice explorer, and a Titan aerobot are examples of missions, some unprecedented, which typify these challenges. This paper describes the set of NASA missions that aim to utilize autonomy and recent developments in the creation of space platform autonomy capabilities at NASA.

Author

Autonomy; Solar System; Space Exploration; Onboard Equipment; Deep Space; NASA Space Programs

92
SOLAR PHYSICS

Includes solar activity, solar flares, solar radiation and sunspots. For related information see *93 Space Radiation*.

20030093496 Science Applications International Corp., San Diego, CA, USA

Modeling the Magnetic and Thermal Structure of Active Regions: 1st Year 1st Semi-Annual Progress Report

Mikic, Zoran; October 07, 2003; 38 pp.; In English

Contract(s)/Grant(s): NAS5-03008; NASW-03008

Report No.(s): SAIC-03/8013:APPAT-322; Rept-01-0157-04-6811-000; No Copyright; Avail: CASI; A03, Hardcopy

This report covers technical progress during the first six months of the first year of NASA SR&T contract ’Modeling the Magnetic and Thermal Structure of Active Regions‘, NASW-03008, between NASA and Science Applications International Corporation, and covers the period January 14, 2003 to July 13, 2003. Under this contract SAIC has conducted research into

theoretical modeling of the properties of active regions using the MHD model.
Derived from text
Magnetohydrodynamics; Solar Corona; Solar Magnetic Field; Magnetic Field Configurations; Coronal Mass Ejection

20030093541 NASA Goddard Space Flight Center, Greenbelt, MD, USA, Air Force Research Lab., Hanscom AFB, MA, USA
CMEs, the Tail of the Solar Wind Magnetic Field Distribution, and 11-yr Cosmic Ray Modulation at 1 AU
Cliver, E. W.; Ling, A. G.; Richardson, I. G.; [2003]; 24 pp.; In English
Contract(s)/Grant(s): F19628-00-C-0089; No Copyright; Avail: CASI; A03, Hardcopy

Using a recent classification of the solar wind at 1 AU into its principal components (slow solar wind, high-speed streams, and coronal mass ejections (CMEs) for 1972-2000, we show that the monthly-averaged galactic cosmic ray intensity is anti-correlated with the percentage of time that the Earth is imbedded in CME flows. We suggest that this correlation results primarily from a CME related change in the tail of the distribution function of hourly-averaged values of the solar wind magnetic field (B) between solar minimum and solar maximum. The number of high-B (square proper subset 10 nT) values increases by a factor of approx. 3 from minimum to maximum (from 5% of all hours to 17%), with about two-thirds of this increase due to CMEs. On an hour-to-hour basis, average changes of cosmic ray intensity at Earth become negative for solar wind magnetic field values square proper subset 10 nT.
Author
Coronal Mass Ejection; Galactic Cosmic Rays; Solar Activity Effects; Solar Wind; Solar Cycles

20030093744 Boeing Co., Huntington Beach, CA, USA
Probabilistic Model for Low Altitude Trapped Proton Fluxes
Xapsos, M. A.; Huston, S. L.; Barth, J. L.; Stassiinopoulos, E. G.; [2003]; 8 pp.; In English; Copyright; Avail: CASI; A02, Hardcopy

A new approach is developed for the assessment of low altitude trapped proton fluxes for future space missions. Low altitude fluxes are dependent on solar activity levels due to the resulting heating and cooling of the upper atmosphere. However, solar activity levels cannot be accurately predicted far enough into the future to accommodate typical spacecraft mission planning. Thus, the approach suggested here is to evaluate the trapped proton flux as a function of confidence level for a given mission time period. This is possible because of a recent advance in trapped proton modeling that uses the solar 10.7 cm radio flux, a measure of solar cycle activity, to calculate trapped proton fluxes as a continuous function of time throughout the solar cycle. This trapped proton model is combined with a new statistical description of the 10.7 cm flux to obtain the probabilistic model for low altitude trapped proton fluxes. Results for proton energies ranging from 1.5 to 81.3 MeV are examined as a function of time throughout solar cycle 22 for various orbits. For altitudes below 1000 km, fluxes are significantly higher and energy spectra are significantly harder than those predicted by the AP8 model.
Author
Low Altitude; Proton Energy; Mathematical Models; Space Missions; Probability Theory

20030105567 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Low-Latitude Solar Wind During the Fall 1998 SOHO-Ulysses Quadrature
Poletto, G.; Suess, S. T.; Biesecker, D. A.; Esser, R.; Gloeckler, G.; Ko, Y.-K.; Zurbuchen, T. H.; Journal of Geophysical Research; October 16, 2002; ISSN 0148-0227; Volume 107, No. A10, pp. 9-1 - 9-16; In English
Report No.(s): Paper-2001JA000275; Copyright; Avail: Other Sources

Solar and Heliospheric Observatory (SOH0)-Ulysses quadratures occur when the SOHO-Sun-Ulysses-included angle is 90 deg. These offer the opportunity to directly compare properties of plasma parcels, observed by SOHO [Dorningo et al.] in the low corona, with properties of the same parcels measured, in due time, in situ, by Ulysses [Wenzel et al]. We refer the reader to Suess et al. for an extended discussion of SOHO-Ulysses quadrature geometry. Here it suffices to recall that there are two quadratures per year, as SOHO makes its one-year revolution around the Sun. This, because SOHO is at the L1 Lagrangian point, in essentially the same place as the Earth, while Ulysses is in a near-polar -5-year solar orbit with a perihelion of 1.34 AU and aphelion of 5.4 AU.
Derived from text
Solar Wind; Soho Mission; Ulysses Mission

93
SPACE RADIATION

Includes cosmic radiation; and inner and outer Earth radiation belts. For biological effects of radiation on plants and animals see *51 Life Sciences*; on human beings see 52 Aerospace Medicine. For theory see *73 Nuclear Physics*.

20030105568 ROR Enterprises, Athol, ID, USA
Electrostatic Return of Contaminants
Rantanen, R.; Gordon, T.; August 2003; 64 pp.; In English
Contract(s)/Grant(s): NASA Order H-3246-D
Report No.(s): NASA/CR-2003-212637; NAS 1.26:212637; M-1084; No Copyright; Avail: CASI; A04, Hardcopy

A Model has been developed capable of calculating the electrostatic return of spacecraft-emitted molecules that are ionized and attracted back to the spacecraft by the spacecraft electric potential on its surfaces. The return of ionized contaminant molecules to charged spacecraft surfaces is very important to all altitudes. It is especially important at geosynchronous and interplanetary environments, since it may be the only mechanism by which contaminants can degrade a surface. This model is applicable to all altitudes and spacecraft geometries. In addition to results of the model will be completed to cover a wide range of potential space systems.
Author
Mathematical Models; Electrostatics; Electric Potential; Contaminants; Aerospace Systems

99
GENERAL

Includes aeronautical, astronautical, and space science related histories, biographies, and pertinent reports too broad for categorization; histories or broad overviews of NASA programs such as Apollo, Gemini, and Mercury spacecraft, Earth Resources Technology Satellite (ERTS), and Skylab; NASA appropriations hearings.

20030095847 Massachusetts Inst. of Tech., Cambridge, MA, USA
Optimizing Individual Learning Performance with Multidimensional Evaluations and Adaptive Systems
Sonwalkar. Nishikant; Advanced Learning Technologies and Learning Networks and Their Impact on Future Aerospace Workforce; September 2003, pp. 35-72; In English; See also 20030095837; No Copyright; Avail: CASI; A03, Hardcopy

The technology enhanced learning is a multidimensional space that allows individual students learn with their own learning preferences. The individual preferences depend on the personality type that can be inferred using various Jungian psychological learning type descriptors. It is proposed by the presenters that correlations can be found between the personality type and the learning preference. The fundamental dimensions for the learning are, media, learning models, and interactivity. The main agenda of this presentation is describing a multi-dimensional evaluation model that can measure the pedagogical effectiveness of the on-line courses and measure individual performance. It is proposed that the correlations between personality types and learning preferences in the area of media, models and interactivity are then used to optimize the individual learning performance.
Author
Education; Computer Assisted Instruction; Assessments

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