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Langley Research Center

Scientific and Technical Information Program Office

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Introduction

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

- NASA, NASA contractor, and NASA grantee reports
- Reports issued by other U.S. Government agencies, domestic and foreign institution, universities, and private firms
- Translations
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- Other U.S. Government agency and foreign patents and patent applications
- Domestic and foreign dissertations and theses

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NASA Center for AeroSpace Information (CASI)

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Subject Term Index

Personal Author Index

SCIENTIFIC AND TECHNICAL AEROSPACE REPORTS

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01
AERONAUTICS (GENERAL)

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

20030063088 NASA Glenn Research Center, Cleveland, OH, USA

On Human Resource Diversity in Distributed Energy Technology

Kalu, A.; Emrich, C.; Ventre, G.; Acosta, Roberto J.; HBCUs/OMUs Research Conference Agenda and Abstracts; February 2003, pp. 24; In English; See also 20030063082; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The purpose of this Historically Black Colleges and Universities (HBCUs/OMUs) Research Conference was to provide an opportunity for principal investigators and their students to present research progress reports. The abstracts included in this report indicate the range and quality of research topics such as aeropropulsion, space propulsion, space power, fluid dynamics, designs, structures and materials being funded through grants from Glenn Research Center to HBCUs. The conference generated extensive networking between students, principal investigators, Glenn technical monitors, and other Glenn researchers.

Author

Energy Technology; Human Resources; Aeronautics; Research And Development; Conferences

20030063926 National Advisory Committee for Aeronautics. Langley Aeronautical Lab., Langley Field, VA, USA

Investigation of an Experimental Supersonic Axial-Flow Compressor

Erwin, John R.; Wright, Linwood C.; Kantrowitz, Arthur; August 7, 1947; 59 pp.; In English; Original contains black and white illustrations

Report No.(s): NACA-RM-L6J01b; No Copyright; Avail: CASI; A04, Hardcopy

An investigation is in progress at the Langley Laboratory of the NACA to explore the possibilities of axial-flow compressors operating with supersonic velocities relative to the blade rows. The first phase of this investigation, a study of supersonic diffusers, has been reported. The second phase, an analysis of supersonic compressors, has also been reported. Preliminary calculations have shown that very high pressure ratios across a stage, together with somewhat increased mass flows, are possible with compressors which decelerate air through the speed of sound in their rotor blading. These performance characteristics are desirable in compressors for aircraft jet propulsion units, gas turbines, or superchargers. The third phase, presented here, is a preliminary experimental investigation of a supersonic compressor designed to produce a high pressure ratio in a single stage.

Derived from text

Turbocompressors; Axial Flow; Supersonic Speed; Rotor Blades (Turbomachinery); Flight Tests; Jet Aircraft

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*.

20030063911 Ohio Aerospace Inst., Brook Park, OH, USA
Effect of Velocity in Icing Scaling Tests
Anderson, David N.; Bond, Thomas H., Technical Monitor; June 2003; 17 pp.; In English; 38th Aerospace Sciences Meeting and Exhibit, 10-13 Jan. 2000, Reno, NV, USA
Contract(s)/Grant(s): NCC3-884; WU-708-20-13
Report No.(s): NASA/CR-2003-211828; AIAA Paper 2000-0236; NAS 1.26:211828; E-13521; No Copyright; Avail: CASI; A03, Hardcopy

This paper presents additional results of a study first published in 1999 to determine the effect of scale velocity on scaled icing test results. Reference tests were made with a 53.3-cm-chord NACA 0012 airfoil model in the NASA Glenn Icing Research Tunnel at an airspeed of 67 m/s, an MVD of 40 microns, and an LWC of 0.6 g/cu m. Temperature was varied to provide nominal freezing fractions of 0.8, 0.6, and 0.5. Scale tests used both 35.6- and 27.7-cm-chord 0012 models for 2/3- and 1/2-size scaling. Scale test conditions were found using the modified Ruff (AEDC) scaling method with the scale velocity determined in five ways. Four of the scale velocities were found by matching the scale and reference values of water-film thickness, velocity, Weber number, and Reynolds number. The fifth scale velocity was simply the average of those found by matching the Weber and Reynolds numbers. The resulting scale velocities ranged from 85 to 220 percent of the reference velocity. For a freezing fraction of 0.8, the value of the scale velocity had no effect on how well the scale ice shape simulated the reference shape. For nominal freezing fractions of 0.5 and 0.6, the best simulation of the reference shape was achieved when the scale velocity was the average of the constant-Weber-number and the constant-Reynolds-number velocities.
Author
Aircraft Safety; Aircraft Icing; Ice Formation; Airspeed

20030063930 Ohio Aerospace Inst., Brook Park, OH, USA
Evaluation of Methods to Select Scale Velocities in Icing Scaling Tests
Anderson, David N.; Ruff, Gary A.; Bond, Thomas H., Technical Monitor; June 2003; 16 pp.; In English; 37th Aerospace Sciences Meeting and Exhibit, 11-14 Jan. 1999, Reno, NV, USA
Contract(s)/Grant(s): NCC3-884
Report No.(s): NASA/CR-2003-211827; AIAA Paper 99-0244; NAS 1.26:211827; E-13520; No Copyright; Avail: CASI; A03, Hardcopy

A series of tests were made in the NASA Glenn Icing Research Tunnel to determine how icing scaling results were affected by the choice of scale velocity. Reference tests were performed with a 53.3-cm-chord NACA 0012 airfoil model, while scale tests used a 27.7-cm-chord 0012 model. Tests were made with rime, mixed, and glaze ice. Reference test conditions included airspeeds of 67 and 89 m/s, an MVD of 40 microns, and LWCs of 0.5 and 0.6 g/cu m. Scale test conditions were established by the modified Ruff (AEDC) scaling method with the scale velocity determined in five ways. The resulting scale velocities ranged from 85 to 220 percent of the reference velocity. This paper presents the ice shapes that resulted from those scale tests and compares them to the reference shapes. It was concluded that for freezing fractions greater than 0.8 as well as for a freezing fraction of 0.3, the value of the scale velocity had no effect on how well the scale ice shape simulated the reference shape. For freezing fractions of 0.5 and 0.7, the simulation of the reference shape appeared to improve as the scale velocity increased.
Author
Airspeed; Scale Models; Airfoils; Ice Formation; Aircraft Icing

20030063934 Bureau of Aeronautics (Navy), Washington, DC, USA
High-Speed Load Distribution of the Wing of a 3/16-Scale Model of the Douglas XSB2D-1 Airplane with Flaps Deflected
Barnes, Robert H.; February 5, 1947; 95 pp.; In English; Original contains black and white illustrations
Report No.(s): NACA-RM-A7A30; No Copyright; Avail: CASI; A05, Hardcopy

The tests reported herein were made for the purpose of determining the high-speed load distribution on the wing of a 3/16 scale model of the Douglas XSB2D-1 airplane. Comparisons are made between the root bending moment and section torsional

moment coefficients as obtained experimentally and derived analytically. The results show good correlation for the bending moment coefficients but considerable disagreement for the torsional moment coefficients, the measured moments being greater than the analytical moments. The effects of Mach number on both the bending moment and torsional moment coefficients were small.
Author
Load Distribution (Forces); Wing Loading; Scale Models; Aircraft Models; Aerodynamic Loads; Aerodynamics

20030063936 National Advisory Committee for Aeronautics. Ames Aeronautical Lab., Moffett Field, CA, USA
High-Speed Aerodynamic Characteristics of a 1/7-Scale Model of the Northrop YB-49 Airplane
Robinson, Robert C.; March 24, 1947; 41 pp.; In English; Original contains black and white illustrations
Report No.(s): NACA-RM-A7C13; No Copyright; Avail: CASI; A03, Hardcopy

Tests were conducted to find the effects of compressibility on the longitudinal stability and control of a 1/7-scale semispan model of the Northrop YB-49 airplane. Lift, drag, pitching moment, and elevon hinge moments were measured and are presented in graphical form. The results show that, due to a loss of lift on the outboard portion of the wing, the longitudinal static stability decreased rapidly as the Mach numbers increased above 0.735 the model experienced a climbing moment at positive lift coefficients. Also, a longitudinal-control effectiveness began to decrease at a Mach number of about 0.725
Author
Semispan Models; Aerodynamic Characteristics; Aerodynamic Stability; Longitudinal Control; Aircraft Control; Longitudinal Stability; Compressibility; Wind Tunnel Tests

20030063954 National Advisory Committee for Aeronautics. Langley Aeronautical Lab., Langley Field, VA, USA
An Investigation of the Effects of Sweep on the Characteristics of a High-Aspect-Ratio Wing in the Langley 8-Foot High-Speed Tunnel
Whitcomb, Richard T.; February 14, 1947; 75 pp.; In English; Original contains black and white illustrations
Report No.(s): NACA-RM-L6J01a; No Copyright; Avail: CASI; A04, Hardcopy

An untwisted wing, which when unswept has an NACA 65-210 section, an aspect ratio of 9.0 and a taper ration of 2.5:1.0, has been tested with no sweep, and 30 deg and 45 deg of sweepback and sweepforward in conjunction with a typical fuselage at Mach numbers from 0.60 to 0.96 at angles of attack generally between -2 deg and 10 deg in the Langley 8-foot high-speed tunnel. Sweep was obtained by rotating the wing semispans about a point in the plane of symmetry. The normal-force, pitching-moment, profile-drag, and loading characteristics for the wings have been obtained from pressure measurements and wake surveys. The results indicate that the wings with +/-30 deg of sweep experienced the severe changes in characteristics associated with the presence of a shock at higher Mach numbers then did the wing without sweep. The differences between the Mach numbers at which the changes occurred for the wings with +/-30 deg sweep and no sweep were generally slightly less than the factor 1/cosDelta(sub r) times the Mach numbers at which the changes occurred for the unswept wing, Delta(sub r) being the sweep angle. The wings with +/-45 deg of sweep did not experience the changes in the characteristics associated with the presence of shock at an angle of attack of 2 deg at Mach numbers up to the highest test value. The magnitudes of changes in the normal-force and pitching-moment coefficients that occurred were less for the wing with 30 deg of sweep than for the unswept wing. The use of sweepforward was superior to sweepback in delaying and reducing the changes in the normal-force coefficients, but was inferior in delaying and reducing the changes in the profile-drag coefficients. Increasing the Mach number to the highest test values had little effect on the positions of the center of loads on the various configurations for the probable design load conditions.
Author
Unswept Wings; Sweepback; Angle Of Attack; Wind Tunnel Tests; Aerodynamic Characteristics; Aerodynamic Configurations; Aerodynamic Coefficients; Shock Loads; Mach Number

20030063971 National Advisory Committee for Aeronautics. Langley Aeronautical Lab., Langley Field, VA, USA
Drag Measurements at Transonic Speeds of NACA 65-009 Airfoils Mounted on a Freely Falling Body to Determine the Effects of Sweepback and Aspect Ratio
Mathews, Charles W.; Thompson, Jim Rogers; January 22, 1947; 18 pp.; In English
Report No.(s): NACA-RM-L6K08c; No Copyright; Avail: CASI; A03, Hardcopy

Drag measurements at transonic speeds of NACA 65-009 rectangular airfoils and airfoils swept-back 45 degrees mounted on a freely falling body to determine the effects of sweepback and aspect ratio are reported. Tests were made to compare the

drag of rectangular and swept-back airfoils at a higher aspect ratio than had been used in a similar comparison reported previously.
CASI
Airfoils; Aerodynamic Configurations; Drag

20030063988 Eidgenoessische Technische Hochschule, Zurich, Switzerland
Investigations of Compression Shocks and Boundary Layers in Gases Moving at High Speed
Ackeret, J.; Feldmann, F.; Rott, N.; Mitteilungen aus dem Institut fuer Aerodynamik an der Eidgenoessischen Technischen Hochschule; January 1947, No. 10; 74 pp.; In English
Report No.(s): NACA-TM-1113; No Copyright; Avail: CASI; A04, Hardcopy

The mutual influences of compression shocks and friction boundary layers were investigated by means of high speed wind tunnels.Schlieren optics provided a clear picture of the flow phenomena and were used for determining the location of the compression shocks, measurement of shock angles, and also for Mach angles. Pressure measurement and humidity measurements were also taken into consideration.Results along with a mathematical model are described.
CASI
Drag; Aircraft Performance; Aerodynamics

20030064026 Kansas Univ. Center for Research, Inc., Lawrence, KS, USA
Estimation of Unsteady Aerodynamic Models from Flight Test Data
Lan, C. Edward; July 07, 2003; 5 pp.; In English
Contract(s)/Grant(s): NAG1-01011; No Copyright; Avail: CASI; A01, Hardcopy

This report summarizes the activities in aerodynamic model estimation from flight data. In addition to public presentations at the AIAA Atmospheric Flight Mechanics Conferences, two presentations at Boeing-Seattle were made during personal trips. These are discussed in the following: 1. Methodology of Aerodynamic Model Estimation from Flight Data. 2. Applications of F-16XL aerodynamic modeling. 3. Modeling of turbulence response. 5. Presentations at Boeing-Seattle. 6. Recommendations. and 7. References.
Derived from text
Flight Tests; Models; Unsteady Aerodynamics

20030064040 Ohio Aerospace Inst., Brook Park, OH, USA
Acceptable Tolerances for Matching Icing Similarity Parameters in Scaling Applications
Anderson, David N.; June 2003; 17 pp.; In English; 39th Aerospace Sciences Meeting and Exhibit, 8-11 Jan. 2001, Reno, NV, USA
Contract(s)/Grant(s): NCC3-884; WU-708-20-13-00
Report No.(s): NASA/CR-2003-211822; NAS 1.26:211822; E-13514; AIAA Paper 2001-0832; No Copyright; Avail: CASI; A03, Hardcopy

This paper reviews past work and presents new data to evaluate how changes in similarity parameters affect ice shapes and how closely scale values of the parameters should match reference values. Experimental ice shapes presented are from tests by various researchers in the NASA Glenn Icing Research Tunnel. The parameters reviewed are the modified inertia parameter (which determines the stagnation collection efficiency), accumulation parameter, freezing fraction, Reynolds number, and Weber number. It was demonstrated that a good match of scale and reference ice shapes could sometimes be achieved even when values of the modified inertia parameter did not match precisely. Consequently, there can be some flexibility in setting scale droplet size, which is the test condition determined from the modified inertia parameter. A recommended guideline is that the modified inertia parameter be chosen so that the scale stagnation collection efficiency is within 10 percent of the reference value. The scale accumulation parameter and freezing fraction should also be within 10 percent of their reference values. The Weber number based on droplet size and water properties appears to be a more important scaling parameter than one based on model size and air properties. Scale values of both the Reynolds and Weber numbers need to be in the range of 60 to 160 percent of the corresponding reference values. The effects of variations in other similarity parameters have yet to be established.
Author
Aircraft Icing; Aircraft Safety; Ice Formation; Inertia; Drop Size

20030064080 NASA Langley Research Center, Hampton, VA, USA
Aircraft Drag Reduction-A Review
Bushnell, D. M.; Proc. Instn Mech. Engrs; January 2003; Volume 217, Part G, pp. 1-18; In English; Copyright; Avail: Other Sources

The paper summarizes the state of the art in aeronautical drag reduction across the speed range for the conventional drag components of viscous drag, drag due to lift and wave drag. It also describes several emerging drag-reduction approaches that are either active or reactive/interactive and the drag reduction potentially available from synergistic combinations of advanced configuration aerodynamics, viscous drag-reduction approaches, revolutionary structural concepts and propulsion integration. Author

Drag Reduction; Lift; Viscous Drag; Wave Drag; Aerodynamic Configurations; Aerodynamics

20030064135 National Advisory Committee for Aeronautics. Langley Aeronautical Lab., Langley Field, VA, USA
The Base Pressure at Supersonic Speeds on Two-Dimensional Airfoils and Bodies of Revolution (With and Without Fins) Having Turbulent Boundary Layers
Love, Eugene S.; April 29, 1953; 66 pp.; In English; Original contains black and white illustrations
Report No.(s): NACA-RM-L53C02; No Copyright; Avail: CASI; A04, Hardcopy

An analysis has been made of available experimental data to show the effects of most variables that are predominant in determining base pressure at supersonic speeds. Two dimensional bases and bases of bodies of revolution, restricted to turbulent boundary layers, are covered.

CASI

Turbulent Boundary Layer; Two Dimensional Bodies; Supersonic Speed; Airfoils

20030064138 Zentrale fuer Wissenschaftliches Berichtswesen, Berlin, Germany
The Calculation of Compressible Flows with Local Regions of Supersonic Velocity
Goethert, B.; Kawalki, K. H.; Zentrale fuer Wissenschaftliches Berichtswesen der Luftfahrtforschung des Generalluftzeugmeisters; March 1947; 22 pp.; In English
Report No.(s): NACA-TM-1114; Forschungsbericht-1794; No Copyright; Avail: CASI; A03, Hardcopy

This report addresses a method for the approximate calculation of compressible flows about profiles with local regions of supersonic velocity. The flow around a slender profile is treated as an example.

Author

Supersonic Flow; Aircraft Design; Subsonic Flow; Aerodynamics

20030064148 National Advisory Committee for Aeronautics. Langley Aeronautical Lab., Langley Field, VA, USA
The Lift Distribution of Swept-Back Wings
Weissinger, J.; Zentrale fuer Wissenschaftliches Berichtswesen der Luftfahrtforschung des Generalluftzeugmeisters; March 1947, 1553; 51 pp.; In English
Report No.(s): NACA-TM-1120; No Copyright; Avail: CASI; A04, Hardcopy

Two procedures for calculating the lift distribution along the span are given in which a better account is taken of the distribution of circulation over te area than in the Prandtl lifting-line theory. The methods are also applicable to wing sweepback. Calculated results for the two methods were in agreement.

Author

Sweepback; Lift; Mathematical Models; Trapezoidal Wings; Aerodynamic Forces

20030064188 National Advisory Committee for Aeronautics. Langley Aeronautical Lab., Langley Field, VA, USA
Three-Component Force and Mass-Flow Measurement on a Jet Nacelle
Ilgmann, G.; Moeller, E.; June 1947; 32 pp.; In English; Original contains black and white illustrations
Report No.(s): NACA-TM-1149; No Copyright; Avail: CASI; A03, Hardcopy

The present report contains three-component forces and mass-flow measurements on a jet nacelle at small inlet-velocity ratios v(sub A)/v(sub o) < 1. The mass-flow measurement on two cross sections of the nacelle demonstrate the local-velocity distribution with varying flow and angle of attack.

Author

Mass Flow; Flow Measurement; Nacelles

20030064196 National Advisory Committee for Aeronautics. Langley Aeronautical Lab., Langley Field, VA, USA
Flight Tests to Determine the Effect of Length of a Conical Windshield on the Drag of a Bluff Body at Supersonic Speeds
Alexander, Sidney R.; Katz, Ellis; January 29, 1947; 14 pp.; In English; Original contains black and white illustrations
Report No.(s): NACA-RM-L6J16a; No Copyright; Avail: CASI; A03, Hardcopy

Flight tests were conducted to determine the effect of length of a conical windshield on the drag of a bluff body moving at supersonic speeds. A comparison is made between results obtained and results of previous drag tests of body-windshield combinations.The effect of increasing the length of the windshield is discussed.
Author
Bluff Bodies; Windshields; Flight Tests; Aerodynamic Drag; Nose Cones

20030064197 National Advisory Committee for Aeronautics. Langley Aeronautical Lab., Langley Field, VA, USA
The Separation of Flow Due to Compressibility Shock
Weise, A.; Technische Berichte Band; July 1947; Volume 10, 2, pp. 59-61; In English; Original contains black and white illustrations
Report No.(s): NACA-TM-1152; No Copyright; Avail: CASI; A03, Hardcopy

It is known that the compressibility shocks accompanying local or total supersonic flows lead to pronounced flow separations which result in unusually high energy losses on airplane wings, vanes, and in diffusers. These phenomena were investigated experimentally and theoretically.
Author
Compressibility; Vanes; Wings; Supersonic Flow; Compressible Flow

20030064477 Air Force Research Lab., Wright-Patterson AFB, OH
Comparison of Predicted and Measured Formation Flight Interference Effects
Blake, William B.; Gingras, David R.; Aug. 2001; 14 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F33615-99-C-3002; Proj-3005
Report No.(s): AD-A411596; AFRL-VA-WP-TP-2003-301; No Copyright; Avail: CASI; A03, Hardcopy

Results from a wind tunnel test of two delta wings in close proximity are presented and compared with predictions from a vortex lattice method. The wake effects on lift are slightly overpredicted when the aircraft overlap in the spanwise direction. The wake induced effects on pitching and rolling moment are well predicted. A maximum induced drag reduction of 25\% is measured on the trail aircraft, compared with a 40\% predicted reduction.
DTIC
Delta Wings; Wind Tunnel Tests; Formation Flying; Interference; Aircraft Wakes

20030064922 Ohio Aerospace Inst., Brook Park, OH, USA
A Study of Scaling for Intercycle Ice Accretion Tests
Anderson, David N.; Botura, Galdemir C.; Broeren, Andy P.; Bond, Thomas H., Technical Monitor; June 2003; 16 pp.; In English; 39th Aerospace Sciences Meeting and Exhibit, 8-11 Jan. 2001, Reno, NV, USA; Original contains black and white illustrations
Contract(s)/Grant(s): NCC3-884; WU 708-20-13
Report No.(s): NASA/CR-2003-211825; AIAA Paper 2001-0834; E-13517; NAS 1.26:211825; Copyright; Avail: CASI; A03, Hardcopy

The Ruff method with matched scale and reference velocity was used to determine appropriate 1/2-scale test conditions to simulate a full-size icing encounter for an NACA 23012 wing section protected with a pneumatic boot deicing system. Intercycle ice accretions were recorded on a 36-in-chord model used to represent 1/2-scale and compared with a hybrid reference model (full-size leading-edge and truncated aft section) representing a 72-in-chord full-size airfoil. The intercycle ice thickness and extent of icing for the scale tests generally compared well with those from the reference model. However, the scale tests did not reproduce the location and number of feather rows seen in the reference tests aft of the main ice shape. Many of the differences observed were believed to result from not scaling the pneumatic boot design along with the model size for these tests.
Author
Cryogenic Wind Tunnels; Wind Tunnel Tests; Aircraft Safety; Aircraft Icing; Ice Prevention; Ice Formation; Scaling Laws

20030064940 Douglas Aircraft Co., Inc., Santa Monica, CA, USA
On the Contribution of Turbulent Boundary Layers to the Noise Inside a Fuselage
Corcos, G. M.; Liepmann, H. W.; December 1956; 50 pp.; In English
Report No.(s): NACA-TM-1420; No Copyright; Avail: CASI; A03, Hardcopy

The following report deals in preliminary fashion with the transmission through a fuselage of random noise generated on the fuselage skin by a turbulent boundary layer. The concept of attenuation is abandoned and instead the problem is formulated as a sequence of two linear couplings: the turbulent boundary layer fluctuations excite the fuselage skin in lateral vibrations and the skin vibrations induce sound inside the fuselage. The techniques used are those required to determine the response of linear systems to random forcing functions of several variables. A certain degree of idealization has been resorted to. Thus the boundary layer is assumed locally homogeneous, the fuselage skin is assumed flat, unlined and free from axial loads and the 'cabin' air is bounded only by the vibrating plate so that only outgoing waves are considered. Some of the details of the statistical description have been simplified in order to reveal the basic features of the problem. The results, strictly applicable only to the limiting case of thin boundary layers, show that the sound pressure intensity is proportional to the square of the free stream density, the square of cabin air density and inversely proportional to the first power of the damping constant and to the second power of the plate density. The dependence on free stream velocity and boundary layer thickness cannot be given in general without a detailed knowledge of the characteristics of the pressure fluctuations in the boundary layer (in particular the frequency spectrum). For a flat spectrum the noise intensity depends on the fifth power of the velocity and the first power of the boundary layer thickness. This suggests that boundary layer removal is probably not an economical means for decreasing cabin noise. In general, the analysis presented here only reduces the determination of cabin noise intensity to the measurement of the effect of any one of our variables (free stream velocity, boundary layer thickness, plate thickness or the characteristic velocity of propagation in the plate). The plate generates noise by vibrating in resonance over a wide range of frequencies and increasing the damping constant is consequently an effective method of decreasing noise generation. One of the main features of the results is that the relevant quantities upon which noise intensity depends are non-dimensional numbers in which boundary layer and plate properties enter as ratios. This is taken as an indication that in testing models of structures for boundary layer noise it is not sufficient to duplicate in the model the structural characteristics of the fuselage. One must match properly the characteristics of the exicitng pressure fluctuations to that of the structure.
Author
Aerodynamic Noise; Fuselages; Aircraft Noise; Aircraft Compartments; Turbulent Boundary Layer; Random Noise

20030064944 National Advisory Committee for Aeronautics. Langley Aeronautical Lab., Langley Field, VA, USA
Wind-Tunnel Tests at Low Speed of Swept and Yawed Wings Having Various Plan Forms
Purser, Paul E.; Spearman, M. Leroy; May 22, 1947; 91 pp.; In English
Report No.(s): NACA-RM-L7D23; No Copyright; Avail: CASI; A05, Hardcopy

Wind tunnel tests haved been made at low speed to various small-scale models of swept-back, swept-forward, and yawed wings. Tests covered changes in aspect ratio, taper ratio, and tip shape.
Derived from text
Wind Tunnel Tests; Scale Models; Aspect Ratio; Swept Forward Wings; Sweptback Wings

20030064975 National Advisory Committee for Aeronautics. Langley Aeronautical Lab., Langley Field, VA, USA
Altitude-Wind-Tunnel Investigation of a 4000-Pound-Thrust Axial-Flow Turbojet Engine, 5, Analysis of Turbine Performance
Krebs, Richard P.; Hensley, Reece V.; August 04, 1948; 29 pp.; In English
Report No.(s): NACA-RM-E8F09d; No Copyright; Avail: CASI

Performance characteristics of the turbine of a 4000-pound-thrust axial-flow turbojet engine was determined in investigations of the complete engine in the NACA Cleveland altitude wind tunnel. Characteristics are presented as functions of the total-pressure ratio across the turbine and of turbine speed and gas flow corrected to sea-level conditions. Three turbine nozzles of different areas were used to determine the area that gave optimum performance. Inasmuch as tail-pipe nozzles of different diameters were investigated in combination with the standard turbine nozzle, the effect of varying discharge conditions on turbine operation could be observed. The investigations covered a range of pressure attitudes from 5000 to 40,000 feet. The engine was investigated over the entire operable range of speeds at each altitude. At pressure altitude of 30,000 feet, the effect on turbine operation of varying the ram pressure ration over a range from 1.10 to 1.77 was evaluated. An altitude effect was apparent when turbine pressure ratio was plotted against corrected turbine speed but it was so slight as to be negligible insofar as the turbine efficiencies were concerned. A maximum turbine efficiency of slightly more than 82 percent was obtained with the configuration using the standard turbine nozzle and the low-flow compressor. This efficiency,

which is somewhat lower than the actual turbine efficiency, is uncorrected for accessories drive power, bearing friction, tail-pipe pressure drop, compressor thermal radiation, and introduction of turbine-disk cooling air into the gas stream. Changes in the ram pressure ratio had a negligible effect on the turbine efficiency.
Author
Wind Tunnel Tests; Aerodynamic Characteristics; Axial Flow Turbines; Turbojet Engines; Nozzle Design; Pressure Ratio; Turbine Exhaust Nozzles

20030065198 National Advisory Committee for Aeronautics. Lewis Flight Propulsion Lab., Cleveland, OH, USA
Preliminary Results of an Altitude-Wind-Tunnel Investigation of an Axial-Flow Gas Turbine-Propeller Engine, 5, Combustion-Chamber Characterisitcs
Geisenheyner, Robert M.; Berdysz, Joseph J.; August 6, 1948; 34 pp.; In English; Original contains black and white illustrations
Report No.(s): NACA-RM-E8F10d; No Copyright; Avail: CASI; A03, Hardcopy

An investigation to determine the performance and operational characteristics of an axial-flow gas turbine-propeller engine was conducted in the Cleveland altitude wind tunnel. As part of this investigation, the combustion-chamber performance was determined at pressure altitudes from 5000 to 35,000 feet, compressor-inlet ram-pressure ratios of 1.00 and 1.09, and engine speeds from 8000 to 13,000 rpm. Combustion-chamber performance is presented as a function of corrected engine speed and corrected horsepower. For the range of corrected engine speeds investigated, overall total-pressure-loss ratio, cycle efficiency, and the fractional loss in cycle efficiency resulting from pressure losses in the combustion chambers were unaffected by a change in altitude or compressor-inlet ram-pressure ratio. For the range of corrected horsepowers investigated, the total-pressure-loss ratio and the fractional loss in cycle efficiency resulting from pressure losses in the combustion chambers decreased with an increase in corrected horsepower at a constant corrected engine speed. The combustion efficiency remained constant for the range of corrected horsepowers investigated at all corrected engine speeds.
Author
Wind Tunnel Tests; Axial Flow Turbines; Gas Turbine Engines; Combustion Chambers; Combustion Efficiency; Propulsion System Performance

20030065204 NASA Langley Research Center, Hampton, VA, USA
Identification of Computational and Experimental Reduced-Order Models
Silva, Walter A.; Hong, Moeljo S.; Bartels, Robert E.; Piatak, David J.; Scott, Robert C.; [2003]; 15 pp.; In English; International Forum on Aeroelasticity and Structural Dynamics 2003, 2-4 Jun. 2003, Amsterdam, Netherlands; Original contains color and black and white illustrations
Report No.(s): IFASD Paper 2003-US-39; Copyright; Avail: CASI; A03, Hardcopy

The identification of computational and experimental reduced-order models (ROMs) for the analysis of unsteady aerodynamic responses and for efficient aeroelastic analyses is presented. For the identification of a computational aeroelastic ROM, the CFL3Dv6.0 computational fluid dynamics (CFD) code is used. Flutter results for the AGARD 445.6 Wing and for a Rigid Semispan Model (RSM) computed using CFL3Dv6.0 are presented, including discussion of associated computational costs. Modal impulse responses of the unsteady aerodynamic system are computed using the CFL3Dv6.0 code and transformed into state-space form. The unsteady aerodynamic state-space ROM is then combined with a state-space model of the structure to create an aeroelastic simulation using the MATLAB/SIMULINK environment. The MATLAB/SIMULINK ROM is then used to rapidly compute aeroelastic transients, including flutter. The ROM shows excellent agreement with the aeroelastic analyses computed using the CFL3Dv6.0 code directly. For the identification of experimental unsteady pressure ROMs, results are presented for two configurations: the RSM and a Benchmark Supercritical Wing (BSCW). Both models were used to acquire unsteady pressure data due to pitching oscillations on the Oscillating Turntable (OTT) system at the Transonic Dynamics Tunnel (TDT). A deconvolution scheme involving a step input in pitch and the resultant step response in pressure, for several pressure transducers, is used to identify the unsteady pressure impulse responses. The identified impulse responses are then used to predict the pressure responses due to pitching oscillations at several frequencies. Comparisons with the experimental data are then presented.
Author
Unsteady Aerodynamics; Aeroelasticity; Computational Fluid Dynamics; Computerized Simulation

20030065216 Connecticut Univ., Storrs, CT

Advanced Structural Modeling for Fully Coupled Parachute Dynamics

Accorsi, Michael L.; Leonard, John W.; Aug. 31, 2002; 17 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAAD19-99-1-0235

Report No.(s): AD-A413498; ARO-38891-EG; No Copyright; Avail: CASI; A03, Hardcopy

The goal of this project has been to advance the state-of-the-art in performing fluid-structure interaction (FSI) simulations of parachute systems. This capability is being used by the Army to evaluate the dynamic behavior of new and existing airdrop systems. Airdrop systems have traditionally been designed using semi-empirical methods supplemented by extensive testing, which is time consuming and expensive. Computer simulation provides a cost effective alternative to this approach. FSI simulations of airdrop systems require coupling of computational structural and fluid dynamics models. These simulations are very computationally intensive and therefore parallel computational methods are essential. Specifics objectives addressed under this project focused on both the structural mechanics and parallel requirements; the required fluid dynamics component has been performed collaboratively at Rice University under a separate effort. The project accomplishments are classified into the following three general areas that are described in detail in this report: 1. Development of parallel structural algorithms required for FSI simulations 2. Development of new structural mechanics theory for modeling airdrop systems 3. Performance of large-scale computer simulations of Army airdrop systems

DTIC

Computerized Simulation; Air Drop Operations; Parachutes

20030065221 Case Inst. of Tech., Cleveland, OH, USA

On Possible Similarity Solutions for Three-Dimensional Incompressible Laminar Boundary-Layer Flows Over Developable Surfaces and with Proportional Mainstream Velocity Components

Hansen, Arthur G.; September 1958; 82 pp.; In English

Report No.(s): NACA-TM-1437; No Copyright; Avail: CASI; A05, Hardcopy

Analysis is presented on the possible similarity solutions of the three-dimensional, laminar, incompressible, boundary-layer equations referred to orthogonal, curvilinear coordinate systems. Requirements of the existence of similarity solutions are obtained for the following: flow over developable surface and flow over non-developable surfaces with proportional mainstream velocity components.

Author

Laminar Boundary Layer; Three Dimensional Flow; Velocity

20030065232 NASA Langley Research Center, Hampton, VA, USA

Quantifying the Effect of Pressure Sensitive Paint On Aerodynamic Data

Amer, T. R.; Obara, C. J.; Liu, T.; 2003; 11 pp.; In English; 21st AIAA Applied Aerodynamics Conference, 23-26 Jun. 2003, Orlando, FL, USA

Report No.(s): AIAA Paper 2003-3951; Copyright; Avail: CASI; A03, Hardcopy

A thin pressure sensitive paint (PSP) coating can slightly modify the overall shape of a wind-tunnel model and produce surface roughness or smoothness that does not exist on the unpainted model. These undesirable changes in model geometry may alter flow over the model, and affect the pressure distribution and aerodynamic forces and moments on the model. This study quantifies the effects of PSP on three models in low-speed, transonic and supersonic flow regimes. At a 95\% confidence level, the PSP effects on the integrated forces are insignificant for a slender arrow-wing-fuselage model and delta wing model with two different paints at Mach 0.2, 1.8, and 2.16 relative to the total balance accuracy limit. The data displayed a repeatability of 2.5 drag counts, while the balance accuracy limit was about 5.5 drag counts. At transonic speeds, the paint has a localized effect at high angles of attack and has a resolvable effect on the normal force, which is significant relative to the balance accuracy limit. For low speeds, the PSP coating has a localized effect on the pressure tap measurements, which leads to an appreciable decrease in the pressure tap reading. Moreover, the force and moment measurements had a poor precision, which precluded the ability to measure the PSP effect for this particular test.

Author

Aerodynamic Forces; Pressure Distribution; Pressure Sensitive Paints

20030065300 Air Force Inst. of Tech., Wright-Patterson AFB, OH, USA

Statistical Process Control: An Application in Aircraft Maintenance Management

Beabout, Bradley A.; Mar. 2003; 93 pp.; In English; Original contains color illustrations

Report No.(s): AD-A413139; AFIT/GOR/ENS/03-03; No Copyright; Avail: CASI; A05, Hardcopy

Maintenance management at the 135th Airlift Wing, Maryland Air National Guard desires a visualization tool for their maintenance performance metrics. Currently they monitor their metrics via an electronic spreadsheet. They desire a tool that presents the performance information in a graphical manner. This thesis effort focuses on the development of a visualization tool utilizing two of the seven tools offered by Statistical Process Control (SPC). This research demonstrates the application of p-charts and Pareto diagrams in the aircraft maintenance arena. P-charts are used for displaying mission capable (MC) rates and flying scheduling effectiveness (FSE) rates. Pareto diagrams are then used to highlight which aircraft subsystems are affecting those two performance indicators.
DTIC
Aircraft Maintenance; Spreadsheets

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*.

20030064046 Boeing Commercial Airplane Co., Seattle, WA, USA
Commercial Aircraft Emission Scenario for 2020: Database Development and Analysis
Sutkus, Donald J., Jr.; Baughcum, Steven L.; DuBois, Douglas P.; Wey, Chowen C., Technical Monitor; May 2003; 59 pp.; In English; Original contains color and black and white illustrations
Contract(s)/Grant(s): NAS3-01140; WBS-22-714-01-14
Report No.(s): NASA/CR-2003-212331; NAS 1.26:212331; E-13926; No Copyright; Avail: CASI; A04, Hardcopy

This report describes the development of a three-dimensional database of aircraft fuel use and emissions (NO(x), CO, and hydrocarbons) for the commercial aircraft fleet projected to 2020. Global totals of emissions and fuel burn for 2020 are compared to global totals from previous aircraft emission scenario calculations.
Author
Commercial Aircraft; Hydrocarbons; Aircraft Fuels

20030064243
Forward Collision Warning Requirements Project: Refining the CAMP Crash Alert Timing Approach by Examining Last-Second Braking and Lane Change Maneuvers under Various Kinematic Conditions
Kiefer, R. J.; Cassar, M. T.; Flannagan, C. A.; LeBlanc, D. J.; Palmer, M. D.; Jan. 2003; 102 pp.; In English
Report No.(s): PB2003-104543; No Copyright; Avail: CASI; A06, Hardcopy

This final report describes a follow-on study to the previous Crash Avoidance Metrics Partnership (CAMP) human factors work addressing Forward Collision Warning (FCW) timing requirements. This research extends this work by gathering not only 'last-second' braking maneuver data, but also data from 'last-second' steering (or lane-change) maneuvers. Drivers performed last-second braking and steering maneuvers under instructions for 'normal' or 'hard' intensity responses under a wide variety of vehicle-to-vehicle kinematic scenarios. This strategy of varying instruction during these last-second maneuvers was taken so that drivers' perceptions of 'normal' and 'non-normal' kinematics situations (or envelopes) could be properly identified and modeled for crash alert timing purposes. In addition, unlike the previous CAMP work that only examined lead vehicle stationary and lead vehicle braking scenarios, the current study also included scenarios where the lead vehicle was moving at a slower but constant speed prior to the last-second maneuver. Results provided validation of the Required Deceleration Model developed in the prior CAMP FCW project. In addition, a new model was developed, referred to as the '3-Tiered Inverse Time-To-Collision Model'. This promising model assumes the driver deceleration response (in response to the crash alert) is based on an inverse Time-To-Collision (TTC) threshold that decreases linearly with speed. One advantage of this model is that it requires only coarse (rather than accurate) knowledge of lead vehicle deceleration levels.
NTIS
Collision Avoidance; Warning Systems

20030064335 Federal Aviation Administration, Washington, DC, USA
Story of FAA Flight Inspection: Flight Check (Revised)
Thompson, S. A.; September 2002; In English
Report No.(s): PB2003-104326; No Copyright; Avail: National Technical Information Service (NTIS)

;Table of Contents: Introduction; What is Flight Inspection; The Beginnings of Flight Inspection (1926-1938); The Development of Flight Inspection (1938-1955); The Standardization of Flight Inspection (1955-1968); Flight Inspection in Transition (1968-1988); Flight Inspection and Procedural Development Since 1988; Appendices; Selected Bibliography.
NTIS
Inspection; Standardization

20030064346 Department of Transportation, Washington, DC, USA
U.S. Commercial Space Transporation Developments and Concepts: Vehicles, Technologies, and Spaceports, 2003
Jan. 2003; 66 pp.; In English
Report No.(s): PB2003-105730; No Copyright; Avail: CASI; A04, Hardcopy

This report reviews the major events relating to U.S. commercial space transportation in the past year and showcases current and planned U.S. commercial and commercially-oriented activities. The Federal Aviation Administration Associate Administrator for Commercial Space Transportation (FAA/AST) first published the report in 1998 with an exclusive focus on reusable launch vehicles (RLV). The current edition addresses not only RLVs but also expendable launch vehicles (ELV), propulsion technologies, and launch and reentry sites--commonly referred to as spaceports to provide a complete picture of the U.S. commercial space transportation industry. This report objectively reviews space transportation programs and projects as well as launch and reentry sites that will impact and support the development of commercial space activities and applications. The private sector plays a prominent role in the management, development, and funding of these activities; the federal government and several state governments substantially contribute to or provide leadership for many of the technologies and facilities described herein as well. With the exception of a few X PRIZE vehicle concepts, all activities and developments described in this report are being led by U.S. entities.
NTIS
Space Transportation; Reusable Launch Vehicles; Space Commercialization; Market Research

20030064476 NASA Langley Research Center, Hampton, VA, USA
Pilot Interactions in an Over-Constrained Conflict Scenario as Studied in a Piloted Simulation of Autonomous Aircraft Operations
Wing, David J.; Barhydt, Richard; Barmore, Bryan; Krishnamurthy, Karthik; [2003]; 11 pp.; In English; 5th US/Europe Air Traffic Management R and D Seminar, 23-27 Jun. 2003, Budapest, Hungary; Original contains color and black and white illustrations; No Copyright; Avail: CASI; A03, Hardcopy

Feasibility and safety of autonomous aircraft operations were studied in a multi-piloted simulation of overconstrained traffic conflicts to determine the need for, and utility of, priority flight rules to maintain safety in this extraordinary and potentially hazardous situation. An overconstrained traffic conflict is one in which the separation assurance objective is incompatible with other objectives. In addition, a proposed scheme for implementing priority flight rules by staggering the alerting time between the two aircraft in conflict was tested for effectiveness. The feasibility study was conducted through a simulation in the Air Traffic Operations Laboratory at the NASA Langley Research Center. This research activity is a continuation of the Distributed Air-Ground Traffic Management feasibility analysis reported in the 4th USA/Europe Air Traffic Management R&D Seminar in December 2001 (paper #48). The over-constrained conflict scenario studied here consisted of two piloted aircraft that were assigned an identical en-route waypoint arrival time and altitude crossing restriction. The simulation results indicated that the pilots safely resolved the conflict without the need for a priority flight rule system. Occurrences of unnecessary maneuvering near the common waypoint were traced to false conflict alerts, generated as the result of including waypoint constraint information in the broadcast data link message issued from each aircraft. This result suggests that, in the conservative interests of safety, broadcast intent information should be based on the commanded trajectory and not on the Flight Management System flight plan, to which the aircraft may not actually adhere. The use of priority flight rules had no effect on the percentage of the aircraft population meeting completely predictable which aircraft in a given pair would meet the constraints and which aircraft would make the first maneuver to yield right-of-way. Therefore, the proposed scheme for implementing priority flight rules through staggering the alerting time between the two aircraft was completely effective. The data and observations from this experiment, together with results from the previously reported study, support the feasibility of autonomous aircraft operations.
Author
Pilot Performance; Autonomy; Simulation; Air Traffic Control; Flight Rules; Air Navigation

20030065169 NASA Langley Research Center, Hampton, VA, USA

Progress Towards the Investigation of Technical Issues Relevant to the Design of an Aircraft Wake Vortex Advisory System (WakeVAS)

Rutishauser, David K.; [2003]; 6 pp.; In English; 21st AIAA Applied Aerodynamics Conference, 23-26 Jun. 2003, Orlando, FL, USA; Original contains color illustrations

Report No.(s): AIAA paper 2003-3808; No Copyright; Avail: CASI; A02, Hardcopy

Wake vortex separations applied to aircraft during instrument operations have been shown to potentially introduce inefficiencies in air traffic operations during certain weather conditions conducive to short duration wake hazards between pairs of landing aircraft. NASA Langley Research Center (LaRC) demonstrated an integration of technologies that provided real-time observations and predictions of aircraft wake behavior, from which reduced wake spacing from the current criteria was derived. In order to take this proof of concept to an operational prototype system, NASA has been working in cooperation with the FAA and other government and industry members to design operational concepts for a Wake Vortex Advisory System (WakeVAS). In addition to concept development, open research issues are being addressed and activities to quantify system requirements and specifications are currently underway. This paper describes the technological issues relevant to WakeVAS development and current NASA efforts to address these issues.

Author

Vortex Advisory System; Design Analysis; Aircraft Wakes

20030065174 NASA Langley Research Center, Hampton, VA, USA

Airborne Conflict Management within Confined Airspace in a Piloted Simulation of DAG-TM Autonomous Aircraft Operations

Barmore, Bryan; Johnson, Edward; Wing, David J.; Barhydt, Richard; [2003]; 10 pp.; In English; 5th US/Europe Air Traffic Management R and D Seminar, 23-27 Jun. 2003, Budapest, Hungary; Original contains color illustrations; No Copyright; Avail: CASI; A02, Hardcopy

A human-in-the-loop experiment was performed at the NASA Langley Research Center to study the feasibility of Distributed Air/Ground Traffic Management (DAG-TM) autonomous aircraft operations in highly constrained airspace. The airspace was constrained by a pair of special use airspace (SUA) regions on either side of the pilot s planned route. The available airspace was further varied by changing the separation standard for lateral separation between 3 nm and 5 nm. The pilot had to maneuver through the corridor between the SUA s, avoid other traffic and meet flow management constraints. Traffic flow management (TFM) constraints were imposed as a required time of arrival and crossing altitude at an en route fix. This is a follow-up study to work presented at the 4th USA/Europe Air Traffic Management R&D Seminar in December 2001. Nearly all of the pilots were able to meet their TFM constraints while maintaining adequate separation from other traffic. In only 3 out of 59 runs were the pilots unable to meet their required time of arrival. Two loss of separation cases are studied and it is found that the pilots need conflict prevention information presented in a clearer manner. No degradation of performance or safety was seen between the wide and narrow corridors. Although this was not a thorough study of the consequences of reducing the en route lateral separation, nothing was found that would refute the feasibility of reducing the separation requirement from 5 nm to 3 nm. The creation of additional, second-generation conflicts is also investigated. Two resolution methods were offered to the pilots: strategic and tactical. The strategic method is a closed-loop alteration to the Flight Management System (FMS) active route that considers other traffic as well as TFM constraints. The tactical resolutions are short-term resolutions that leave avoiding other traffic conflicts and meeting the TFM constraints to the pilot. Those that made use of the strategic tools avoided additional conflicts, whereas, those making tactical maneuvers often caused additional conflicts. Many of these second-generation conflicts could be avoided by improved conflict prevention tools that clearly present to the pilot which maneuver choices will result in a conflict-free path. These results, together with previously reported studies, continue to support the feasibility of autonomous aircraft operations.

Author

Flight Management Systems; Free Flight; Air Traffic Control; Autonomy; Airspace; Flight Simulation; Aircraft Pilots; Confinement

20030065175 NASA Langley Research Center, Hampton, VA, USA

Application of Probabilistic Analysis to Aircraft Impact Dynamics

Lyle, Karen H.; Padula, Sharon L.; Stockwell, Alan E.; [2003]; 11 pp.; In English; 44th AIAA/ASME/ASCE/AHS/ASC Structure, Structural Dynamics Conference, 7-10 Apr. 2003, Norfold, VA, USA

Report No.(s): AIAA Paper 2003-1482; Copyright; Avail: CASI; A03, Hardcopy

Full-scale aircraft crash simulations performed with nonlinear, transient dynamic, finite element codes can incorporate

structural complexities such as: geometrically accurate models; human occupant models; and advanced material models to include nonlinear stressstrain behaviors, laminated composites, and material failure. Validation of these crash simulations is difficult due to a lack of sufficient information to adequately determine the uncertainty in the experimental data and the appropriateness of modeling assumptions. This paper evaluates probabilistic approaches to quantify the uncertainty in the simulated responses. Several criteria are used to determine that a response surface method is the most appropriate probabilistic approach. The work is extended to compare optimization results with and without probabilistic constraints.
Author
Aircraft Accidents; Crashes; Finite Element Method

20030065179 National Advisory Committee for Aeronautics. Langley Aeronautical Lab., Langley Field, VA, USA
The Icing of Aircraft
Robitzsch, M.; Beitraege zur Physik der Freien Atmosphaere; September 1942; Volume 18, No. 4, pp. 235-241; In English
Report No.(s): NACA-TM-1028; No Copyright; Avail: CASI; A03, Hardcopy

This technical memorandum presents a theoretical study of the processes accompanying the formation of ice on solid bodies. It discusses vapor pressure and sublimation in two air masses separated by a boundary area.
CASI
Aircraft Icing; Numerical Analysis

20030065197 National Advisory Committee for Aeronautics. Langley Aeronautical Lab., Langley Field, VA, USA
The Formation of Ice on Aircraft
Bleeker, W.; Meteorologische Zeitschrift; August 1942, pp. 349-354; In English; No Copyright; Avail: CASI; A03, Hardcopy

The phenomenon accompanying the formation of ice on aircraft has been frequently discussed. The consequences of ice formation have been briefly analyzed in an article , but a definite physical solution of the problem has not been reached up to the present. Most of the authors agree that subcooled water droplets play a prominent part, but they fail to specify the exact manner in which this occurs.
Author
Ice Formation; Aircraft Icing; Drops (Liquids); Cooling; Surface Properties; Interfacial Tension; Evaporation

20030065269 Federal Aviation Administration, Washington, DC, USA
FAA Aerospace Forecasts. Fiscal Years 2003 - 2014
Mar. 2003; 298 pp.; In English
Report No.(s): AD-A413323; FAA-APO-03-1; No Copyright; Avail: CASI; A13, Hardcopy

This report contains the Federal Aviation Administration (FAA) forecasts of aviation activity at FAA facilities for fiscal years 2003-2014. These include airports with FAA and contract control towers, air route traffic control centers, and flight service stations. Detailed forecasts were developed for the major users of the National Aviation System--air carriers, air taxi/commuters, general aviation, and military. The forecasts have been prepared to meet the budget and planning needs of the constituent units of the FAA and to provide information that can be used by State and local authorities, the aviation industry, and the general public. The outlook for the 12-year forecast period is for a slower recovery in the demand for aviation services and products relative to last years published forecasts. This is due to sluggish U.S. and global economic growth, the loss of 'consumer wealth' resulting from the plunge in equity stock prices, and the deterioration in air carrier yields and profitability caused by the loss of significant numbers of full-fare business travelers. In addition, the possibility of war with Iraq has greatly increased the risk and uncertainty of the forecasts. Overall, the outlook is for moderate economic growth and inflation and declining real fuel prices. Aviation activity is forecast to increase by 22.0 percent at the combined FAA (266 in 2002) and contract towered airports (217 in 2002, 224 in 2003) and 27.2 percent at air route traffic control centers. U.S. scheduled domestic passenger enplanements are forecast to increase 57.3 percent--large air carriers increasing 51.1 percent and regional/commuters growing by 92.1 percent. Total international passenger traffic between the USA and the rest of the world is projected to increase 72.5 percent. International passenger traffic carried on U.S. flag carriers is forecast to increase 74.4 percent.
DTIC
Economic Analysis; Forecasting; Airline Operations

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*.

20030052752 NASA Ames Research Center, Moffett Field, CA, USA

The Effect of Symbology Location and Format on Attentional Deployment within a Cockpit Display of Traffic Information

Johnson, Walter W.; Liao, Min-Ju; Tse, Stephen; April 2003; 10 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): RTOP 538-04-23

Report No.(s): NASA/TM-2003-212264; NAS 1.15:212264; IH-038; Copyright; Avail: CASI; A02, Hardcopy

The present experiment employed target detection tasks to investigate attentional deployment during visual search for target aircraft symbols on a cockpit display of traffic information (CDTI). Targets were defined by either a geometric property (aircraft on a collision course with Ownship) or a textual property (aircraft with associated altitude tags indicating an even altitude level). Effects of target location and target brightness (highlighting) were examined. Target location was systematically related to target detection time, and this interacted with the target's defining property (collision geometry or associated text). Highlighting (which was not linked to whether an aircraft symbol was the target) did not influence target detection time. Author

Symbols; Cockpits; Display Devices; Target Acquisition; Air Traffic

20030063995 Hughes Technical Center, Atlantic City International Airport, NJ, USA

Application of Color to Reduce Complexity in Air Traffic Control

Yuditsky, Tanya; Sollenberger, Randy L.; Della Rocco, Pamela S.; Friedman-Berg, Ferne; Manning, Carol A.; Nov. 2002; 54 pp.; In English; Original contains color illustrations

Report No.(s): AD-A411937; DOT/FAA/CT-TN03/01; No Copyright; Avail: CASI; A04, Hardcopy

The USA Air Traffic Control (ATC) system is designed to provide for the safe and efficient flow of air traffic from origin to destination. The Federal Aviation Administration predicts that traffic levels will continue increasing over the foreseeable future. It is important to identify and reduce the factors that increase ATC complexity because of the potential consequences of errors. This research examined the application of specific information coding techniques to ATC displays as a method of reducing complexity in the en route environment. It tested color coding of (a) aircraft destination airport, (b) overflights, and (c) Special Use Airspace. Eight Certified Professional Controllers participated in the high fidelity, human-in-the-loop simulation. Results indicated that these specific enhancements may improve controller performance and efficiency. However, when we presented all of the enhancements simultaneously, we did not find the beneficial effects that occurred when we tested the enhancements individually. Further research is needed to systematically investigate the application of color to radar displays in the dynamic Air Traffic environment.

DTIC

Computerized Simulation; Air Traffic Control

20030064911 NASA Langley Research Center, Hampton, VA, USA

The Aeronautical Data Link: Decision Framework for Architecture Analysis

Morris, A. Terry; Goode, Plesent W.; [2003]; 10 pp.; In English; 3rd Integrated Commmunication, Navigation and Surveillance Conference, 19-22 May 2003, Annapolis, MD, USA; Original contains color and black and white illustrations; No Copyright; Avail: CASI; A02, Hardcopy

A decision analytic approach that develops optimal data link architecture configuration and behavior to meet multiple conflicting objectives of concurrent and different airspace operations functions has previously been developed. The approach, premised on a formal taxonomic classification that correlates data link performance with operations requirements, information requirements, and implementing technologies, provides a coherent methodology for data link architectural analysis from top-down and bottom-up perspectives. This paper follows the previous research by providing more specific approaches for mapping and transitioning between the lower levels of the decision framework. The goal of the architectural analysis methodology is to assess the impact of specific architecture configurations and behaviors on the efficiency, capacity, and safety of operations. This necessarily involves understanding the various capabilities, system level performance issues and performance and interface concepts related to the conceptual purpose of the architecture and to the underlying data link technologies. Efficient and goal-directed data link architectural network configuration is conditioned on quantifying the risks

and uncertainties associated with complex structural interface decisions. Deterministic and stochastic optimal design approaches will be discussed that maximize the effectiveness of architectural designs.
Author
Flight Management Systems; Communication Networks; Data Links; Air Traffic Control; Computer Systems Design; Computer Networks; National Airspace System; Airspace; Decision Making

20030065199 Federal Aviation Administration, Atlantic City, NJ
The Effect of Voice Communications Latency in High Density, Communications-Intensive Airspace
Sollenberger, Randy L.; McAnulty, D. M.; Kerns, Karol; Jan. 2003; 62 pp.; In English
Report No.(s): AD-A413279; DOT/FAA/CT-TN03/04; No Copyright; Avail: CASI; A04, Hardcopy

The Federal Aviation Administration (FAA) Next Generation Air-Ground Communications program plans to replace aging analog radio equipment with the Very High Frequency Digital Link Mode 3 (VDL3) system. VDL3 will implement both digital voice and data link communications and will include special features such as controller override, antiblocking, and a transmit status indicator. There are two human factors concerns with the VDL3 system: voice quality and voice throughput delay. Previous research has determined that digital voice technology is highly intelligible and acceptable for Air Traffic Control (ATC) operations. Researchers from the National Airspace System Human Factors Group (ACB-220) of the FAA William J. Hughes Technical Center conducted a high fidelity, human-in-the-loop simulation to examine the impact of voice throughput delay on ATC operations. The communications equipment simulated the VDL3 system with controller override, antiblocking, and transmit status indicator features. The researchers examined ground system delays of 250 ms (current specification), 350 ms (practical alternative), and 750 ms (to demonstrate the sensitivity of the simulation measures) each with their appropriate airborne system delays. Ten controllers from Level 11 and 12 Air Route Traffic Control Centers participated in the study. The results indicated that there were no significant differences between the 250 ms and 350 ms delay conditions. However, the 750 ms condition did produce a significant increase in controller overrides, and the controllers rated it as interfering with some aspects of their communication (e.g., providing optional services). The researchers concluded that the VDL3 system with controller override, antiblocking, and a transmit status indicator can be implemented with a 350 ms ground system delay without causing problems for controllers.
DTIC
Voice Communication; Airspace; Air Traffic Control; Digital Systems

20030065219 Naval Research Lab., Stennis Space Center, MS
Demonstration of a Moving-Map System for Improved Lane Navigation of Amphibious Vehicles
Clohrenz, Maura; Myrick, Stephanie A.; Edwards, Stephanie S.; Gendron, Marlin; Feb. 13, 2003; 11 pp.; In English; Original contains color illustrations
Report No.(s): AD-A413087; NRL/PP/7440--03-1009; No Copyright; Avail: CASI; A03, Hardcopy

The Naval Research Laboratory (NRL) is testing and demonstrating a prototype moving-map system on amphibious vehicles and landing craft to aid the location neutralization and navigation around mines and obstacles in the surf and beach zone. NRL proposed that a moving-map would improve crew situational awareness and communications thereby improving precise lane navigation (and reducing the requisite lane width). Two platforms were targeted for moving-map teats: Landing Craft Utility and Amphibious Assault Vehicles.
DTIC
Amphibious Vehicles; Position (Location); Landing Aids; Navigation Aids

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*.

20030053044 NASA Ames Research Center, Moffett Field, CA, USA
A Cockpit Display Designed to Enable Limited Flight Deck Separation Responsibility
Johnson, Walter W.; Battiste, Vernol; Bochow, Sheila Holland; February 2003; 31 pp.; In English; 1999 World Aviation Conference, 1999, San Francisco, CA, USA; Original contains color illustrations
Contract(s)/Grant(s): RTOP 538-04-23
Report No.(s): NASA/TM-2003-212261; IH-036; NAS 1.15:212261; Copyright; Avail: CASI; A03, Hardcopy

Cockpit displays need to be substantially improved to serve the goals of situational awareness, conflict detection, and path replanning, in Free Flight. This paper describes the design of such an advanced cockpit display, along with an initial simulation based usability evaluation. Flight crews were particularly enthusiastic about color coding for relative altitude, dynamically pulsing predictors, and the use of 3-D flight plans for alerting and situational awareness.
Author
Free Flight; Cockpits; Display Devices; Design Analysis

20030062217 Quebec Univ., Quebec, Canada
Outdoor Testing of Type I Fluids in Snow
Beisswenger, Arlene; Gagne, Nathalie; Laforte, Jean-Louis; Sep. 2002; 34 pp.; In English
Report No.(s): AD-A411483; DOT/FAA/AR-02/107; No Copyright; Avail: CASI; A03, Hardcopy

Outdoor testing of five SAE Type I ground aircraft deicing fluids were conducted for natural snow in Chicoutimi, Quebec, Canada, between January and March 2002. These tests were performed using aluminum boxes which were shown to be thermodynamically equivalent to a wing leading edge coated with fluid. For these tests, the boxes were coated with 0.5 L of Type I fluid heated to 60C and applied to the test surface by means of a specially made spreader. The objective of this investigation was to conduct outdoor testing and determine the anti-icing endurance times of five Type I deicing fluids under natural snowfall conditions on wing thermodynamic equivalent boxes. Testing was performed on five fluids, three of which were diluted to a 100 buffer with the outside air temperature, according to dilution charts provided by the manufacturer, the other two were premixed fluids and were tested as received, without further dilution. Tests were performed during 18 natural snow events. Most of them occurred at temperatures between -3.5 and -15.0C producing fine snow with stellar and spatial dendrite crystal types in the less than 1 mm size range. The results showed that, given the scatter of results under natural conditions, all five fluids had relatively similar endurance times; the greatest difference of 40\% being observed between fluids with the longest and shortest times, with the same intensity. The prediluted fluids had, in general, longer times by about 20\%, as compared to the fluids tested at a 100 buffer with the outside air temperature. Results were compared to those obtained at the APS Aviation site, where events occurred at warmer temperatures, which led to longer endurance times. However, when the temperature differences are taken into consideration, the times are comparable. The data at both sites generated the following holdover times for various temperature ranges.
DTIC
Snow; Aircraft Icing; Deicers; Wings

20030063918 National Advisory Committee for Aeronautics. Ames Aeronautical Lab., Moffett Field, CA, USA
Aerodynamic Characteristics of a Portion of the Horizontal Tail from a Douglas C-74 Airplane with Fabric-Covered Elevators
Perone, Angelo; Berthold, Cecil L.; May 06, 1947; 54 pp.; In English; Original contains black and white illustrations
Report No.(s): NACA-RM-A7D28; No Copyright; Avail: Other Sources

A Douglas C-74 airplane, during a test dive at about 0.525 Mach number, experienced uncontrollable longitudinal oscillations sufficient to cause shedding of the outer wing panels and the subsequent crash of the airplane. Tests of a section of the horizontal tail plane from a C-74 airplane were conducted in the Ames 16-foot high-speed wind tunnel to investigate the possibility of the tail as a contributing factor to the accident. The results of the investigations of fabric-covered elevators in various conditions of surface deformation are presented in this report.
Derived from text
Aerodynamic Characteristics; Horizontal Tail Surfaces; Hypersonic Wind Tunnels; Wind Tunnel Tests; Douglas Aircraft; Fabrics; Elevators (Control Surfaces)

20030063925 National Advisory Committee for Aeronautics. Langley Aeronautical Lab., Langley Field, VA, USA
Partial Measurements in Flight of the Flying Qualities of a Grumman XF7F-1 Airplane with a Modified Vertical Tail
Turner, Howard L.; Cooper, George E.; April 24, 1947; 39 pp.; In English; Original contains black and white illustrations
Report No.(s): NACA-RM-A7D15; No Copyright; Avail: CASI; A03, Hardcopy

Partial measurements in flight of the handling qualities of a Grumman XF7F-1 airplane were investigated. Results are for low altitude and normal center of gravity conditions only.
CASI
Aircraft Performance; Airspeed; Controllability; Flight Characteristics

20030063941 National Advisory Committee for Aeronautics. Ames Aeronautical Lab., Moffett Field, CA, USA
High-Speed Load Distribution on the Wing of a 3/16-Scale Model of a Scout-Bomber Airplane with Flaps Deflected
Barnes, Robert H.; August 21, 1947; 89 pp.; In English; Original contains black and white illustrations
Report No.(s): NACA-RM-A7D23; No Copyright; Avail: CASI; A05, Hardcopy

The tests reported herein were made for the purpose of determining the high-speed load distribution on the wing of a 3/16 scale model of a scout-bomber airplane. Comparisons are made between the root bending-moment and section torsional-moment coefficients as obtained experimentally and derived analytically. The results show good correlation for the bending-moment coefficients but considerable disagreement for the torsional-moment coefficients.
Author
Load Distribution (Forces); Scale Models; Deflection; Flapping; Wings; Bomber Aircraft

20030063943 National Advisory Committee for Aeronautics. Langley Aeronautical Lab., Langley Field, VA, USA
Results of Tests to Determine the Effect of a Conical Windshield on the Drag of a Bluff Body at Supersonic Speeds
Alexander, Sidney R.; January 14, 1947; 13 pp.; In English
Report No.(s): NACA-RM-L6K08a; No Copyright; Avail: CASI; A03, Hardcopy

Tests to evaluate the effect of a conical windshield on the drag of a bluff body at supersonic speeds were performed for the following configurations: a sharp nose fuselage with stabilizing fins,a blunt nose fuselage with a hemispherical shape, and a blunt nose fuselage with a conical point. Results of the drag coeeficient are described at Mach 1.0 and the greatest Mach number of 1.37.
CASI
Supersonic Drag; Fuselages; Aircraft Design; Windshields

20030063952 National Advisory Committee for Aeronautics. Ames Aeronautical Lab., Moffett Field, CA, USA
Force Tests of the Boeing XB-47 Full-Scale Empennage in the Ames 40- by 80-Foot Wind Tunnel
Hunton, Lynn W.; August 14, 1947; 20 pp.; In English; Original contains black and white illustrations
Report No.(s): NACA-RM-A7H12; No Copyright; Avail: CASI; A03, Hardcopy

A wind-tunnel investigation of the Boeing XB-47 full-scale empennage was conducted to provide, prior to flight tests, data required on the effectiveness of the elevator and rudder. The XB-47 airplane is a jet-propelled medium bomber having wing and tail surfaces swept back 35 degrees. The investigation included tests of the effectiveness of the elevator with normal straight sides, with a buldged trailing edge, and with a modified hinge-line gap and tests of the effectiveness of the rudder with a normal straight-sided tab and with a bulged tab.
Author
B-47 Aircraft; Tail Assemblies; Wind Tunnel Tests; Aircraft Models; Force Distribution; Full Scale Tests

20030063953 National Advisory Committee for Aeronautics. Langley Aeronautical Lab., Langley Field, VA, USA
Tests of a Horizontal-Tail Model through the Transonic Speed Range by the NACA Wing-Flow Method
Adams, Richard E.; Silsby, Norman S.; April 11, 1947; 26 pp.; In English
Report No.(s): NACA-RM-L7C25a; No Copyright; Avail: CASI; A03, Hardcopy

A 1/12-scale model of a horizontal tail of a fighter airplane was tested through the transonic speeds in the high-speed flow over an airplane wing, the surface of which served as a reflection plane for the model. Measurements of lift, elevator-hinge moment, angle of attack, and elevator angle were made in the Mach number range from 0.75 to 1.04 for elevator deflections ranging from 10 degrees to minus 10 degrees, and for angles of attack of minus 1.2 degrees, 0.4 degrees, and 3.4 degrees. The equipment used to measure the hinge moments of the model proved to be unsatisfactory, and for this reason the hinge-moment data are considered to be only qualitative.
Author
Fighter Aircraft; Horizontal Tail Surfaces; Elevators (Control Surfaces)

20030063970 National Advisory Committee for Aeronautics. Lewis Flight Propulsion Lab., Cleveland, OH, USA
Acceleration Characteristics of R-3350 Engine Equipped with NACA Injection Impeller
Hickel, Robert O.; Snider, William E.; January 8, 1947; 24 pp.; In English; Original contains black and white illustrations
Report No.(s): NACA-RM-E6L03a; No Copyright; Avail: CASI; A03, Hardcopy

Qualitative investigations have shown that use of the NACA injection impeller with the R-3350 engine increases the inertia of the fuel-injection system and, when the standard fuel-metering system is used, this increase in inertia results in poor

engine acceleration characteristics. This investigation was therefore undertaken to determine whether satisfactory acceleration characteristics of the engine equipped with the injection impeller could be obtained by simple modifications to the fuel-monitoring system. The engine was operated with two types of carburetor; namely, a hydraulic-metering carburetor incorporating a vacuum-operated accelerating pump and a direct-metering carburetor having a throttle-actuated accelerating pump. The vacuum-operated accelerating pump of the hydraulic-metering carburetor was modified to produce satisfactory accelerations by supplementing the standard air chamber with an additional 75-cubic spring. The throttle-actuated accelerating pump of the direct-metering carburetor was modified to produce satisfactory accelerations by replacing the standard 0.028-inch-diameter bleed in the load-compensator balance line with a smaller bleed of 0.0225-inch diameter. The results of this investigation indicated that both carburetors can be easily modified to produce satisfactory acceleration characteristics of the engine and no definite choice between the types of carburetor and accelerating pump can be made. Use of the direct-metering carburetor, however, probably resulted in better fuel distribution to the cylinders during the acceleration period and reduced the backfire hazard because all the fuel is introduced through the injection impeller.
Author
Aircraft Engines; Engine Design; Impellers; Fuel Injection; Carburetors; Aerodynamic Characteristics; Aircraft Fuel Systems

20030063972 National Advisory Committee for Aeronautics. Lewis Flight Propulsion Lab., Cleveland, OH, USA
Performance of the Modified V-1710-93 Engine-Stage Supercharger with a Constant-Area Vaneless Diffuser
Douglas, John E.; Schwartz, Irving R.; December 20, 1946; 18 pp.; In English
Report No.(s): NACA-RM-E6K22; No Copyright; Avail: CASI; A03, Hardcopy

As part of an investigation to increase the power output of the V-1710-93 engine at altitude, the engine-stage supercharger was combined with a constant-area vaneless diffuser designed to improve the performance of the engine-stage supercharger at the rated engine operating point. The performance of the modified supercharger was investigated in a variable-component supercharger test rig and compared with that of the standard supercharger with an 8-vaned diffuser. A separate evaluation of the component efficiencies and a study of the flow characteristics of the modified supercharger was made possible by internal diffuser instrumentation. At the volume flow required by the engine for rated operating conditions, the modified supercharger increased the over-all adiabatic efficiency 0.05 and the over-all pressure coefficient 0.035. Furthermore, the capacity of the engine-stage supercharger was increased by replacing the standard 8-vaned diffuser with the vaneless diffuser. The peak over-all adiabatic efficiency for the modified supercharger, however, was 0.05 to 0.07 lower than that of the standard unit over the range of tip speeds investigated. The improved performance of the modified supercharger at rated engine operating conditions resulted from a shift of the point of peak adiabatic efficiency and pressure coefficient of the standard supercharger to a higher flow. The energy loss through the vaneless diffuser was found to be small. Because of the restricted diffuser diameter, however, diffusion was inadequate, which resulted in a relatively small static-pressure rise through the diffuser, high diffuser-exit velocities, and excessive collector-case losses.
Author
Superchargers; Vaneless Diffusers; Aircraft Performance; Wind Tunnel Tests; Engine Design; Flow Characteristics; Aerodynamic Characteristics

20030063975 Textron Bell Helicopter, USA
Development and Flight Demonstration of a HUMS-Based Helicopter Limit Cueing (HLC) System
Augustin, M.; Dreier, M.; Yeary, R. D.; Erdos, R.; Gubbels, A.; Damin, M.; Whalley, M.; [2002]; 8 pp.; In English; American Helicopter Society 58th Annual Forum, 11-13 Jun. 2002, Montreal, Canada
Contract(s)/Grant(s): NAS2-14115; Copyright; Avail: CASI; A02, Hardcopy

A prototype helicopter limit cueing (HLC) system was designed, installed, and evaluated in flight test in early 2002. This paper describes the design, cueing methodology, and interim flight test results of this project. The system described in this paper used available Health and Usage Monitoring System (HUMS) parameters and a simple and cost-effective mechanical spring/electric motor combination to achieve a tactile cue that warned the pilot of impending exceedences of the transmission torque limit. Three high-workload maneuvers were used to evaluate the prototype HLC system. Results indicate that with an appropriate design, inadvertent over-torque events could be eliminated with a HLC system while reducing pilot workload.
Author
Helicopters; Cues; Flight Tests; Systems Health Monitoring

20030063991 National Advisory Committee for Aeronautics. Lewis Flight Propulsion Lab., Cleveland, OH, USA
Altitude-Wind-Tunnel Investigation of Performance of Several Propellers on YP-47M Airplane at High Blade Loading, 1, Aeroproducts H20C-162-X11M2 Four-Blade Propeller
Saari, Martin J.; Wallner, Lewis E.; October 11, 1946; 42 pp.; In English
Report No.(s): NACA-RM-E6I24; No Copyright; Avail: CASI; A03, Hardcopy

An investigation was made in the Cleveland Altitude wind tunnel to determine the performance of an Aeroproducts H20C-162-X11M2 four-blade propeller on a YP-47M airplane at high blade loadings and high engine powers. The propeller characteristics were obtained for a range of power coefficients from 0.30 to 1.00 at free-stream Mach numbers of 0.40 and 0.50. The results of the force measurements are indicative only of trends in propeller efficiency with changes in power coefficient and advance-diameter ratio because unknown interference effects existed during the investigation. At a free-stream Mach number of 0.40, the envelopes of the efficiency curves decreased about 11\% between advance-diameter ratios of 2.40 and 4.40. An increase in power coefficient from 0.30 to 0.80 at an advance-diameter ratio of 2.40 had little effect on the propeller efficiency. A change in power coefficient from 0.40 to 1.00 at an advance-diameter ratio of 4.40 increased the propeller efficiency by about 40\%. For conditions below the stall the thrust loading on the outboard blade sections increased more rapidly than on the inboard sections as the power coefficient was increased or as the advance-diameter ratio was decreased. For conditions beyond the stall, the thrust loading decreased on the outboard sections and increased on the inboard sections.
Author
Wind Tunnel Tests; Propeller Efficiency; Propellers; Performance Tests; Aircraft Performance; Rotor Dynamics

20030063996 National Advisory Committee for Aeronautics. Lewis Flight Propulsion Lab., Cleveland, OH, USA
Altitude-Wind-Tunnel Investigation of Performance of Several Propellers on YP-47M Airplane at High Blade Loading, 2, Curtiss 838-1C2-18R1 Four-Blade Propeller
Wallner, Lewis E.; Sorin, Solomon M.; November 26, 1946; 39 pp.; In English
Report No.(s): NACA-RM-E6J14; No Copyright; Avail: CASI; A03, Hardcopy

An investigation was conducted in the Cleveland altitude wind tunnel to determine the performance of a Curtiss propeller with four 838-lC2-lSRl blades on a YP-47M airplane at high blade loadings and engine powers. The study was made for a range of power coefficients between 0.30 and 1.00 at free-stream Mach numbers of 0.40 and 0.50. The results of the force measurements indicate primarily the trend of propeller efficiency for changes in power coefficient or advance-diameter ratio, inasmuch as corrections for the effects of tunnel-wall constriction on the installation have not been applied. Slip-stream pressure surveys across the propeller disk are presented to illustrate blade thrust load distribution for several operating conditions. At a free-stream Mach number of 0.40, nearly constant peak efficiencies were obtained at power coefficients from 0.30 to 0.70. A change in power coefficient from 0.70 to 0.90 reduced the peak efficiency about 5 percent. Blade stall at the tip sections became evident for a power coefficient of 0.91 when the advance-diameter ratio was reduced to 1.87. At a free-stream Mach number of 0.50, the highest propeller efficiencies were obtained for power coefficients from 0.80 to 1.00 at advance-diameter ratios above 2.90. At advance-diameter ratios below 2.90, the highest efficiencies were obtained for power coefficients of 0.60 and 0.70. The envelope of the efficiency curves decreased about 12 percent between advance-diameter ratios of 2.60 and 4.20. Local compressibility effects became evident for a power coefficient of 0.40 when the advance-diameter ratio was decreased to 1.75.
Author
Wind Tunnel Tests; Performance Tests; Propeller Efficiency; Propellers; Pressure Measurement; Thrust Loads

20030064141 NASA Ames Research Center, Moffett Field, CA, USA
Modeling and Simulation of a Helicopter Slung Load Stabilization Device
Cicolani, Luigi S.; Ehlers, George E.; [2002]; 12 pp.; In English; American Helicopter Society 58th Annual Forum, 11-13 Jun. 2002, Montreal, Canada
Contract(s)/Grant(s): RTOP 712-30-22; No Copyright; Avail: CASI; A03, Hardcopy

This paper addresses the problem of simulation and stabilization of the yaw motions of a cargo container slung load. The study configuration is a UH-60 helicopter carrying a 6ft x 6 ft x 8 ft CONEX container. This load is limited to 60 KIAS in operations and flight testing indicates that it starts spinning in hover and that spin rate increases with airspeed. The simulation reproduced the load yaw motions seen in the flight data after augmenting the load model with terms representing unsteady load yaw moment effects acting to reinforce load oscillations, and augmenting the hook model to include yaw resistance at the

hook. The use of a vertical fin to stabilize the load is considered. Results indicate that the CONEX airspeed can be extended to 110 kts using a 3x5 ft fin.
Author
Mathematical Models; Aerodynamic Loads; Flight Tests; H-60 Helicopter; Computerized Simulation; Aerodynamic Configurations; Stability

20030064157 Army Aviation and Missile Command, Moffett Field, CA, USA
Airfoil Design and Rotorcraft Performance
Bousman, William G.; January 2003; 13 pp.; In English; American Helicopter Society 58th Annual Forum, 11-13 Jun. 2002, Montreal, Canada; Copyright; Avail: CASI; A03, Hardcopy

The relationship between global performance of a typical helicopter and the airfoil environment, as represented by the airfoil angles of attack and Mach number, has been examined using the comprehensive analysis CAMRAD II. A general correspondence is observed between global performance parameters, such as rotor L/D, and airfoil performance parameters, such as airfoil L/D, the drag bucket boundaries, and the divergence Mach number. Effects of design parameters such as blade twist and rotor speed variation have been examined and, in most cases, improvements observed in global performance are also observed in terms of airfoil performance. The relations observed between global Performance and the airfoil environment suggests that the emphasis in airfoil design should be for good L/D, while the maximum lift coefficient performance is less important.
Author
Rotary Wing Aircraft; Airfoils; Aerodynamic Coefficients; Design Analysis; Drag; Lift

20030064162 NASA Ames Research Center, Moffett Field, CA, USA
Calculation of Tilt Rotor Aeroacoustic Model (TRAM DNW) Performance, Airloads, and Structural Loads
Johnson, Wayne; [2000]; 5 pp.; In English; American Helicopter Society Aeromechanics Specialists' Meeting, 13-15 Nov. 2000, Atlanta, GA, USA; No Copyright; Avail: CASI; A01, Hardcopy

The tiltrotor aircraft configuration has the potential to revolutionize air transportation by providing an economical combination of vertical take-off and landing capability with efficient, high-speed cruise flight. To achieve this potential it is necessary to have validated analytical tools that will support future tiltrotor aircraft development. These analytical tools must calculate tiltrotor aeromechanical behavior, including performance, structural loads, vibration, and aeroelastic stability, with an accuracy established by correlation with measured tiltrotor data. For many years such correlation has been performed for helicopter rotors (rotors designed for edgewise flight), but correlation activities for tiltrotors have been limited, in part by the absence of appropriate measured data. The recent test of the Tilt Rotor Aeroacoustic Model (TRAM) with a single, 1/4-scale V-22 rotor in the German-Dutch Wind Tunnel (DNW) now provides an extensive set of aeroacoustic, performance, and structural loads data. This paper will document correlation between the TRAM DNW measured performance and structural loads data and CAMRAD II calculations. CAMRAD II is a modern rotorcraft comprehensive analysis, with advanced models intended for application to tiltrotor aircraft as well as helicopters. Comprehensive analyses have received extensive correlation with performance and loads measurements on helicopter rotors. The proposed paper is the initial effort to perform an equally extensive correlation with tiltrotor data. The correlation will establish the level of predictive capability achievable with current technology; identify the limitations of the current aerodynamic, wake, and structural models of tiltrotors; and lead to recommendations for research to extend tiltrotor aeromechanics analysis capability. The purpose of the Tilt Rotor Aeroacoustic Model (TRAM) experimental project is to provide data necessary to validate tiltrotor performance and aeroacoustic prediction methodologies and to investigate and demonstrate advanced civil tiltrotor technologies. The TRAM project is a key part of the NASA Short Haul (Civil Tiltrotor) (SH(CT)) project . The SH(CT) project is an element of the Aviation Systems Capacity Initiative within NASA.
Author
Aeroacoustics; Tilt Rotor Aircraft; Structural Vibration; Aircraft Design; Aerodynamic Loads; Aeroelasticity; V-22 Aircraft; Prediction Analysis Techniques

20030064194 National Advisory Committee for Aeronautics. Lewis Flight Propulsion Lab., Cleveland, OH, USA
Altitude-Wind-Tunnel Investigation of a 3000-Pound-Thrust Axial-Flow Turbojet Engine, 6, Analysis of Effects of Inlet Pressure Losses
Sanders, Newell D.; Palasics, John; [1948]; 42 pp.; In English
Report No.(s): NACA-RM-E8C16a; No Copyright; Avail: CASI; A03, Hardcopy

The losses in the inlet air ducts, the diffusers, and the de-icing equipment associated with turbojet engine installations cause a reduction in the total pressure at the inlet of the engine and result in reduced thrust and increased specific fuel consumption. An analytical evaluation of the effects of inlet losses on the net thrust and the fuel economy of a 3000-pound-thrust axial flow turbojet engine with a two-stage turbine is presented. The analysis is based on engine performance characteristics that were determined from experiments in the NACA Cleveland altitude wind tunnel. The experimental investigation did not include tests in which inlet losses were systematically varied, but the effects of these losses can be accurately estimated from the experimentally determined performance characteristics of the engine.
Derived from text
Air Ducts; Axial Flow; Turbojet Engines; Two Stage Turbines; Wind Tunnel Tests; Jet Thrust

20030064260 National Inst. of Standards and Technology, Gaithersburg, MD
Two-Phase Airframe Shielding Performance Study using Ultra-wideband Measurement Systems
Grosvenor, C. A.; Johnk, R. T.; Novotny, D. R.; Canales, N.; Weil, C. M.; Jan. 2003; In English
Report No.(s): PB2003-103828; NISTIR-6622; No Copyright; Avail: National Technical Information Service (NTIS)
The National Institute of Standards and Technology participated in a comprehensive study of electromagnetic aircraft shielding. The effect consisted of two parts: (1) shielding measurements on a box model with a simple and precisely controlled geometry, and (2) a shielding evaluation of a Boeing 737-800 commercial airliner. The box measurements provided a baseline with which to study and to compare different shielding measurement techniques. A stepped-CW measurement system based on a vector network analyzer was used to perform direct-illumination measurements on the box, and to acquire a direct antenna-to-antenna coupling reference.
NTIS
Airframes; Antenna Couplers; Electromagnetic Shielding; Broadband

20030064339 Technische Univ., Delft
Measuring the Locations of the Disc Edge Vortices and Flapping Angles of the TU-LR Helicopter Model
Renier, B. S. M.; Jul. 1998; 84 pp.; In English
Report No.(s): PB2003-104366; M-846; Copyright; Avail: National Technical Information Service (NTIS)
An experimental investigation was conducted in the 2. 24m diameter Open Tunnel Facility of the Delft University of Technology to locate the disc vortices of a rotor at two advance ratios: mu = 0.091 (CT = 0.0055) and mu = 0.121 (CT=0.0062). A two-bladed 1.4 m diameter teeterrotor was used for this experiment. The rotor had rectangular untwisted blades with a NACA 0015 airfoil section and was driven by an 840 kW electromotor. Total pressure measurements were conducted in three planes perpendicular to the freestream flow to locate the disc edged vortices at both the retreating and advancing side. Smoke visualization was used for a qualitative investigation of the rotor wake flow. The results were compared to the analytical theory of Roos. The correlation showed large deviations between theory and the experiment. Besides the wake measurements, the flapping angles of the rotor at advance ratios between 0 and 0.15 were determined optically.
NTIS
Wind Tunnel Tests; Helicopter Design; Flapping; Vortices; Aircraft Models

20030064359 California Univ., Los Angeles, CA, USA
Design, Manufacturing, and Performance of Stitched Stiffened Composite Panels With and Without Impact Damage
Hahn, H. T.; Yang, J. M.; Suh, S. S.; Han, N.; October 2002; 100 pp.; In English
Report No.(s): PB2003-104614; No Copyright; Avail: CASI; A05, Hardcopy
The goal of this project was to develop the knowledge base required for certification of composite structures in air transportation systems in the form of a design-manufacturing-performance relationship. Specifically, this project contributes to an improved definition of certification requirements for substantiating damage tolerance and durability of structural elements based on textile composites. Fundamental questions concerning analytical certification procedure, spectrum versus constant-amplitude fatigue, effect of low-velocity impact on strength, and effect of manufacturing defects were addressed. Unstitched and stitched blade-stiffened panels applicable to airframe construction were investigated during Phases I and II of this project. The specific areas addressed were as follows: Analytical models to predict properties of unidirectional, fabric, and stitched fabric laminates; Manufacturing processes; Inspection methods; Predictions of buckling and postbuckling loads; Static compression properties; Constant-amplitude fatigue properties; Spectrum fatigue properties; and Effect of impact damage on static and fatigue properties.
NTIS
Composite Structures; Aircraft Construction Materials; Impact Damage; Loads (Forces)

20030064400 Northwestern Univ., Evanston, IL, USA
Practices and Perspectives in Outsourcing Aircraft Maintenance
Czepiel, E.; Mar. 2003; 78 pp.; In English
Report No.(s): PB2003-104527; No Copyright; Avail: CASI; A05, Hardcopy

The objective of this study was to identify the most common criteria that airlines use to select, monitor, and assess the performance of third-party maintenance facilities. These criteria formed the basis to develop performance measures and risk indicators for the operation of aviation maintenance repair stations. In particular, this study focused on outsourcing of major maintenance to larger repair stations. A limited data collection effort was conducted by interviewing representatives from both airlines and repair stations, primarily in their respective quality assurance departments. The most important measures and risk indicators are grouped into three areas. The most important measures for repair station capabilities include training of employees, experience level of employees, and tools and test equipment of the repair station. The most important measures for repair station performance include audit procedures, ability to meet turn times, number of work discrepancies, suspected unapproved part(s) infractions, and certification infractions of the repair station. The most important measures for repair station administration include the financial status of the repair station and change management of the repair station.
NTIS
Aircraft Maintenance; Civil Aviation; Commercial Aircraft

20030064402 Hughes Technical Center, Atlantic City International Airport, NJ, USA
Response of Aircraft Oxygen Generators Exposed to Elevated Temperatures
Blake, D.; Apr. 2003; 14 pp.; In English
Report No.(s): PB2003-105502; DOT/FAA/AR-TN03/35; No Copyright; Avail: CASI; A03, Hardcopy

The purpose of this testing was to determine the temperatures that would cause self-activation of sodium chlorate oxygen generators. The data will be used to establish the degree of thermal protection that would be required to prevent the activation of chemical oxygen generators should they be exposed to heat from a cargo compartment fire involving other materials. The minimum temperature that caused the activation of one of the generators was 600 degrees F. Due to uncertainties with other designs not tested and the physical properties of sodium chlorate, it is recommended that the generators not be exposed to temperatures above 400 degrees F.
NTIS
Oxygen Production; Sodium Compounds; Temperature Effects; Aircraft Equipment; Gas Generators

20030064479 NASA Langley Research Center, Hampton, VA, USA
Development and Flight Testing of an Autonomous Landing Gear Health-Monitoring System
Woodard, Stanley E.; Coffey, Neil C.; Gonzalez, Guillermo A.; Taylor, B. Douglas; Brett, Rube R.; Woodman, Keith L.; Weathered, Brenton W.; Rollins, Courtney H.; [2003]; 12 pp.; In English; IFASD 2003: International Forum on Aeroelasticity and Structural Dynamics 2003, 4-6 Jun. 2003, Amsterdam, Netherlands; Original contains color illustrations; Copyright; Avail: CASI; A03, Hardcopy

Development and testing of an adaptable vehicle health-monitoring architecture is presented. The architecture is being developed for a fleet of vehicles. It has three operational levels: one or more remote data acquisition units located throughout the vehicle; a command and control unit located within the vehicle; and, a terminal collection unit to collect analysis results from all vehicles. Each level is capable of performing autonomous analysis with a trained expert system. Communication between all levels is done with wireless radio frequency interfaces. The remote data acquisition unit has an eight channel programmable digital interface that allows the user discretion for choosing type of sensors; number of sensors, sensor sampling rate and sampling duration for each sensor. The architecture provides framework for a tributary analysis. All measurements at the lowest operational level are reduced to provide analysis results necessary to gauge changes from established baselines. These are then collected at the next level to identify any global trends or common features from the prior level. This process is repeated until the results are reduced at the highest operational level. In the framework, only analysis results are forwarded to the next level to reduce telemetry congestion. The system's remote data acquisition hardware and non-analysis software have been flight tested on the NASA Langley B757's main landing gear. The flight tests were performed to validate the following: the wireless radio frequency communication capabilities of the system, the hardware design, command and control; software operation; and, data acquisition, storage and retrieval.
Author
Systems Health Monitoring; Computer Programs; Computer Programming; Architecture (Computers); Landing Gear; Component Reliability; Computer Systems Design; Fault Detection; Aircraft Parts

20030064917 NASA Langley Research Center, Hampton, VA, USA
Pitch Oscillation Data and Analysis for a Large HSCT Semispan Wing
Scott, Robert C.; Silva, Walter A.; [2003]; 12 pp.; In English; IFASD 2003: International Forum on Aeroelasticity and Structural Dynamics 2003, 4-6 Jun. 2003, Amsterdam, Netherlands; Original contains black and white illustrations; No Copyright; Avail: CASI; A03, Hardcopy

Data from wind-tunnel tests of the Rigid Semispan Model are presented. The primary focus is on data obtained from testing on the Oscillating Turntable (OTT), The OTT is capable of oscillating models in pitch at various amplitudes and frequencies about mean angles of attack. Steady and unsteady pressure data is presented and compared to data from previous tests on a load balance and on a Pitch and Plunge Apparatus (PAPA).
Author
Wind Tunnel Tests; Semispan Models; Oscillations; Aeroelasticity; Wings

20030064921 National Advisory Committee for Aeronautics. Langley Aeronautical Lab., Langley Field, VA, USA
Aeroelastic Problems of Airplane Design
Kuessner, H. G.; Zeitschrift fuer Flugwissenschaften 3 Jahrgang, Heft 1; November 1956, pp. 1-18; In English
Report No.(s): NACA-TM-1402; No Copyright; Avail: CASI; A04, Hardcopy

The technical memorandum briefly summarizes the growth of interest in aeroelastic phenomena as aircraft speed increased and wing designs changed for faster aircraft. Different types of aircraft vibrations are then introduced, and the mathematical basis for the theory behind them is described. Special attention is given to static oscillations, wing flutter, and the flutter of skin panels. The last section of the memorandum deals with the prevention of flutter by design specifications.
CASI
Aeroelasticity; Wing Oscillations; Panel Flutter; Numerical Analysis; Aircraft Design

20030064926 NASA Langley Research Center, Hampton, VA, USA
A Conceptual Wing Flutter Analysis Tool for Systems Analysis and Parametric Design Study
Mukhopadhyay, Vivek; [2003]; 12 pp.; In English; IFASD 2003: International Forum on Aeroelasticity and Structural Dynamics 2003, 4-6 Jun. 2003, Amsterdam, Netherlands; Original contains color illustrations; No Copyright; Avail: CASI; A03, Hardcopy

An interactive computer program was developed for wing flutter analysis in the conceptual design stage. The objective was to estimate flutter instability boundaries of a typical wing, when detailed structural and aerodynamic data are not available. Effects of change in key flutter parameters can also be estimated in order to guide the conceptual design. This userfriendly software was developed using MathCad and Matlab codes. The analysis method was based on non-dimensional parametric plots of two primary flutter parameters, namely Regier number and Flutter number, with normalization factors based on wing torsion stiffness, sweep, mass ratio, taper ratio, aspect ratio, center of gravity location and pitch-inertia radius of gyration. These parametric plots were compiled in a Chance-Vought Corporation report from database of past experiments and wind tunnel test results. An example was presented for conceptual flutter analysis of outer-wing of a Blended-Wing-Body aircraft.
Author
Blended-Wing-Body Configurations; Flutter Analysis; Torsion

20030064935 National Advisory Committee for Aeronautics. Langley Aeronautical Lab., Langley Field, VA, USA
Contribution to the Design of Plywood Shells
Blumrich, S.; Luftfahrtforschung; October 1942; Volume 18, No. 9, pp. 331-337; In English
Report No.(s): NACA-TM-1031; No Copyright; Avail: CASI; A03, Hardcopy

The writer sets out to prove by calculation and experiment that by extensive utilization of the skin to carry axial load (reduction of stringer spacing) the stringer sections can be made small enough to afford a substantial saving in structural weight. This saving ranges from 5 to about 40 percent.
Author
Shells (Structural Forms); Plywood; Airframe Materials; Aircraft Structures

20030064945 NASA Langley Research Center, Hampton, VA, USA
Effect of Resonator Axis Skew on Normal Incidence Impedance
Parrott, Tony L.; Jones, Michael G.; Homeijer, Brian; [2003]; 8 pp.; In English; 9th AIAA/CEAS Aeroacoustics Conference and Exhibition, 12-14 May 2003, Hilton Head, SC, USA
Report No.(s): AIAA Paper 2003-3307; No Copyright; Avail: CASI; A02, Hardcopy

High by-pass turbofan engines have fewer fan blades and lower rotation speeds than their predecessors. Consequently, the noise suppression at the low frequency end of the noise spectra has become an increasing concern. This has led to a renewed emphasis on improving noise suppression efficiency of passive, duct liner treatments at the lower frequencies. For a variety of reasons, passive liners are comprised of locally-reacting, resonant absorbers. One reason for this design choice is to satisfy operational and economic requirements. The simplest liner design consists of a single layer of honeycomb core sandwiched between a porous facesheet and an impervious backing plate. These resonant absorbing structures are integrated into the nacelle wall and are very ef- ficient over a limited bandwidth centered on their resonance frequency. Increased noise suppression bandwidth and greater suppression at lower frequencies is typically achieved for conventional liners by increasing the liner depth and incorporating thin porous septa into the honeycomb core. However, constraints on liner depth in modern high by-pass engine nacelles severely limit the suppression bandwidth extension to lower frequencies. Also, current honeycomb core liners may not be suitable for irregular geometric volumes heretofore not considered. It is of interest, therefore, to find ways to circumvent liner depth restrictions and resonator cavity shape constraints. One way to increase effective liner depth is to skew the honeycomb core axis relative to the porous facesheet surface. Other possibilities are to alter resonator cavity shape, e.g. high aspect ratio, narrow channels that possibly include right angle bends, 180. channel fold-backs, and splayed channel walls to conform to irregular geometric constraints. These possibilities constitute the practical motivation for expanding impedance modeling capability to include unconventional resonator orientations and shapes. The work reported in this paper is in the nature of a progress report and is limited to examining the implications of resonator axis skew on the composite normal incidence impedance of an array of resonator channels. Specifically, experimental results are compared with a modified impedance prediction model for highaspect- ratio, rectangular, resonator channels with varying amounts of skew relative to the incident particle velocity. It is shown that for resonator channel widths of 1 to 2 mm, aspect ratios of 25 to 50, and skew angles of zero to sixty degrees, the surface impedance of test models can be predicted with good accuracy. Predicted resistances and reactances are particularly well correlated through the first resonance and first anti-resonance for all six test models investigated. Beyond the first anti-resonance, the impedance prediction model loses the ability to predict details of resistance and reactance but still predicts the mean trends very well.
Author
Resonators; Turbofan Engines; Impedance; Mathematical Models

20030065034 NASA Langley Research Center, Hampton, VA, USA
An Inboard-Wing Arrangement for High-Capacity Airlift and Sealift Vehicles
Spearman, M. Leroy; January 2003; 5 pp.; In English; NATO Research and Technology Agency Applied Vehicle Technology Panel Symposium On Novel Vehicle Concepts and Emerging Vehicle Technologies, 7-10 Apr. 2003, Brussels, Belgium; No Copyright; Avail: CASI; A01, Hardcopy

The purpose of this paper is to consider the application of an inboard-wing design arrangement to high-capacity airlift and sealift logistic support vehicles. The inboard-wing arrangement consists of a relatively low aspect-ratio rectangular wing that has large bodies attached to each wing tip. All of the required wing area is located between the two bodies and there are no outboard cantilevered wing panels as are found on conventional aircraft. When compared to a conventional aircraft design the use of an inboard-wing design would permit an increase in capacity within more reasonable geometric constraints. In addition, such a design would provide the increased lift required without creating a potentially dangerous trailing vortex wake. The concept could be applied to an airship by utilizing twin hulls connected with an inboard-wing. The hulls would contain helium to provide buoyant lift. The connecting wing would provide additional kinetic lift in forward flight. The additional lift would permit greater combinations of payload and altitude than would be possible with a conventional airship with buoyant lift alone. The concept could also be applied to a sealift vehicle by connecting twin hulls with an inboard wing. The under surface of the wing could provide a boundary for an air cushion that would permit operation as a wing-in-ground (WIG) vehicle with a speed advantage over surface craft. In addition, the wing would provide some lift that would enhance the payload capability.
Author
Transport Aircraft; Aircraft Structures; Body-Wing Configurations; Aircraft Design

20030065096 Air Force Inst. of Tech., Wright-Patterson AFB, OH, USA
Computational Fluid Dynamics Investigation of Vortex Breakdown for a Delta Wing at High Angle of Attack
Freeman, Jacob A.; Mar. 2003; 172 pp.; In English; Original contains color illustrations
Report No.(s): AD-A413228; AFIT/GAE/ENY/03-3; No Copyright; Avail: CASI; A08, Hardcopy

Using the commercially available FLUENT 3-D flow field solver, this research effort investigated vortex breakdown over a delta wing at high angle of attack (a) in preparation for investigation of active control of vortex breakdown using steady, along-core blowing. A flat delta-shaped half-wing with sharp leading edge and sweep angle of 600 was modeled at a 180 in

a wind tunnel at Mach 0.04 and Reynolds number of 3,4 x 10(sub 5). A hybrid (combination of structured and unstructured) numerical mesh was generated to accommodate blowing ports on the wing surface. Results for cases without and with along-core blowing included comparison of various turbulence models for predicting both flow field physics and quantitative flow characteristics, FLUENT turbulence models included Spalart-Allmaras (S-A), Renormalization Group k-e, Reynolds Stress (RSM), and Large Eddy Simulation (LES), as well as comparison with laminar and inviscid models. Mesh independence was also investigated, and solutions were compared with experimentally determined results and theoretical prediction, These research results show that, excepting the LES model for which the computational mesh was insufficiently refined and which was not extensively investigated, none of the turbulence models above, as implemented with the given numerical grid, generated a solution which was suitably comparable to the experimental data. Much more work is required to find a suitable combination of numerical grid and turbulence model.
DTIC
Angle Of Attack; Computational Fluid Dynamics; Delta Wings; Vortex Breakdown; Wind Tunnels; Flow Distribution; Three Dimensional Models

20030065156 Universal Energy Systems, Inc., Dayton, OH, USA
Thermal Management Research for Power Generation. Delivery Order 0002 -Volume 1: Plain Fin Array Cooler for Electronics Cooling
Lin, Lanchao; Dec. 2002; 35 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F33615-98-D-2867; Proj-3145
Report No.(s): AD-A413410; UES-P183-03-602-VOL-1; AFRL-PR-WP-TR-2003-2051; No Copyright; Avail: CASI; A03, Hardcopy

A fin array cooler was developed to cool a substrate of high-heat flux electronics. Plain copper fin strips were soldered onto the substrate to minimize the contact thermal resistance between the electronics and heat sink. Two new types of fin arrays based on offset fin strips and aligned fin strips were employed in order to mitigate the thermal stress problem found in the integral finned substrate concept. The cooler with different fin strip layouts was tested using polyalphaolefin as the coolant for flow Reynolds number variation from 53 to 482. The fin strip gaps of 0.13, 0. 38, and 1.0 mm were experimented. Heat transfer data for different fin strip layouts were obtained under various operating conditions and compared. It was shown that, in general, the heat transfer coefficient was 29 to 36 percent higher for the offset fin strip layout than for the aligned fin strip layout. New heat transfer correlations for offset fin strip layout and aligned fin strip layout are presented.
DTIC
Electronic Equipment; Aircraft Equipment; Liquid Cooling; Cooling Fins; Contact Resistance; Heat Transfer

20030065178 NASA Langley Research Center, Hampton, VA, USA
Measurement and Control of the Variability of Scanning Pressure Transducer Measurements
Kuhl, David D.; Everhart, Joel L.; Hallissy, James B.; 2003; 12 pp.; In English; 21st AIAA Applied Aerodynamics Conference, 23-26 Jun. 2003, Orlando, FL, USA
Report No.(s): AIAA Paper 2003-3816; Copyright; Avail: CASI; A03, Hardcopy

This paper describes the new wall pressure measurement system and data-quality monitoring software installed at 14x22 Ft subsonic tunnel at the NASA Langley Research Center. The monitoring software was developed to enable measurement and control of the variability of the reference pressures and approximately 400 tunnel wall pressure measurements. Variability of the system, based upon data acquired over a year of wind tunnel tests and calibrations, is presented. The level of variation of the wall pressure measurements is shown to be predictable.
Author
Pressure Measurement; Subsonic Wind Tunnels

20030065185 Lehigh Univ., Bethlehem, PA
Fatigue 2002 Conference
Wei, Robert P.; Dec. 31, 2002; 11 pp.; In English
Contract(s)/Grant(s): F49620-02-1-0150
Report No.(s): AD-A413359; AFRL-SR-AR-TR-03-0129; No Copyright; Avail: CASI; A03, Hardcopy

This report highlights the proceedings of the Special Topic Session on 'Life-Cycle Management of Aging Aircraft' that was held as a part of Fatigue 2002 in Stockholm, Sweden, 2-7 June 2002. Fatigue 2002 is the 8th in the series of International

Fatigue Congresses which began in Stockholm in 1981 and are recognized as the pre-eminent world conference in the field of fatigue.
DTIC
Aircraft Maintenance; Fatigue (Materials)

20030065200 Little (Arthur D.), Inc., Cambridge, MA
Modular Aircraft Support System (MASS) Proof-of-Concept Demonstrator Field Demonstration
Hablanian, David A.; Bryant, Michael; Carbonell, Nelson; Chertok, Allan; McTaggart, Paul; Oct. 2001; 70 pp.; In English
Contract(s)/Grant(s): F41624-96-D-5002; Proj-2745
Report No.(s): AD-A413306; 73058-50; AFRL-HE-WP-TR-2002-0217; No Copyright; Avail: CASI; A04, Hardcopy

The Modular Aircraft Support System (MASS) program is part of an effort to reduce the deployment footprint and increase the supportability of aerospace ground equipment (AGE). The MASS program was initiated by the USA Air Force Research Laboratory (AFRL). The contract directed Arthur D Little, Inc (ADL) to develop and evaluate concepts, and design, fabricate and test five MASS modules (and a chassis) in order to demonstrate the key features of the MASS design. The MASS Cart met all performance requirements during laboratory testing at ADL. The MASS program concluded with the successful demonstration of the MASS Cart at Edwards AFB, CA, using actual aircraft (F-15, F-16, B-52). This report, the Final Report for the field demonstration (Delivery Order 0012), also summarizes the other Delivery Orders involving the MASS cart.
DTIC
Aircraft Design; Ground Support Equipment; Fabrication; Modules; Performance Tests

20030065214 National Advisory Committee for Aeronautics. Lewis Flight Propulsion Lab., Cleveland, OH, USA
Performance Investigations of a Large Centrifugal Compressor from an Experimental Turbojet Engine
Ginsburg, Ambrose; Creagh, John W. R.; Ritter, William K.; October 18, 1948; 58 pp.; In English; Original contains black and white illustrations
Report No.(s): NACA-RM-E8H13; No Copyright; Avail: CASI; A04, Hardcopy

An investigation was conducted on a large centrifugal compressor from an experimental turbojet engine to determine the performance of the compressor and to obtain fundamental information on the aerodynamic problems associated with large centrifugal-type compressors. The results of the research conducted on the compressor indicated that the compressor would not meet the desired engine-design air-flow requirements (78 lb/sec) because of an air-flow restriction in the vaned collector (diffuser). Revision of the vaned collector resulted in an increased air-flow capacity over the speed range and showed improved matching of the impeller and diffuser components. At maximum flow, the original compressor utilized approximately 90 percent of the available geometric throat area at the vaned-collector inlet and the revised compressor utilized approximately 94 percent, regardless of impeller speed. The ratio of the maximum weight flows of the revised and original compressors were less than the ratio of effective critical throat areas of the two compressors because of the large pressure losses in the impeller near the impeller inelt and the difference increased with an increase in impeller speed. In order to further increase the pressure ratio and maximum weight flow of the compressor, the impeller must be modified to eliminate the pressure losses therein.
Author
Centrifugal Compressors; Turbojet Engines; Wind Tunnel Tests; Aerodynamic Characteristics; Air Flow; Impellers; Engine Design; Computational Fluid Dynamics

20030065215 National Advisory Committee for Aeronautics. Langley Aeronautical Lab., Langley Field, VA, USA
Preliminary Tests of a Burner for Ram-Jet Applications
Huber, Paul W.; January 15, 1947; 15 pp.; In English
Report No.(s): NACA-RM-L6K08b; No Copyright; Avail: CASI; A03, Hardcopy

Preliminary tests have been made of a small burner to meet the requirements for application to supersonic ram jets. The principal requirements were taken as: (1) efficient combustion in a high-velocity air stream, (2) utilization for combustion of only a small fraction of the air passing through the unit, (3) low resistance to air flow, (4) simple construction, and (5) light weight. Tests of a small burner were carried to stream velocities of nearly 150 feet per second and fuel rates such that one-eighth to one-fourth of the total air was involved in combustion. Commercial propane was selected as the fuel since its low boiling point facilitated vaporization. Combustion which was 80 percent complete along with low aerodynamic losses was obtained by injecting the fuel evenly, prior to ignition, and allowing it to mix with the air without appreciably disturbing the

stream. The pressure drop due to frictional losses around the burner and to the adjacent inside walls of the ram jet is small compared with the pressure drop due to combustion.
Derived from text
Burners; Ramjet Engines; Air Flow; Supersonic Jet Flow; Combustion Efficiency

20030065218 National Advisory Committee for Aeronautics. Langley Aeronautical Lab., Langley Field, VA, USA
Analysis of Experimental Investigations of the Planing Process of the Surface of Water
Sottorf, W.; Jahrbuch 1937 der Deutschen Luftfahrtforschung; March 1944, pp. 320-339; In English
Report No.(s): NACA-TM-1061; No Copyright; Avail: CASI; A04, Hardcopy

Pressure distribution and spray measurements were carried out on rectangular flat and V-bottom planing surfaces. Lift, resistance, and center of pressure data are analyzed and it is shown how these values may be computed for the pure planing procees of a flat or V-bottom suface of arbitrary beam, load and speed, the method being illustrated with the aid of an example.
Author
Planing; Seaplanes; Floats

20030065238 NASA Langley Research Center, Hampton, VA, USA
Transition in a Supersonic Boundary-Layer Due to Roughness and Acoustic Disturbances
Balakumar, P.; [2003]; 20 pp.; In English; 33rd Fluid Dynamics Conference, 23-26 Jun. 2003, Orlando, FL, USA
Report No.(s): AIAA Paper 2003-3589; No Copyright; Avail: CASI; A03, Hardcopy

The transition process induced by the interaction of an isolated roughness with acoustic disturbances in the free stream is numerically investigated for a boundary layer over a flat plate with a blunted leading edge at a free stream Mach number of 3.5. The roughness is assumed to be of Gaussian shape and the acoustic disturbances are introduced as boundary condition at the outer field. The governing equations are solved using the 5'h-~rder accurate weighted essentially non-oscillatory (WENO) scheme for space discretization and using third- order total-variation-diminishing (TVD) Runge- Kutta scheme for time integration. The steady field induced by the two and three-dimensional roughness is also computed. The flow field induced by two-dimensional roughness exhibits different characteristics depending on the roughness heights. At small roughness heights the flow passes smoothly over the roughness, at moderate heights the flow separates downstream of the roughness and at larger roughness heights the flow separates upstream and downstream of the roughness. Computations also show that disturbances inside the boundary layer is due to the direct interaction of the acoustic waves and isolated roughness plays a minor role in generating instability waves.
Author
Supersonic Boundary Layers; Navier-Stokes Equation; Roughness

20030065244 National Advisory Committee for Aeronautics. Lewis Flight Propulsion Lab., Cleveland, OH, USA
Experimental Pressure Distribution on Fuselage Nose and Pilot Canopy of Supersonic Airplane at Mach Number 1.90
Wyatt, DeMarquis D.; October 15, 1948; 60 pp.; In English; Original contains black and white illustrations
Report No.(s): NACA-RM-E8I07; No Copyright; Avail: CASI; A04, Hardcopy

An investigation of the pressure distribution on the fuselage nose and the pilot canopy of a supersonic airplane model has been conducted at a Mach number of 1.90 over a wide range of angles of attack and yaw. Boundary layer separation apparently occurred from the upper surface at angles of attack above 24 degrees and from the lower surface at minus 15 degrees. No separation from the sides of the fuselage was evident at yaw angles up to 12 degrees.
Author
Supersonic Aircraft; Fuselages; Canopies; Pressure Distribution

20030065250 NASA Langley Research Center, Hampton, VA, USA
Computational Study of Fluidic Thrust Vectoring using Separation Control in a Nozzle
Deere, Karen; Berrier, Bobby L.; Flamm, Jeffrey D.; Johnson, Stuart K.; [2003]; 11 pp.; In English; The 21st AIAA Applied Aerodynamics Conference, 23-26 Jun. 2003, Orlando, FL, USA
Report No.(s): AIAA Paper 2003-3803; No Copyright; Avail: CASI; A03, Hardcopy

A computational investigation of a two- dimensional nozzle was completed to assess the use of fluidic injection to manipulate flow separation and cause thrust vectoring of the primary jet thrust. The nozzle was designed with a recessed cavity to enhance the throat shifting method of fluidic thrust vectoring. The structured-grid, computational fluid dynamics code PAB3D was used to guide the design and analyze over 60 configurations. Nozzle design variables included cavity convergence

angle, cavity length, fluidic injection angle, upstream minimum height, aft deck angle, and aft deck shape. All simulations were computed with a static freestream Mach number of 0.05. a nozzle pressure ratio of 3.858, and a fluidic injection flow rate equal to 6 percent of the primary flow rate. Results indicate that the recessed cavity enhances the throat shifting method of fluidic thrust vectoring and allows for greater thrust-vector angles without compromising thrust efficiency.
Author
Nozzle Design; Thrust Vector Control; Fluid Injection; Exhaust Nozzles

20030065295 National Advisory Committee for Aeronautics. Lewis Flight Propulsion Lab., Cleveland, OH, USA
Design Data for Graphical Construction of Two-Dimensional Sharp-Edge-Throat Supersonic Nozzles
Shames, Harold; Seashore, Ferris L.; December 2, 1948; 29 pp.; In English; Original contains black and white illustrations
Report No.(s): NACA-RM-E8J12; No Copyright; Avail: CASI; A03, Hardcopy

Design data are presented for the graphical construction of two-dimensional sharp-edge-throat supersonic nozzles of minimum length for test-section Mach numbers from 1.20 to 10.00. The method of characteristics used in the design is briefly reviewed.
Author
Supersonic Nozzles; Throats; Two Dimensional Flow; Nozzle Design; Method Of Characteristics; Sharp Leading Edges

20030065299 Air Force Inst. of Tech., Wright-Patterson AFB, OH, USA
A Service Life Analysis of Coast Guard C-130 Aircraft
Duff, Jonathan B.; Mar. 2003; 148 pp.; In English; Original contains color illustrations
Report No.(s): AD-A413132; AFIT/GAQ/ENS/03-02; No Copyright; Avail: CASI; A07, Hardcopy

The U.S. Coast Guard is facing a dramatic transformation of its forces to meet current and future service requirements. Responding to this transformation, the Coast Guard has initiated the Deepwater System, a complete review of the offshore mission requirements and the modernization of its infrastructure. Deepwater will review and modernize the Coast Guard's aviation assets, improving aircraft systems, airborne sensors, and communications and information management systems. However, these capability advancements will take time and money to implement, and will require careful management of the current resources. One of the oldest and most versatile Coast Guard aircraft is the C-130. Service life decisions regarding the C-130 are complicated by aging aircraft issues, and the introduction of the C-130. It will be difficult for Coast Guard decision makers to select bow program funding should be executed within the C- 130 fleet. This study examines bow long the current airframes can safely remain in service, bow mud the remaining service life will cost, and what level of availability can be realized for the rest of the service life. Answering these questions, it will then be possible to perform an insightful analysis of alternatives for modernizing, sustaining, and if necessary retiring the C-130s.
DTIC
Airborne Equipment; C-130 Aircraft; Service Life; Airframes

20030065302 National Advisory Committee for Aeronautics. Langley Aeronautical Lab., Langley Field, VA, USA
Lift Increase by Blowing Out Air, Tests on Airfoil of 12 Percent Thickness, Using Various Types of Flap
Schwier, W.; June 1947; 35 pp.; In English
Report No.(s): NACA-TM-1148; No Copyright; Avail: CASI; A03, Hardcopy

The NACA 23012-4 airfoil was investigated for the purpose of increasing lift by means of blowing out air from the wing, in conjunction with the effect of plain flap of variable contour and slotted flap of 25 percent chord length. The wing also was provided with a hinged nose, to be deflected at will. Air was blown out frcm the wing immediately in front of the flap; also at the opening between wing and hinged nose,tangentially to the surface of the wing. Another device employed to increase maximum lift was a movable slat, to be opened to form a clot. Lift was measured in relation to the volume of blown-out air and considerable increases were observed with increasing volume.
Author
Airfoils; Flaps (Control Surfaces); Lift

20030065307 Air Force Inst. of Tech., Wright-Patterson AFB, OH, USA
Simulation of Autonomic Logistics System (ALS) Sortie Generation
Faas, Paul D.; Mar. 2003; 104 pp.; In English; Original contains color illustrations
Report No.(s): AD-A413196; AFIT/GOR/ENS/03-07; No Copyright; Avail: CASI; A06, Hardcopy

The Air Force needs tools for analysis and evaluation of new logistic operational concepts. The purpose of this research

was to conflict a discrete event simulation model of the aircraft sortie generation process to permit what-if analyses of these concepts. The current Air Force logistics operations system is reactive in nature meaning that after the aircraft detects a part failure, the maintenance person must perform fault isolation procedures and then steps are taken to repair or replace the faulty item. The Autonomic Logistics System (ALS) concept changes the reactive process into a proactive one with the employment of technologies such as prognostics and distributed information network. Certain logistics tasks can be handled automatically or autonomously i. e. ordering parts, requesting maintenance specialists, and notifying maintenance control center. The conclusion of this research was that an aircraft equipped with the ALS increased the measures of effectiveness (MOE) like mission capable rate and flying scheduling effectiveness tip to a point. The research indicated that as ALS false alarms grew these MOEs decreased and eventually were worse than the baseline system. However, it is worth noting that this research simulated a worst case false alarm scenario, a part removal and replacement with each false alarm.
DTIC
Logistics; Computerized Simulation; Aircraft Maintenance; Autonomy; Military Operations

06
AVIONICS AND AIRCRAFT INSTRUMENTATION

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

20030053042 NASA Ames Research Center, Moffett Field, CA, USA
Learning About Cockpit Automation: From Piston Trainer to Jet Transport
Casner, Stephen M.; February 2003; 25 pp.; In English
Contract(s)/Grant(s): RTOP 728-20-30
Report No.(s): NASA/TM-2003-212260; NAS 1.15:212260; IH-033; No Copyright; Avail: CASI; A03, Hardcopy

Two experiments explored the idea of providing cockpit automation training to airline-bound student pilots using cockpit automation equipment commonly found in small training airplanes. In a first experiment, pilots mastered a set of tasks and maneuvers using a GPS navigation computer, autopilot, and flight director system installed in a small training airplane Students were then tested on their ability to complete a similar set of tasks using the cockpit automation system found in a popular jet transport aircraft. Pilot were able to successfully complete 77\% of all tasks in the jet transport on their first attempt. An analysis of a control group suggests that the pilot's success was attributable to the application of automation principles they had learned in the small airplane. A second experiment looked at two different ways of delivering small-aeroplane cockpit automation training: a self-study method, and a dual instruction method. The results showed a slight advantage for the self-study method. Overall, the results of the two studies cast a strong vote for the incorporation of cockpit automation training in curricula designed for pilot who will later transition to the jet fleet.
Author
Cockpits; Students; Training Devices; Education; Automatic Pilots

20030053052 NASA Ames Research Center, Moffett Field, CA, USA
Color and Luminance Analysis of the Space Shuttle Multifunction Display Units(MDUs)
Johnson, Walter W.; Liao, Min-Ju; Tse, Stephen; February 2003; 30 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): RTOP 538-04-23
Report No.(s): NASA/CR-2003-212258; NAS 1.26:212258; IH-035; No Copyright; Avail: CASI; A03, Hardcopy

The purpose of this evaluation is to measure and analyze the colors that can be shown on the Multifunction Display Units (MDUs) of the Space Shuttle cockpit. The evaluation was conducted in the JSC Avionics Engineering Laboratory (JAEL) in building 16A at NASA Johnson Space Center. The JAEL contains a suite of 11 MDUs, each of which can be configured to show colors based on input values of the MDU red, green and blue (RGB) channels. Each of the channels has a range of 0 to 15. For example, bright green is produced by setting RGB to 0,15,0, and orange is produced by setting RGB to 15,4,0. The Cockpit Avionics Upgrade (CAU) program has specified the RGB settings for 14 different colors in the Display Design document (Rev A, 29 June 2001). The analysis in this report may help the CAU program determine better RGB settings for the colors.
Author
Evaluation; Color; Measurement; Display Devices

20030063980 National Advisory Committee for Aeronautics. Langley Aeronautical Lab., Langley Field, VA, USA
The Effect on the Sperry Directional Gyro in Turning
RosselliDelTurco, Rossello; August 1946, No. 18, pp. 373-380; In English; No Copyright; Avail: CASI; A03, Hardcopy

The present report is concerned with an analytical treatment of the effects of the transverse inclination of an airplane in a turn on the indication of the directional gyro. It is found that the extreme inclinations which the airplane must necessarily assume for a correct turn in the approaches executed at high speed and small radius of curvature, renders the indications of the instrument worthless during such maneuvers.
Author
Aircraft Maneuvers; Gyroscopes; Error Analysis; Instrument Errors; Flight Instruments; Equations Of Motion

20030064941 NASA Langley Research Center, Hampton, VA, USA
Using X-band Weather Radar Measurements to Monitor the Integrity of Digital Elevation Models for Synthetic Vision Systems
Young, Steve; UijtdeHaag, Maarten; Sayre, Jonathon; [2003]; 11 pp.; In English; 21st Digital Avionics Systems Conference, 27-31 Oct. 2002, Irvine, CA, USA; Original contains color and black and white illustrations
Contract(s)/Grant(s): NCC1-351; Copyright; Avail: CASI; A03, Hardcopy

Synthetic Vision Systems (SVS) provide pilots with displays of stored geo-spatial data representing terrain, obstacles, and cultural features. As comprehensive validation is impractical, these databases typically have no quantifiable level of integrity. Further, updates to the databases may not be provided as changes occur. These issues limit the certification level and constrain the operational context of SVS for civil aviation. Previous work demonstrated the feasibility of using a realtime monitor to bound the integrity of Digital Elevation Models (DEMs) by using radar altimeter measurements during flight. This paper describes an extension of this concept to include X-band Weather Radar (WxR) measurements. This enables the monitor to detect additional classes of DEM errors and to reduce the exposure time associated with integrity threats. Feature extraction techniques are used along with a statistical assessment of similarity measures between the sensed and stored features that are detected. Recent flight-testing in the area around the Juneau, Alaska Airport (JNU) has resulted in a comprehensive set of sensor data that is being used to assess the feasibility of the proposed monitor technology. Initial results of this assessment are presented.
Author
Enhanced Vision; Multisensor Applications; Pattern Recognition; Pilot Support Systems; Digital Elevation Models; Knowledge Bases (Artificial Intelligence); Meteorological Radar; Error Analysis

20030065031 NASA Langley Research Center, Hampton, VA, USA
Feature Visibility Limits in the Non-Linear Enhancement of Turbid Images
Jobson, Daniel J.; Rahman, Zia-ur; Woodell, Glenn A.; [2003]; 8 pp.; In English; AeroSense 2003: Aerospace/Defense Sensing, Simulation, and Controls, 21-25 Apr. 2003, Orlando, FL, USA; Original contains color illustrations
Contract(s)/Grant(s): NCC1-01030; No Copyright; Avail: CASI; A02, Hardcopy

The advancement of non-linear processing methods for generic automatic clarification of turbid imagery has led us from extensions of entirely passive multiscale Retinex processing to a new framework of active measurement and control of the enhancement process called the Visual Servo. In the process of testing this new non-linear computational scheme, we have identified that feature visibility limits in the post-enhancement image now simplify to a single signal-to-noise figure of merit: a feature is visible if the feature-background signal difference is greater than the RMS noise level. In other words, a signal-to-noise limit of approximately unity constitutes a lower limit on feature visibility.
Author
Signal To Noise Ratios; Imagery; Nonlinearity; Visual Acuity; Flight Conditions

20030065211 Air Force Research Lab., Wright-Patterson AFB, OH
Transmissivity and Night Vision Goggle Compatibility Data for Select Aircraft Transparencies
Pinkus, Alan R.; Task, Harry L.; Dixon, Sharon A.; Jan. 2003; 376 pp.; In English
Contract(s)/Grant(s): Proj-7184
Report No.(s): AD-A413134; AFRL-HE-WP-TR-2003-0015; No Copyright; Avail: CASI; A17, Hardcopy

This document is a compilation of spectral transmissivity data measured from numerous aircraft transparencies. The spectral transmissivity of each part was measured from wavelengths of 450 nm through 950 nm. Some parts were also measured at several different angles relative to the optical axis of the spectroradiometric instrument. The measurements

yielded both visible light and near infrared (NIR) spectra. The NIR data were used to calculate night vision goggle-weighted transmissivity (TNVG) values (Pinkus and Task, 1997). TNVG is a measure of a transparency's compatibility when it is used in conjunction with night vision goggles (NVGs). NVGs utilize the NIR portion (600 nm through 950 nm) of the night sky ambient illumination. Generally speaking, the higher the TNVG coefficient, the higher the NVG visual performance (Pinkus & Task, 1998a; Pinkus & Task, 1997).
DTIC
Night Vision; Goggles; Visual Tasks; Transmissivity

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*.

20030053060 NASA Glenn Research Center, Cleveland, OH, USA
Development of a Turbofan Engine Simulation in a Graphical Simulation Environment
Parker, Khary I.; Guo, Ten-Heui; November 26, 2001; 26 pp.; In English; JANNAF Interagency Propulsion Joint Committee Meeting, 8-12 Apr. 2002, Destin, FL, USA
Contract(s)/Grant(s): WBS 22-704-30-02; RTOP 704-01-30
Report No.(s): Rept-1; E-13718; No Copyright; Avail: CASI; A03, Hardcopy

This paper presents progress on 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 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; Simulation; Digital Systems

20030063932 National Advisory Committee for Aeronautics. Langley Aeronautical Lab., Langley Field, VA, USA
On the Automatic Regulation of Output in Centrifugal Compressors
Ris, V. F.; Sovetskos Kotloturbostroenie; July 1945, No. 8, pp. 261-269; In English
Report No.(s): NACA-TM-1081; Copyright; Avail: CASI; A03, Hardcopy

This paper discussed the theory and design of dynamic 'pressure augmentors' (diaphragms equal orifice plates and nozzles) and various forms of 'pressure multipliers' (simple venturi tubes, Rateau-type multiple venturis, and a combination of shaped nozzle and simple venturi developed by the author). No complete theory of pressure multiplication is yet available; conditions of governing are discussed in relation to pressure-augmenting devices fitted either on the suction or the pressure side of the blower; fluctuations of output and power consumption caused by the presence of an augmentor are analyzed with the result that fitting on the pressure side appears generally preferable. Some considerations on the suitable design and selection of pressure-augmenting devices are appended.
Author
Centrifugal Compressors; Automatic Control; Nozzle Design; Power Efficiency; Dynamic Pressure; Mechanical Devices

20030063942 National Advisory Committee for Aeronautics. Lewis Flight Propulsion Lab., Cleveland, OH, USA
Knock-Limited Power Outputs from a CFR Engine Using Internal Coolants, 3, Four Alkyl Amines, Three Alkanolamines, Six Amides, and Eight Heterocyclic Compounds
Imming, Harry S.; Bellman, Donald R.; February 3, 1947; 16 pp.; In English; Original contains black and white illustrations
Report No.(s): NACA-RM-E6L05a; No Copyright; Avail: CASI; A03, Hardcopy

An investigation of the antiknock effectiveness of various additive-water solutions when used as internal coolants has been conducted at the NACA Cleveland laboratory. Nine compounds have been previously run in a CFR engine and the results are presented. In an effort to find a good anti-knock-coolant additive with more desirable physical properties than those of the

nine compounds previously investigated, water solutions of four alkyl amines, three alkanolamines, six amides, and eight heterocyclic compounds were investigated and the results are presented.
Derived from text
Antiknock Additives; Coolants; Heterocyclic Compounds; Aircraft Engines; Physical Properties

20030063948 Allison Engine Co., Indianapolis, IN, USA
Mixing and NO(x) Emission Calculations of Confined Reacting Jet Flows in a Cylindrical Duct
Holdeman, James D., Technical Monitor; Oechsle, Victor L.; June 2003; 222 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): NAS3-25950; WBS 22-714-01-38
Report No.(s): NASA/CR-2003-212321; E-13908; NAS 1.26:212321; No Copyright; Avail: CASI; A10, Hardcopy

Rapid mixing of cold lateral jets with hot cross-stream flows in confined configurations is of practical interest in gas turbine combustors as it strongly affects combustor exit temperature quality, and gaseous emissions in for example rich-lean combustion. It is therefore important to further improve our fundamental understanding of the important processes of dilution jet mixing especially when the injected jet mass flow rate exceeds that of the cross-stream. The results reported in this report describe some of the main flow characteristics which develop in the mixing process in a cylindrical duct. A 3-dimensional tool has been used to predict the mixing flow field characteristics and NOx emission in a quench section of an RQL combustor, Eighteen configurations have been analyzed in a circular geometry in a fully reacting environment simulating the operating condition of an actual RQL gas turbine combustion liner. The evaluation matrix was constructed by varying three parameters: 1) jet-to-mainstream momentum-flux ratio (J), 2) orifice shape or orifice aspect ratio, and 3) slot slant angle. The results indicate that the mixing flow field significantly varies with the value of the jet penetration and subsequently, slanting elongated slots generally improve the mixing uniformity at high J conditions. Round orifices produce more uniform mixing and low NO(x) emissions at low J due to the strong and adequate jet penetration. No significant correlation was found between the NO(x) production rates and the mixing deviation parameters, however, strong correlation was found between NO(x) formation and jet penetration. In the computational results, most of the NO(x) formation occurred behind the orifice starting at the orifice wake region. Additional NO(x) is formed upstream of the orifice in certain configurations with high J conditions due to the upstream recirculation.
Author
Nitrogen Oxides; Exhaust Emission; Computation; Jet Flow; Cylindrical Bodies; Ducts

20030063961 National Advisory Committee for Aeronautics. Lewis Flight Propulsion Lab., Cleveland, OH, USA
Characteristics of a Hot Jet Discharged from a Jet-Propulsion Engine
Fleming, William A.; December 27, 1946; 23 pp.; In English
Report No.(s): NACA-RM-E6L27a; No Copyright; Avail: CASI; A03, Hardcopy

An investigation of a heated jet was conducted in conjunction with tests of an axial-flow jet-propulsion engine in the Cleveland altitude wind tunnel. Pressure and temperature surveys were made across the jet 10 and 15 feet behind the jet-nozzle outlet of the engine. Surveys were obtained at pressure altitudes of 10,000, 20,000, 30,000, and 40,000 feet with test-section velocities from 30 to 110 feet per second and test-section temperatures from 60 F to -50 F. From measurements taken throughout the operable range of engine speeds, tail-pipe outlet temperatures from 500 F to 1250 F and jet velocities from 400 to 2200 feet per second were obtained. The jet-survey data presented extend the work previously done with low-velocity and low-temperature jets to the region of high velocities and high temperatures. The results obtained agree with previously determined experimental data and with predicted theoretical expressions for the dimensionless transverse velocity and temperature profiles across a jet. The spread of both the temperature and the velocity profiles was very nearly linear. Dimensionless plots of temperature and velocity along the axis of a heated jet agree with experimental results of tests with a cold jet.
Derived from text
Jet Propulsion; Wind Tunnel Tests; Jet Flow; Aerodynamic Characteristics; Axial Flow; Altitude; Aircraft Engines

20030063965 National Advisory Committee for Aeronautics. Lewis Flight Propulsion Lab., Cleveland, OH, USA
Preliminary Results of an Altitude-Wind-Tunnel Investigation of a TG-100A Gas Turbine-Propeller Engine, 4, Compressor and Turbine Performance Characteristics
Wallner, Lewis E.; Saari, Martin J.; November 13, 1947; 46 pp.; In English; Original contains black and white illustrations
Report No.(s): NACA-RM-E7J20; No Copyright; Avail: CASI; A03, Hardcopy

As part of an investigation of the performance and operational characteristics of the TG-100A gas turbine-propeller engine, conducted in the Cleveland altitude wind tunnel, the performance characteristics of the compressor and the turbine were obtained. The data presented were obtained at a compressor-inlet ram-pressure ratio of 1.00 for altitudes from 5000 to 35,000 feet, engine speeds from 8000 to 13,000 rpm, and turbine-inlet temperatures from 1400 to 2100R. The highest compressor pressure ratio was 6.15 at a corrected air flow of 23.7 pounds per second and a corrected turbine-inlet temperature of 2475R. Peak adiabatic compressor efficiencies of about 77 percent were obtained near the value of corrected air flow corresponding to a corrected engine speed of 13,000 rpm. This maximum efficiency may be somewhat low, however, because of dirt accumulations on the compressor blades. A maximum adiabatic turbine efficiency of 81.5 percent was obtained at rated engine speed for all altitudes and turbine-inlet temperatures investigated.
Author
Gas Turbine Engines; Wind Tunnel Tests; Compressors; Power Efficiency; Turbines; Propulsive Efficiency; Engine Design; Aircraft Design

20030063981 National Advisory Committee for Aeronautics. Lewis Flight Propulsion Lab., Cleveland, OH, USA
Effect of Various Methods of Boundary-Layer Control on Performance of V-1710-93 Engine-Stage Supercharger
Kohl, Robert C.; Diggs, Donald R.; [1947]; 28 pp.; In English; Original contains black and white illustrations
Report No.(s): NACA-RM-E6L19; No Copyright; Avail: CASI; A03, Hardcopy

Four methods of boundary-layer control were tried during an investigation to improve the flow in the impeller passages of a V-1710-93 engine-stage supercharger. The boundary layer along the impeller front shroud was removed by suction. In one method the removal was accomplished by recirculation of the air to the impeller inlet; in another method, by external removal. In the other methods, slots were cut through the impeller-blade faces first at 30 percent and then at 30 and 70 percent of the mean-flow-path length measured from leading edges of the rotating inlet guide vanes to introduce air from the high-pressure side of the blades into the region where stagnation and separation were suspected. A slight improvement in performance was obtained when the boundary layer was removed through the impeller front shroud. In general, this improvement become more pronounced as the amount of air removed was increased even though the excessive impeller frontal clearance maintained for these tests, together with an exaggerated negative pressure gradient, apparently induced flow separation on the diffuser front and rear walls as well as on the impeller front shroud. The use of slots in the impellers at the locations selected had a detrimental effect on the supercharger performance characteristics.
Author
Boundary Layer Control; Impellers; Superchargers; Engine Inlets; Engine Design; Leading Edges; Aerodynamic Characteristics; Aircraft Performance; Air Flow; Wind Tunnel Tests

20030063985 National Advisory Committee for Aeronautics. Lewis Flight Propulsion Lab., Cleveland, OH, USA
Cooling of Gas Turbines I - Effects of Addition of Fins to Blade Tips and Rotor, Admission of Cooling Air Through Part of Nozzles, and Change in Thermal Conductivity of Turbine Components
Brown, Byron; February 11, 1947; 28 pp.; In English; Original contains black and white illustrations
Report No.(s): NACA-RM-E7B11a; No Copyright; Avail: CASI; A03, Hardcopy

An analysis was developed for calculating the radial temperature distribution in a gas turbine with only the temperatures of the gas and the cooling air and the surface heat-transfer coefficient known. This analysis was applied to determine the temperatures of a complete wheel of a conventional single-stage impulse exhaust-gas turbine. The temperatures were first calculated for the case of the turbine operating at design conditions of speed, gas flow, etc. and with only the customary cooling arising from exposure of the outer blade flange and one face of the rotor to the air. Calculations were next made for the case of fins applied to the outer blade flange and the rotor. Finally the effects of using part of the nozzles (from 0 to 40 percent) for supplying cooling air and the effects of varying the metal thermal conductivity from 12 to 260 Btu per hour per foot per degree Farenheit on the wheel temperatures were determined. The gas temperatures at the nozzle box used in the calculations ranged from 1600F to 2000F. The results showed that if more than a few hundred degrees of cooling of turbine blades are required other means than indirect cooling with fins on the rotor and outer blade flange would be necessary. The amount of cooling indicated for the type of finning used could produce some improvement in efficiency and a large increase in durability of the wheel. The results also showed that if a large difference is to exist between the effective temperature of the exhaust gas and that of the blade material, as must be the case with present turbine materials and the high exhaust-gas temperatures desired (2000F and above), two alternatives are suggested: (a) If metal with a thermal conductivity comparable with copper is used, then the blade temperature can be reduced by strong cooling at both the blade tip and root. The center of the blade will be less than 2000F hotter than the ends; (b) With low conductivity materials some method of direct cooling other than partial

admission of cooling air is essential. From this study, it can be deduced that indirect cooling of turbine blades will not make possible large increases in gas temperature.
Author
Gas Turbines; Turbine Blades; Air Cooling; Fatigue (Materials); Temperature Distribution; Thermal Conductivity; Nozzle Design; Numerical Analysis; Blade Tips; Cooling Fins

20030063990 National Advisory Committee for Aeronautics. Lewis Flight Propulsion Lab., Cleveland, OH, USA
Altitude-Wind-Tunnel Investigation of a 3000-Pound-Thrust Axial-Flow Turbojet Engine, 4, Operational Characteristics
Hawkins, W. Kent; Meyer, Carl L.; August 23, 1948; 40 pp.; In English
Report No.(s): NACA-RM-E8B19a; No Copyright; Avail: CASI; A03, Hardcopy

An investigation was conducted to evaluate the operational characteristics of a 3000 pound thrust axial flow turbojet engine over a range of simulated altitudes from 2000 to 50,000 feet and simulated flight Mach numbers from 0 to 1.04 throughout the operable range of engine speeds. Engine operating range, acceleration, deceleration, starting, altitude, and flight Mach number compensation of the fuel control system, and operation of the lubrication system at high and low ambient air temperatures were evaluated.
Author
Turbojet Engines; Lubrication Systems; Ignition; Propulsion System Performance

20030064029 National Advisory Committee for Aeronautics. Lewis Flight Propulsion Lab., Cleveland, OH, USA
Effect of Distribution of Basket-Hole Area on Simulated Altitude Performance of 25 1/2-Inch-Diameter Annular-Type Turbojet Combustor
Olson, Walter T.; Schroeter, Thomas T.; August 24, 1948; 52 pp.; In English
Report No.(s): NACA-RM-E8A02; No Copyright; Avail: CASI; A04, Hardcopy

A simulated altitude performance of a 25 1/2-inch-diameter annular-type turbojet combustor was performed to determine the effect of the distribution of basket-hole area on the altitude operational limits of the engine as imposed by the combustor.Total pressure drop was recorded, as well as the effect of fuel-nozzle flow capacity,and fuel-nozzle spray angle for one basket configuration. General observations were made for all configurations regarding flames, extent of afterburning, and durability of the baskets.
CASI
Turbojet Engines; Turbocompressors; Combustion Chambers; Pressure Drop; Fuel-Air Ratio

20030064030 National Advisory Committee for Aeronautics. Lewis Flight Propulsion Lab., Cleveland, OH, USA
Altitude-Wind-Tunnel Investigation of a 3000-Pound-Thrust Axial-Flow Turbojet Engine, 7, Pressure and Temperature Distributions
Saari, Martin J.; Prince, William R.; December 10, 1948; 51 pp.; In English
Report No.(s): NACA-RM-E8C17; No Copyright; Avail: CASI; A04, Hardcopy

Temperature and pressure distributions for an original and modified 3000 pound thrust axial flow turbojet engine were investigated. Data are included for a range of simulated altitudes from 5000 to 45000 feet, Mach numbers from 0.24 to 1.08, and corrected engine speeds from 10,550 to 13,359 rpm.
CASI
Turbojet Engines; Spray Nozzles; Turbine Blades; Simulation; Turbocompressors

20030064033 National Advisory Committee for Aeronautics. Lewis Flight Propulsion Lab., Cleveland, OH, USA
Altitude-Wind-Tunnel Investigation of a 4000-Pound-Thrust Axial-Flow Turbojet Engine, 4, Analysis of Compressor Performance
Dietz, Robert O., Jr.; Suozzi, Frank L.; August 5, 1948; 56 pp.; In English
Report No.(s): NACA-RM-E8F09c; No Copyright; Avail: CASI; A04, Hardcopy

Operating characteristics of the 11-stage 4000-pound-thrust axial-flow turbojet engine were determined. A standard compressor and a compressor with the blade angles of the rotor and stator blades increased 5 degrees to obtain greater air flow, were investigated.
CASI
Turbojet Engines; Turbocompressors; Stalling; Exhaust Nozzles

20030064044 National Advisory Committee for Aeronautics. Langley Aeronautical Lab., Langley Field, VA, USA
Infinitesimal Conical Supersonic Flow
Busemann, Adolf; March 1947; 18 pp.; In English
Report No.(s): NACA-TM-1100; No Copyright; Avail: CASI; A03, Hardcopy

The calculation of infinitesimal conical supersonic flow has been applied first to the simplest examples that have also been calculated in another way. Except for the discovery of a miscalculation in an older report, there was found the expected conformity. The new method of calculation is limited more definitely to the conical case.
Author
Conical Flow; Supersonic Flow; Aircraft Design; Differential Equations

20030064085 National Advisory Committee for Aeronautics. Lewis Flight Propulsion Lab., Cleveland, OH, USA
Investigation of Rim Cracking in Turbine Wheels with Welded Blades
Millenson, M. B.; Manson, S. S.; February 12, 1947; 14 pp.; In English; Original contains black and white illustrations
Report No.(s): NACA-RM-E6L17; No Copyright; Avail: CASI; A03, Hardcopy

Rim cracking in turbine wheels with welded blades was evaluated. The problem is explained on the basis of the occurrence of plastic flow in the rim during transient starting conditions when thermal compressive stresses resulting from high-temperature gradients exceed the proportional elastic limit of the material.
CASI
Turbine Wheels; Cracking (Fracturing); Rims; Plastic Deformation; Gas Turbines

20030064087 National Advisory Committee for Aeronautics. Langley Aeronautical Lab., Langley Field, VA, USA
Performance Possibilities of the Turbojet System as a Power Plant for Supersonic Airplanes
Wood, George P.; August 26, 1947; 58 pp.; In English
Report No.(s): NACA-RM-L7H05a; No Copyright; Avail: CASI; A04, Hardcopy

The performance of hypothetical turbojet systems, without thrust augmentation as power plants, for supersonic airplanes has been calculated. Thrust, thrust power, air-fuel ratio, specific fuel consumption, cross sectional area, and thrust coefficient are presented for free-stream Mach numbers from 1.2 to 3.
Author
Turbojet Engines; Thrust Augmentation; Supersonic Aircraft; Jet Propulsion

20030064095 United Technologies Research Center, East Hartford, CT, USA
Experimental Assessment of the Emissions Control Potential of a Rich/Quench/ Lean Combustor for High Speed Civil Transport Aircraft Engines
Tacina, Robert R., Technical Monitor; Rosfjord, T. J.; Padget, F. C.; January 2001; 170 pp.; In English
Contract(s)/Grant(s): NAS3-25952; WU 714-01-4A
Report No.(s): NASA/CR-2001-210613; E-12572; NAS 1.26:210613; No Copyright; Avail: CASI; A08, Hardcopy

In support of Pratt & Whitney efforts to define the Rich burn/Quick mix/Lean burn (RQL) combustor for the High Speed Civil Transport (HSCT) aircraft engine, UTRC conducted a flametube-scale study of the RQL concept. Extensive combustor testing was performed at the Supersonic Cruise (SSC) condition of an HSCT engine cycle. Data obtained from probe traverses near the exit of the mixing section confirmed that the mixing section was the critical component in controlling combustor emissions. Circular-hole configurations, which produced rapidly-, highly-penetrating jets, were most effective in limiting NO(x). The spatial profiles of NO(x) and CO at the mixer exit were not directly interpretable using a simple flow model based on jet penetration, and a greater understanding of the flow and chemical processes in this section are required to optimize it. Neither the rich-combustor equivalence ratio nor its residence time was a direct contributor to the exit NO(x). Based on this study, it was also concluded that: (1) While NO(x) formation in both the mixing section and the lean combustor contribute to the overall emission, the NOx formation in the mixing section dominates. The gas composition exiting the rich combustor can be reasonably represented by the equilibrium composition corresponding to the rich combustor operating condition. Negligible NO(x) exits the rich combustor. (2) At the SSC condition, the oxidation processes occurring in the mixing section consume 99 percent of the CO exiting the rich combustor. Soot formed in the rich combustor is also highly oxidized, with combustor exit SAE Smoke Number <3. (3) Mixing section configurations which demonstrated enhanced emissions control at SSC also performed better at part-power conditions. Data from mixer exit traverses reflected the expected mixing behavior for off-design jet to crossflow momentum-flux ratios. (4) Low power operating conditions require that the RQL combustor operate as a lean-lean combustor to achieve low CO and high efficiency. (5) An RQL combustor can achieve the emissions

goal of EINO(x) = 5 at the Supersonic Cruise operating condition for an HSCT engine.
Author
Aircraft Engines; Supersonic Transports; Combustion Chambers; Nitrogen Oxides; Cross Flow

20030064096 National Advisory Committee for Aeronautics. Lewis Flight Propulsion Lab., Cleveland, OH, USA
Altitude-Wind-Tunnel Investigation of a 3000-Pound-Thrust Axial-Flow Turbojet Engine I - Analysis of Turbine Performance
Conrad, Earl W.; Dietz, Robert O., Jr.; Golladay, Richard L.; August 23, 1948; 28 pp.; In English
Report No.(s): NACA-RM-E8A23; No Copyright; Avail: CASI; A03, Hardcopy

A wind tunnel investigation was conducted to determine the performance of a turbine operating as an integral part of a turbojet engine. Data was obtained while the engine was running over full operable range of speeds at various altitudes and flight mach numbers, and with four nozzles of different outlet areas.A maximum turbine efficiency of 0.875 was obtained at altitude of 15 thousand feet, Mach number 0.53, and corrected turbine speed of 5900 rpm.
CASI
Turbojet Engines; Exhaust Nozzles; Nozzle Efficiency; Power Efficiency; Turbines

20030064100 NASA Glenn Research Center, Cleveland, OH, USA
Active Flow Separation Control of a Stator Vane Using Surface Injection in a Multistage Compressor Experiment
Culley, Dennis E.; Bright, Michelle M.; Prahst, Patricia S.; Strazisar, Anthony J.; June 2003; 18 pp.; In English; Turbo Expo 2003, 16-19 Jun. 2003, Atlanta, GA, USA; Original contains color illustrations
Contract(s)/Grant(s): WBS 22-708-28-03
Report No.(s): NASA/TM-2003-212356; E-13944; NAS 1.15:212356; GT2003-38863; No Copyright; Avail: CASI; A03, Hardcopy

Micro-flow control actuation embedded in a stator vane was used to successfully control separation and improve near stall performance in a multistage compressor rig at NASA Glenn. Using specially designed stator vanes configured with internal actuation to deliver pulsating air through slots along the suction surface, a research study was performed to identify performance benefits using this microflow control approach. Pressure profiles and unsteady pressure measurements along the blade surface and at the shroud provided a dynamic look at the compressor during microflow air injection. These pressure measurements lead to a tracking algorithm to identify the onset of separation. The testing included steady air injection at various slot locations along the vane. The research also examined the benefit of pulsed injection and actively controlled air injection along the stator vane. Two types of actuation schemes were studied, including an embedded actuator for on-blade control. Successful application of an online detection and flow control scheme will be discussed. Testing showed dramatic performance benefit for flow reattachment and subsequent improvement in diffusion through the use of pulsed controlled injection. The paper will discuss the experimental setup, the blade configurations, and preliminary CFD results which guided the slot location along the blade. The paper will also show the pressure profiles and unsteady pressure measurements used to track flow control enhancement, and will conclude with the tracking algorithm for adjusting the control.
Author
Active Control; Stators; Vanes; Computational Fluid Dynamics; Flow Distribution; Pressure Distribution; Separated Flow; Actuators

20030064117 National Advisory Committee for Aeronautics. Lewis Flight Propulsion Lab., Cleveland, OH, USA
Investigation of 10-Stage Axial-Flow X24C-2 Compressor, 1, Performance at Inlet Pressure of 21 Inches Mercury Absolute and Inlet Temperature of 538 R
Schum, Harold J.; Buckner, Howard A., Jr.; July 15, 1947; 41 pp.; In English; Original contains black and white illustrations
Report No.(s): NACA-RM-E7G11; No Copyright; Avail: CASI; A03, Hardcopy

The performance at inlet pressure of 21 inches mercury absolute and inlet temperature of 538 R for the 10-stage axial-flow X24C-2 compressor from the X24C-2 turbojet engine was investigated. the peak adiabatic temperature-rise efficiency for a given speed generally occurred at values of pressure coefficient fairly close to 0.35.For this compressor, the efficiency data at various speeds could be correlated on two converging curves by the use of a polytropic loss factor derived.
CASI
Compressor Efficiency; Turbojet Engines; Turbocompressors

20030064118 National Advisory Committee for Aeronautics. Lewis Flight Propulsion Lab., Cleveland, OH, USA
Altitude-Wind-Tunnel Investigation of a 4000-Pound-Thrust Axial-Flow Turbojet Engine, 3, Performance Characteristics with the High-Flow Compressor
Fleming, William A.; Golladay, Richard L.; August 5, 1948; 71 pp.; In English
Report No.(s): NACA-RM-E8F09b; No Copyright; Avail: CASI; A04, Hardcopy

A wind tunnel investigation was conducted to determine the performance of a 4000-pound-thrust axial-flow turbojet engine with a high flow compressor. Pressure altitudes included 5000 to 40000 feet with ram pressure ratios from 1.00 to 1.82. Altitudes included 20000 to 40000 feet and ram pressure ratios from 1.09 to 1.75. A comparison is made between engine performance with high flow and low flow compressors.

CASI
Turbojet Engines; Turbocompressors; Autorotation; Propulsion System Performance

20030064121 National Advisory Committee for Aeronautics. Lewis Flight Propulsion Lab., Cleveland, OH, USA
Preliminary Results of an Altitude-Wind-Tunnel Investigation of an Axial-Flow Gas Turbine-Propeller Engine, 2, Windmilling Characteristics
Conrad, E. W.; Durham, J. D.; August 3, 1948; 53 pp.; In English
Report No.(s): NACA-RM-E8F10a; No Copyright; Avail: CASI; A04, Hardcopy

Wind tunnel investigations were performed to determine the performance properties of an axial-flow gas turbine-propeller engine II. Windmilling characteristics were determined for a range of altitudes from 5000 to 35,000 feet, true airspeeds from 100 to 273 miles per hour, and propeller blade angles from 4 degrees to 46 degrees.

CASI
Gas Turbine Engines; Axial Flow Turbines; Airspeed; Autorotation

20030064122 Luftfahrtforschungsanstalt Hermann Goering, Brunswick, Germany
The Flow Through Axial Turbine Stages of Large Radial Blade Length
Eckert; Korbacher; Deutsche Luftfahrtforschung; April 1947, pp. 1-39; In English
Report No.(s): NACA-TM-1118; Forschungsbericht-1750; No Copyright; Avail: CASI; A03, Hardcopy

A calulation of the flow in turbine blading is reported that includes the calculation of effect of centrifugal force. Frictional losses on the stator blades and rotor blades are allowed.

CASI
Axial Flow Turbines; Stator Blades; Mathematical Models; Gas Turbines

20030064123 National Advisory Committee for Aeronautics. Lewis Flight Propulsion Lab., Cleveland, OH, USA
Effect of Fuel Composition, Engine Operating Variables, and Spark-Plug Type and Condition on Preignition-Limited Performance of an R-2800 Cylinder
Pfender, John F.; November 15, 1946; 28 pp.; In English
Report No.(s): NACA-RM-E6J08; No Copyright; Avail: CASI; A03, Hardcopy

The preignition characteristics of the R-2800 cylinder, as effected by fuel consumption, engine operating variables, and spark plug type and condition, were evaluated. The effects on preignition-limited performance of various percentages of aromatics (benzene, toluene, cumene, xylene) in a base fuel of triptane were investigated. Two paraffins (triptane and S + 6.0 ml TEL/gal) and two refinery blends (28-R and 33-R) were preignition rated. The effect of changes in the following engine operating variables on preignition limit was determined: inlet-air temperature, rear spark plug gasket temperature, engine speed, spark advance, tappet clearance, and oil consumption. Preignition limits of the R-2800 cylinder using Champion C34S and C35S and AC-LS86, LS87, and LS88 spark plugs were established and the effect of spark plug deterioration was investigated. No definite trends in preignition-limited indicated mean effective pressure were indicated for aromatics as a class when increased percentages of different aromatics were added to a base fuel of triptane. Three types of fuel (aromatics, paraffins, and refinery blends) showed a preignition range for this cylinder from 65 to 104 percent when based on the performance of S plus 6.0 ml TEL per gallon as 100 percent. The R-2800 cylinder is therefore relatively insensitive to fuel composition when compared to a CFR F-4 engine, which had a pre-ignition range from 72 to 100 percent for the same fuels. Six engine operating variables were investigated with the following results: preignition-limited indicated mean effective pressure decreased, with increases in engine speed, rear spark plug gasket temperature, inlet-air temperature, and spark advance beyond 20 F B.T.C. and was unaffected by rate of oil consumption or by tappet clearance. Spark plugs were rated over a range of preignition-limited indicated mean effective pressure from 200 to 390 pounds per square inch at a fuel-air ratio

of 0.07 in the following order of increased resistance to preignition: AC-LS97, AC-LS88, Champion C358, AC-LS86, and Champion C34S. Spark plug deterioration in the form of cracks in the porcelain had been broken away from the center electrode and were retained in the spark plug cavity, the preignition limit was decreased as much as 57 percent. When the broken pieces had been removed, the preignition limit increased from that of the undamaged porcelain as the weight of removed porcelain was increased.
Author
Fuel Consumption; Spark Plugs; Engine Parts; Cylindrical Chambers; Internal Combustion Engines; Aircraft Engines

20030064136 National Advisory Committee for Aeronautics. Lewis Flight Propulsion Lab., Cleveland, OH, USA
Altitude-Wind-Tunnel Investigation of a 3000-Pound-Thrust Axial-Flow Turbojet Engine, 3, Analysis of Combustion-Chamber Performance
Campbell, Carl E.; August 23, 1948; 49 pp.; In English
Report No.(s): NACA-RM-E8B19; No Copyright; Avail: CASI; A03, Hardcopy
Combustion chamber performance properties of a 3000-pound-thrust axial-flow turbojet engine were determined. Data are presented for a range of simulated altitudes from 15,000 to 45,0000 feet and a range of Mach numbers from 0.23 to 1.05 for various modifications of the engine.
CASI
Combustion Chambers; Turbojet Engines; Wind Tunnel Tests; Baskets

20030064137 National Advisory Committee for Aeronautics. Lewis Flight Propulsion Lab., Cleveland, OH, USA
Preliminary Results of an Altitude-Wind-Tunnel Investigation of a TG-100A Gas Turbine-Propeller Engine, 3, Pressure and Temperature Distributions
Geisenheyner, Robert M.; Berdysz, Joseph J.; November 13, 1947; 75 pp.; In English; Original contains black and white illustrations
Report No.(s): NACA-RM-E7J02; No Copyright; Avail: CASI; A04, Hardcopy
An altitude-wind-tunnel investigation of a TG-100A gas turbine-propeller engine was performed. Pressure and temperature data were obtained at altitudes from 5000 to 35000 feet, compressor inlet ram-pressure ratios from 1.00 to 1.17, and engine speeds from 800 to 13000 rpm. The effect of engine speed, shaft horsepower, and compressor-inlet ram-pressure ratio on pressure and temperature distribution at each measuring station are presented graphically.
CASI
Inlet Pressure; Gas Turbine Engines; Turbocompressors

20030064146 National Advisory Committee for Aeronautics. Lewis Flight Propulsion Lab., Cleveland, OH, USA
Altitude-Wind-Tunnel Investigation of Performance of Several Propellers on YP-47M Airplane at High Blade Loadings, 4, Curtiss 732-1C2-0 Four-Blade Propeller
Saari, Martin J.; Sorin, Solomon M.; November 26, 1946; 23 pp.; In English
Report No.(s): NACA-RM-E6J23; No Copyright; Avail: CASI; A03, Hardcopy
An altitude-wind-tunnel investigation has been made to determine the performance of a Curtiss 732-1C2-0 four-blade propeller on a YP-47M airplane at high blade loadings and engine power. Propeller characteristics were obtained for a range of power coefficients from 0.30 to 1.00 at free-stream Mach numbers of 0.40 and .50.
Author
Wind Tunnel Tests; Aircraft; Propeller Blades; Thrust Loads

20030064149 National Advisory Committee for Aeronautics. Lewis Flight Propulsion Lab., Cleveland, OH, USA
Cooling of Gas Turbines, 6, Computed Temperature Distribution Through Cross Section of Water-Cooled Turbine Blade
Livingood, John N. B.; Sams, Eldon W.; May 1947; 19 pp.; In English; Original contains black and white illustrations
Report No.(s): NACA-RM-E7B11F; No Copyright; Avail: CASI; A03, Hardcopy
A theoretical analysis of the cross-sectional temperature distribution of a water-cooled turbine blade was made using the relaxation method to solve the differential equation derived from the analysis. The analysis was applied to specific turbine blade and the studies icluded investigations of the accuracy of simple methods to determine the temperature distribution along the mean line of the rear part of the blade, of the possible effect of varying the perimetric distribution of the hot gas-to -metal

heat transfer coefficient, and of the effect of changing the thermal conductivity of the blade metal for a constant cross sectional area blade with two quarter inch diameter coolant passages.
Author
Turbine Blades; Gas Turbines; Air Cooling; Liquid Cooling; Temperature Distribution

20030064190 National Advisory Committee for Aeronautics. Lewis Flight Propulsion Lab., Cleveland, OH, USA
Performance of a Mixed-Flow Impeller in Combination with Semivaneless Diffuser
Laskin, Eugene B.; Kofskey, Milton G.; April 4, 1947; 19 pp.; In English; Original contains black and white illustrations
Report No.(s): NACA-RM-E7C05a; No Copyright; Avail: CASI; A03, Hardcopy

The performance of a mixed-flow impeller in combination with a semivaneless diffuser were experimentally investigated. The diameter of the impeller was 11.0 inches and a maximum tip diameter of 14.74 inches. The semivaneless diffuser had an overall diameter of 28.00 inches. The performance properties of the mixed-flow impeller were also investigated with a 34.00 inch vane loss diffuser having a transition section of the same geometry as the semivaneless diffuser.
Author
Impellers; Jet Vanes; Jet Propulsion; Aircraft Engines; Diffusers

20030064192 National Advisory Committee for Aeronautics. Lewis Flight Propulsion Lab., Cleveland, OH, USA
Investigation of X24-2 10-Stage Axial-Flow Compressor, 2, Effect of Inlet-Air Pressure and Temperature of Performance
Finger, Harold B.; Schum, Harold J.; Buckner, Howard Jr.; August 21, 1947; 45 pp.; In English; Original contains black and white illustrations
Report No.(s): NACA-RM-E7H22; No Copyright; Avail: CASI; A03, Hardcopy

Effect of inlet-air pressure and temperature on the performance of the X24-2 10-Stage Axial-Flow Compressor from the X24C-2 turbojet engine was evaluated. Speeds of 80, 89, and 100 percent of equivalent design speed with inlet-air pressures of 6 and 12 inches of mercury absolute and inlet-air temperaures of approximately 538 degrees, 459 degrees,and 419 degrees R (79 degrees, 0 degrees, and minus 40 degrees F). Results were compared with prior investigations.
Author
Turbocompressors; Turbojet Engines; Inlet Pressure; Temperature Effects

20030064236 National Advisory Committee for Aeronautics. Langley Aeronautical Lab., Langley Field, VA, USA
Venturi Tube with Varying Mass Flow
Regenscheit, B.; Zentrale fuer Wissenschaftliches Berichtswesen der Luftfahrtforschung des Generalluftzeugmeisters; March 1948, No. 1945; 33 pp.; In English; Original contains black and white illustrations
Report No.(s): NACA-TM-1191; No Copyright; Avail: CASI; A03, Hardcopy

Measurements on three tubes with flow regulated by suction at the trainling edge of the tube are described. It was possible to vary the mass of air flowing through the tube over a large range. Such tubes could be used for shrouded propellers.
Author
Shrouded Propellers; Venturi Tubes; Air Flow; Wind Tunnels

20030064244 National Advisory Committee for Aeronautics. Lewis Flight Propulsion Lab., Cleveland, OH, USA
Altitude-Wind-Tunnel Investigation of a 3000-Pound-Thrust Axial-Flow Turbojet Engine II-Analysis of Compressor Performance
Dietz, Robert O., Jr.; Berdysz, Joseph J.; Howard, Ephraim M.; August 23, 1948; 35 pp.; In English
Report No.(s): NACA-RM-E8A26a; No Copyright; Avail: CASI; A03, Hardcopy

Compressor performance properties for two 11-stage compressors of 3000-pound-thrust axial-flow turbojet engines were determined. Data are presented for a range of simulated altitudes and a range of Mach numbers for various modifications of the engine.
CASI
Turbojet Engines; Wind Tunnel Tests; Turbocompressors; Exhaust Nozzles

20030064253 National Advisory Committee for Aeronautics. Lewis Flight Propulsion Lab., Cleveland, OH, USA
Cooling of Gas Turbines, 3, Analysis of Rotor and Blade Temperatures in Liquid-Cooled Gas Turbines
Brown, W. Byron; Livingood, John N. B.; February 11, 1947; 30 pp.; In English; Original contains black and white illustrations
Report No.(s): NACA-RM-E7B11c; No Copyright; Avail: CASI; A03, Hardcopy

A theoretical analysis of the radial temperature distribution through the rotor and constant cross sectional area blades near the coolant passages of liquid cooled gas turbines was made. The analysis was applied to obtain the rotor and blade temperatures of a specific turbine using a gas flow of 55 pounds per second, a coolant flow of 6.42 pounds per second, and an average coolant temperature of 200 degrees F. The effect of using kerosene, water, and ethylene glycol was determined. The effect of varying blade length and coolant passage lengths with water as the coolant was also determined. The effective gas temperature was varied from 2000 degrees to 5000 degrees F in each investigation.
Author
Gas Turbines; Rotors; Cooling Systems; Glycols; Water; Kerosene; Blades; Turbine Blades; Liquid Cooling

20030064303 National Advisory Committee for Aeronautics. Lewis Flight Propulsion Lab., Cleveland, OH, USA
Computed Temperature Distribution and Cooling of Solid Gas-Turbine Blades
Reuter, J. George; Gazley, Carl, Jr.; February 11, 1947; 15 pp.; In English
Report No.(s): NACA-RM-E7B11h; No Copyright; Avail: CASI; A03, Hardcopy

Computations were made to determine the temperature distribution and cooling of solid gas-turbine blades.A range of temperatures was used from 1500 degrees to 2500 degrees F, blade-root temperatures from 100 degrees to 1000 degrees F, blade thermal conductivity from 8 to 220 BTU/(hr)(sq ft)(degrees F/ft), and net gas to metal heat transfer coefficients from 75 to 250 BTU/(hr)(sq ft)(degrees F).
Author
Temperature Distribution; Heat Transfer Coefficients; Turbine Blades; Gas Turbines; Temperature Effects

20030064308 Technische Univ., Stuttgart, Germany
Possibilities of Reducing the Length of Axial Superchargers for Aircraft Motors
Eckert, B.; Tech. Berichte ZWB; January 1947, 4, pp. 130-133; In English
Report No.(s): NACA-TM-1132; No Copyright; Avail: CASI; A03, Hardcopy

Axial blowers are gaining importance as aircraft engine superchargers. However, the pressure head obtainable per stage is small. Due to the necessary great number of stages, the physical length of the blower becomes too great for an airworthy device. This report discusses several types of construction that permit a reduction in the length of the blower.
CASI
Superchargers; Blowers; Blades; Aircraft Engines; Pressure Heads

20030064309 National Advisory Committee for Aeronautics. Lewis Flight Propulsion Lab., Cleveland, OH, USA
Theoretical Evaluation of Methods of Cooling the Blades of Gas Turbines
Sanders, J. C.; Mendelson, Alexander; February 11, 1947; 36 pp.; In English; Original contains black and white illustrations
Report No.(s): NACA-RM-E7B11g; No Copyright; Avail: CASI; A03, Hardcopy

A study was made of heat transfer in turbine blades and the effects on blade temperature of cooling the blade root and tip, changing the dimensions of the blades, raising the cycle temperatures, insulating with ceramics, and cooling by circulation of air or water through hollow blades.
CASI
Turbine Blades; Gas Turbines; Air Cooling; Liquid Cooling; Coatings

20030064482 National Advisory Committee for Aeronautics, Washington, DC, USA
Turbojet Propulsion-System Research and the Resulting Effects on Airplane Performance
Rothrock, Addison M.; March 17, 1955; 88 pp.; In English; Original contains black and white illustrations
Report No.(s): NACA-RM-54H23; No Copyright; Avail: CASI; A05, Hardcopy

For a period of ten to fifteen years intensive research and development has been conducted on turbojet propulsion systems for aircraft. During this period much has been learned about the system both from the standpoint of current usage and of future development possibilities. It is the purpose of this report to discuss the current status of the turbojet engine as produced in the USA and to discuss the future possibilities for improvement in the engine and in the fuel. The engine and fuel improvements

will be evaluated both from the standpoint of probability of success in obtaining these improvements and from the standpoint of the effects of these improvements on the airplane performance.
Author
Turbojet Engines; Propulsion System Performance; Aircraft Performance; Technology Assessment

20030065144 National Advisory Committee for Aeronautics. Lewis Flight Propulsion Lab., Cleveland, OH, USA
Cooling of Gas Turbines, IV - Calculated Temperature Distribution in the Trailing Part of a Turbine Blade Using Direct Liquid Cooling
Brown, W. Byron; Monroe, William R.; April 18, 1947; 45 pp.; In English; Original contains black and white illustrations
Report No.(s): NACA-RM-E7B11d; No Copyright; Avail: CASI; A03, Hardcopy

A theoretical analysis of the temperature distribution through the trailing portion of a blade near the coolant passages of liquid cooled gas turbines was made. The analysis was applied to obtain the hot spot temperatures at the trailing edge and influence of design variables. The effective gas temperature was varied from 2000 degrees to 5000 degrees F in each investigation.
CASI
Temperature Distribution; Turbine Blades; Liquid Cooling; Trailing Edges

20030065181 National Advisory Committee for Aeronautics. Lewis Flight Propulsion Lab., Cleveland, OH, USA
Investigation of Sea-Level Performance of I-16 Turbojet Engine at Zero Ram with XFR-1 Intake Duct Shroud, and Tail Pipe
Dowman, Harry W.; Anderson, William G.; August 1947; 66 pp.; In English; Original contains black and white illustrations
Report No.(s): NACA-RM-E7G24; No Copyright; Avail: CASI; A04, Hardcopy

The sea-level performance of I-16 turbojet engine at zero ram was investigated to determine the effects of an intake duct, shroud, and tail pipe intended for installation in an XFR-1 airplane. Engine speeds ranged from 8000 to 16,500 rpm for several variations of the intake duct and tail pipes.
Author
Turbojet Engines; Ducts; Shrouds

20030065290 National Advisory Committee for Aeronautics. Lewis Flight Propulsion Lab., Cleveland, OH, USA
Simulated Altitude Performance of Combustor of Westinghouse 19XB-1 Jet-Propulsion Engine
Childs, J. Howard; McCafferty, Richard J.; November 30, 1948; 46 pp.; In English; Original contains black and white illustrations
Report No.(s): NACA-RM-E8J29; No Copyright; Avail: CASI; A03, Hardcopy

A 19XB-1 combustor was operated under conditions simulating zero-ram operation of the 19XB-1 turbojet engine at various altitudes and engine speeds. The combustion efficiencies and the altitude operational limits were determined; data were also obtained on the character of the combustion, the pressure drop through the combustor, and the combustor-outlet temperature and velocity profiles. At altitudes about 10,000 feet below the operational limits, the flames were yellow and steady and the temperature rise through the combustor increased with fuel-air ratio throughout the range of fuel-air ratios investigated. At altitudes near the operational limits, the flames were blue and flickering and the combustor was sluggish in its response to changes in fuel flow. At these high altitudes, the temperature rise through the combustor increased very slowly as the fuel flow was increased and attained a maximum at a fuel-air ratio much leaner than the over-all stoichiometric; further increases in fuel flow resulted in decreased values of combustor temperature rise and increased resonance until a rich-limit blow-out occurred. The approximate operational ceiling of the engine as determined by the combustor, using AN-F-28, Amendment-3, fuel, was 30,400 feet at a simulated engine speed of 7500 rpm and increased as the engine speed was increased. At an engine speed of 16,000 rpm, the operational ceiling was approximately 48,000 feet. Throughout the range of simulated altitudes and engine speeds investigated, the combustion efficiency increased with increasing engine speed and with decreasing altitude. The combustion efficiency varied from over 99 percent at operating conditions simulating high engine speed and low altitude operation to less than 50 percent at conditions simulating operation at altitudes near the operational limits. The isothermal total pressure drop through the combustor was 1.82 times as great as the inlet dynamic pressure. As expected from theoretical considerations, a straight-line correlation was obtained when the ratio of the combustor total pressure drop to the combustor-inlet dynamic pressure was plotted as a function of the ratio of the combustor-inlet air density to the combustor-outlet gas density. The combustor-outlet temperature profiles were, in general, more uniform for runs in which the temperature rise was low and the combustion efficiency was high. Inspection of the combustor basket after 36 hours

of operation showed very little deterioration and no appreciable carbon deposits.
Author
Altitude Simulation; Altitude Tests; Combustion Chambers; Combustion Efficiency; Turbojet Engines; Engine Tests; Temperature Profiles; Velocity Distribution

20030065294 Mississippi Polymer Technologies, Inc., Bay Saint Louis, MS, USA
Lightweight Ablating Insulation for Ramjet Combustion
Carter, Roy L.; Springfield, Robert M.; Dec. 10, 2002; 24 pp.; In English
Contract(s)/Grant(s): N00421-03-P-0057
Report No.(s): AD-A413060; No Copyright; Avail: CASI; A03, Hardcopy

Parmax(trade name), a self reinforcing ultra-high performance polymer, was investigated as an ablative material in ramjet combustor applications, Phase I effort has demonstrated that Parmax(trade name) SRP materials offer a number of advantages over the existing ablative solution, These include 1) Superior erosion rate performance 2) Better insulative properties 3) Lower ablative material density 4) Superior mechanical properties and 5) Lower or comparable cost (in commercial stage) Phase I demonstrated the extraordinary promise of Parmax(trade name) SRP materials as ablative insulators. In order to successfully transport this fundamental, material science promise into the complex rocket motor system environment, The Phase II effort will focus on final material optimization, filling out the gaps in design data and perhaps most importantly, familiarizing engine designers with the promise of these unique materials.
DTIC
Ramjet Engines; Combustion Chambers; Ablative Materials

20030065298 National Advisory Committee for Aeronautics. Lewis Flight Propulsion Lab., Cleveland, OH, USA
Preliminary Results of an Altitude-Wind-Tunnel Investigation of an Axial-Flow Gas Turbine-Propeller Engine, 1, Performance Characteristics
Saari, Martin J.; Wallner, Lewis E.; August 2, 1948; 85 pp.; In English; Original contains black and white illustrations
Report No.(s): NACA-RM-E8F10; No Copyright; Avail: CASI; A05, Hardcopy

A preliminary investigation of an axial-flow gas turbine-propeller engine was conduxted. Performance data were obtained for engine speeds from 8000 to 13,000 rpm and altitudes from 5000 to 35,000 feet and compressor inlet ram pressure ratios from 1.00 to 1.17.
CASI
Axial Flow Turbines; Wind Tunnel Tests; Gas Turbine Engines; Propellers

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*.

20030063933 NASA Ames Research Center, Moffett Field, CA, USA
Neural Flight Control System
Gundy-Burlet, Karen; April 30, 2003; 3 pp.; In English; NASA Symposium on Computational Methods for Stability and Control, 23-25 Sep. 2003, Hampton, VA, USA
Contract(s)/Grant(s): RTOP 704-01-32; No Copyright; Avail: CASI; A01, Hardcopy

The Neural Flight Control System (NFCS) was developed to address the need for control systems that can be produced and tested at lower cost, easily adapted to prototype vehicles and for flight systems that can accommodate damaged control surfaces or changes to aircraft stability and control characteristics resulting from failures or accidents. NFCS utilizes on a neural network-based flight control algorithm which automatically compensates for a broad spectrum of unanticipated damage or failures of an aircraft in flight. Pilot stick and rudder pedal inputs are fed into a reference model which produces pitch, roll and yaw rate commands. The reference model frequencies and gains can be set to provide handling quality characteristics suitable for the aircraft of interest. The rate commands are used in conjunction with estimates of the aircraft s stability and control (S&C) derivatives by a simplified Dynamic Inverse controller to produce virtual elevator, aileron and rudder commands. These virtual surface deflection commands are optimally distributed across the aircraft s available control surfaces using linear programming theory. Sensor data is compared with the reference model rate commands to produce an error signal. A Proportional/Integral (PI) error controller 'winds up' on the error signal and adds an augmented command to the reference

model output with the effect of zeroing the error signal. In order to provide more consistent handling qualities for the pilot, neural networks learn the behavior of the error controller and add in the augmented command before the integrator winds up. In the case of damage sufficient to affect the handling qualities of the aircraft, an Adaptive Critic is utilized to reduce the reference model frequencies and gains to stay within a flyable envelope of the aircraft.
Derived from text
Flight Control; Network Control; Neural Nets; Aircraft Stability; Controllability; Error Signals

20030063966 National Advisory Committee for Aeronautics. Ames Aeronautical Lab., Moffett Field, CA, USA
Stick-Fixed Stability and Control Characteristics of the Consolidated Vultee Model 240 Airplane as Estimated from Tests of a 0.092-Scale Powered Model
McCullough, George B.; Weiberg, James A.; Gault, Donald E.; June 27, 1947; 28 pp.; In English; Original contains black and white illustrations
Report No.(s): NACA-RM-A7F19; No Copyright; Avail: CASI; A03, Hardcopy

Estimates of the static stick-fixed stability and control characteristics of the Consolidated Vultee model 240 airplane are presented in this report. The estimates are based on tests of a 0.092-scale powered model in the 10-foot wind tunnel of the Guggenheim Aeronautical Laboratory of the California Institute of Technology. Results of the analysis are evaluated in terms of the Army specifications for stability and control characteristics which are more specific and, in general, equal to or more rigid than the Civil Aeronautics Administration requirements. The stick-fixed stability and control characteristics of the Consolidated Vultee model 240 were found to be satisfactory except for the following: 1) Marginal longitudinal stability in the landing approach (flaps 30 deg, 50\% minimum continuous power) with aft center of gravity (31\% M.A.C.); 2) Marginal rudder control to hold zero sideslip in a climb after take-off with asymmetric power (flaps 30 deg, left engine inoperative, right engine delivering take-off power) with maximum rudder throw limited to +/- 18 deg; 3) Marginal dihedral effect with flaps 40 deg and engines delivering maximum continuous power.
Author
Wind Tunnel Tests; Static Stability; Aircraft Control; Aircraft Stability

20030064139 National Advisory Committee for Aeronautics. Ames Aeronautical Lab., Moffett Field, CA, USA
Flight Measurements of the Flying Qualities of a Lockheed P-80A Airplane (Army No. 44-85099): Longitudinal-Stability and -Control Characteristics
Anderson, Seth B.; Christofferson, Frank E.; July 1947; 39 pp.; In English; Original contains black and white illustrations
Report No.(s): NACA-RM-A7G01; No Copyright; Avail: CASI; A03, Hardcopy

This report contains the flight-test results of the longitudinal-stability and -control phase of a general flying qualities investigation of the Lockheed P-80A airplane (Army No. 44-85099). The tests were conducted at indicated airspeeds up to 530 miles per hour (0.76 Mach number) at low altitude and up to 350 miles per hour (0.82) Mach number) at high altitude. These tests showed that the flying qualities of the airplane were in accordance with the requirements of the Army Air Forces Stability and Control Specification except for excessive elevator control forces in maneuvering flight and the inadequacy of the longitudinal trimming control at low airspeeds.
Author
In-Flight Monitoring; Flight Characteristics; Aircraft Control; Longitudinal Stability; Longitudinal Control

20030064154 Massachusetts Inst. of Tech., Cambridge, MA, USA
Characterization of Aeromechanics Response and Instability in Fans, Compressors, and Turbine Blades
Tan, Choon S.; August 6, 2003; 90 pp.; In English; Original contains black and white illustrations
Contract(s)/Grant(s): NAG2-321; No Copyright; Avail: CASI; A05, Hardcopy

This study investigated the effect of interaction between tip clearance flow, steady and unsteady upstream wakes in rotor and stator blade rows in terms of blade forced response. In a stator blade row, the interaction of steady wakes in the upstream rotor frame with the stator imply a blade forced response whose spectrum contains the Blade passing frequency (BPF) and its harmonics, with a decaying amplitude as the frequency increases. When the incoming wakes are unsteady, however, the spectrum of blade excitation exhibits unexpectedly amplified high frequencies due to the modulation of BPF with the fluctuation frequency. In a rotor blade row, a tip flow instability has been demonstrated with a frequency (TVF) equal to 0.45 times the Blade Passing frequency corresponding to a reduced frequency (F(sub c) (sup +)) of 0.7. Under uniform inlet flow conditions, the frequency and spatial content of the tip flow region have been characterized. The disturbance TVF was the dominant disturbance in the flow field and was found to imply variations of the pressure coefficient of more than 30\% on the

blade tip (between 35\% to 90\% chord) and in the rotor-generated wake (from 75\% to 100\% hub-to-tip position). In an attempt to better understand the origin of the instability, the structure of the tip flow has also been analyzed. The interface between the tip flow region and the core flow has been found to have periodical wave-like flow patterns which proceed downstream at a speed of approximately 0.42 times the core flow speed at a frequency corresponding to TVF. A list of conclusions derived from these interactions is presented.
Derived from text
Blade Tips; Turbine Blades; Flow Stability; Fans; Compressors; Aircraft Wakes; Unsteady Aerodynamics

20030065140 National Advisory Committee for Aeronautics. Langley Aeronautical Lab., Langley Field, VA, USA
Low-Speed Wind-Tunnel Tests of a Pilotless Aircraft having Horizontal and Vertical Wings and Cruciform Tail
Mastrocola, N.; Assadourian, A.; August 19, 1947; 101 pp.; In English
Report No.(s): NACA-RM-L6J18a; No Copyright; Avail: CASI; A06, Hardcopy

Low-speed wind-tunnel tests of a pilotless aircraft having horizontal and vertical wings and cruciform tail were conducted to provide information for the estimation of the longitudinal stability and control, to measure the aileron effectiveness, and to calibrate the random and the Machmeter pitot-static orifices.
Author
Longitudinal Stability; Wind Tunnel Tests; Pilotless Aircraft; Ailerons

20030065231 National Advisory Committee for Aeronautics. Langley Aeronautical Lab., Langley Field, VA, USA
Systematic Wind-Tunnel Measurements on Missiles
Walchner, O.; Lilienthal-Gesellschaft; March 1947, No. 139, pp. 29-37; In English
Report No.(s): NACA-TM-1122; No Copyright; Avail: CASI; A03, Hardcopy

Wind-tunnel measurements on projectiles are discussed. Tests at the Gottingen Tunnel are described. The tunnel operates on the Prandtl principle, that is, a brief stationary air stream produced in an evacuated tank by induction of atmospheric air.
Author
Wind Tunnel Tests; Projectiles; Missiles

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)*.

20030064301 National Advisory Committee for Aeronautics. Langley Aeronautical Lab., Langley Field, VA, USA
A Photographic Profile Recorder for Airscrews and Wing Models
Kuhl, R.; Raab, K.; June 1946; 10 pp.; In English
Report No.(s): NACA-TM-1088; No Copyright; Avail: CASI; A02, Hardcopy

This report describes an apparatus enabling measurements of bodies to be made photographically, where other methods would be difficult. It is especially useful in the case of airscrews and wing models. The utility of the machine is shown by a few examples of profile records.
Author
Photographic Measurement; Photographic Equipment; Recording Instruments; Airfoil Profiles

20030064883 Army Aviation and Missile Command, USA
Flight Evaluation of the Army/NASA Variable Stability Fly-by-Wire Rotorcraft Aircrew Systems Concept Airborne Laboratory (RASCAL) JUH-60A
Arterburn, Dave; [2002]; 1 pp.; In English; Society of Experimental Test Pilot East Coast Symposium, 18 Apr. 2002, Crystal City, VA, USA; No Copyright; Avail: CASI; A01, Hardcopy

NASA Ames Research Center and the U.S. Army Aeroflightdynamics Directorate (AFDD) have performed initial flight evaluations of the Research Flight Control System (RFCS) integrated into the Army/NASA Rotorcraft Aircrew Systems Concepts Airborne Laboratory (RASCAL) JUH-60A. The highly modified JUH-6OA Black Hawk helicopter is a full authority, high bandwidth, variable stability, in-flight simulator designed to support development of advanced flight control, sensor, and integrated display and control technologies in a fail safe environment. Preparation for flight test required an

extensive hazard analysis and ground testing to ensure proper system operation. A hardware in the loop development facility was utilized to evaluate control law stability following software changes, assess servo hardover upset conditions during manual and monitor disengagements and provide pilot familiarization of test techniques and software changes prior to flight. First engagement of the RFCS was conducted on 31 Aug 2001. RFCS transfer system operation, envelope expansion and a limited rate monitor evaluation have been completed with low bandwidth and model following control laws.
Author
Fly By Wire Control; Flight Management Systems; Ground Based Control; Flight Tests; Computer Programs; Computer Programming; Flight Simulators; Control Stability

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*.

20030064039 NASA Ames Research Center, Moffett Field, CA, USA
A Software Framework to Enhance Training and Operations of Space Missions
Betts, Bradley J.; Papasin, Richard; Elcott, Sharif; McIntosh, Dawn; delMundo, Rommel; Niehaus, Brian; Mah, Robert W.; Guerrero, Michael; Wilson, Edward; [2003]; 7 pp.; In English; Space Mission Challenges for Information Technology 2003, July 2003, Pasadena, CA, USA
Contract(s)/Grant(s): NAS2-00065; Copyright; Avail: Other Sources

Many software development tasks centered on training and operations for spaceflight have common aspects. Software engineers and researchers working in these areas stand to benefit from a software framework that can provide frequently used components. Preliminary results from the development of such a framework are presented in this paper. It is hoped that by documenting design patterns and providing reusable software components, cost savings can be realized and design experience can be captured. Components in the framework are grouped into four major areas: Information Management, Visualization, Simulation and Decision Making, and Real-time Data. An example is presented of the framework being applied to address remote training challenges at the NASA Space Station Training Facility. physically bring the crew together, they should be able to engage in meaningful collaborative training sessions. In the operational realm, ground controllers should be able to easily visualize the current, future, and past configurations of a space platform and be able to rapidly gain complete information about onboard systems. Delivering these kinds of capabilities at a reasonable cost is a challenge. However, the risk reductions and cost savings derived from more efficient training and operations will help offset the development and maintenance outlays for hardware and software systems. Software costs in particular can be vexing-software developed to meet a training or operational requirement may be difficult to reuse to solve a new challenge. The software profession as a whole has recognized the problem of efficient code reuse and has responded with research and development into various toolkits, frameworks, and design patterns.
CASI
Real Time Operation; Portable Equipment; Space Flight Training; Virtual Reality

20030064074 La Salle Univ., Philadelphia, PA, USA
A Subjective Assessment of Alternative Mission Architecture Operations Concepts for the Human Exploration of Mars at NASA Using a Three-Dimensional Multi-Criteria Decision Making Model
Tavana, Madjid; National Aeronautics and Space Administration (NASA)/American Society of Engineering Education (ASEE) Summer Faculty Fellowship Program - 2000; March 2003, pp. 17-1 - 17-14; In English; See also 20030064055; No Copyright; Avail: CASI; A03, Hardcopy

The primary driver for developing missions to send humans to other planets is to generate significant scientific return. NASA plans human planetary explorations with an acceptable level of risk consistent with other manned operations. Space exploration risks can not be completely eliminated. Therefore, an acceptable level of cost, technical, safety, schedule, and political risks and benefits must be established for exploratory missions. This study uses a three-dimensional multi-criteria decision making model to identify the risks and benefits associated with three alternative mission architecture operations concepts for the human exploration of Mars identified by the Mission Operations Directorate at Johnson Space Center. The three alternatives considered in this study include split, combo lander, and dual scenarios. The model considers the seven

phases of the mission including: 1) Earth Vicinity/Departure; 2) Mars Transfer; 3) Mars Arrival; 4) Planetary Surface; 5) Mars Vicinity/Departure; 6) Earth Transfer; and 7) Earth Arrival. Analytic Hierarchy Process (AHP) and subjective probability estimation are used to captures the experts belief concerning the risks and benefits of the three alternative scenarios through a series of sequential, rational, and analytical processes.
Author
Manned Mars Missions; Mission Planning; Decision Making

20030065263 Pennsylvania State Univ., University Park, PA
Development of Improved Molecular Excitation Models for Modeling of High Altitude Space Plume Radiation
Wang, Kon-Well; Mar. 3, 2003; 13 pp.; In English
Contract(s)/Grant(s): F49620-02-1-0104
Report No.(s): AD-A413399; AFRL-SR-AR-TR-03-0094; No Copyright; Avail: CASI; A03, Hardcopy

A main task completed under this project was to understand the sensitivity of chemical models used in the Direct Simulation Monte Carlo method to the pair selection techniques as well as the use of discrete versus continuum energy level.
DTIC
Excitation; Molecular Dynamics; Plumes; Exhaust Gases

20030065308 Massachusetts Inst. of Tech., Cambridge, MA, USA
Data Analysis for CHAWS Modeling
Martinez-Sanchez, Manuel; Mar. 24, 2000; 27 pp.; In English
Contract(s)/Grant(s): F19628-93-K-0029; Proj-2822
Report No.(s): AD-A413197; AFRL-VS-TR-2002-161; No Copyright; Avail: CASI; A03, Hardcopy

We report here on results on two related areas of plasma-structure interaction: the analysis of data on ion collection by a negative probe in the wake of large objects (CHAWS experiment), and the modeling of electron collection by a bare positive tether in a low Earth orbit. In the first area, our analysis contributed to a number of important conclusions, including the identification of a probable density probe miscalibration, quantification of the role of H = ion collection (particularly at low bias), and description of the cylindrical-to-spherical probe sheath transition as bias increases. In the tether modeling ara, we have been able to move beyond the classical analysis of Laframboise for a non-moving, non-magnetized cylindrical probe by including both a meso-thermal plasma flow, and a cross-magnetic field, both representative of orbital conditions. The full Particle-in-Cell codes we developed predict that, in the presence of the cross-flow, current collection exceeds the Orbital Motion Limit by a factor close to 2. Preliminary analysis of these results indicate that the strong plasma fluctuations revealed by the simulation in the frontal (ion stagnation) area are responsible for the current excess.
DTIC
Mathematical Models; Data Processing; Aircraft Wakes; Computer Programs; Electron Trajectories

13
ASTRODYNAMICS

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

20030065296 Air Force Inst. of Tech., Wright-Patterson AFB, OH, USA
Development, Fabrication and Ground Test of an Inflatable Structure Space-Flight Experiment
Philley, Thomas L., Jr; Mar. 2003; 152 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): Proj-03-299
Report No.(s): AD-A413193; AFIT/GA/ENY/03-3; No Copyright; Avail: CASI; A08, Hardcopy

Inflatable, rigidizable structures provide a solution to reduce the costs associated with design, fabrication and launch of a space system while simultaneously increasing the deployment reliability and mission success of the system%. This research focused on the follow on design, fabrication, and ground test of the Rigidizable Inflatable Get-Away-Special Experiment (RIGEX). RIGEX is a self-contained experiment that will test the deployment and structural characteristics of three inflatable rigidizable tubes. Once inflated and rigidized, each tube will be excited using piezoelectric transducers in order to collect vibration data for structural characterization. The goal of this research was to collect ground testing data that will later be used in conjunction with actual space flight results in an effort to validate ground testing methodologies.
DTIC
Fabrication; Get Away Specials (Sts); Ground Tests; Inflatable Structures; Spaceborne Experiments

14
GROUND SUPPORT SYSTEMS AND FACILITIES (SPACE)

Includes launch complexes, research and production facilities; ground support equipment, e.g., mobile transporters; and test chambers and simulators. Also includes extraterrestrial bases and supporting equipment. For related information see also *09 Research and Support Facilities (Air)*.

20030063962 NASA Johnson Space Center, Houston, TX, USA
STS-114 Crew Training Clip
[2003]; In English
Report No.(s): JSC-1938; No Copyright; Avail: CASI; V03, Videotape-VHS; B03, Videotape-Beta

The crew of Space Shuttle Atlantis on STS-114 is seen conducting several training exercises in preparation for their mission. The crew consists of Commander Eileen Collins, Pilot James Kelly, and Mission Specialists Soichi Noguchi and Stephen Robinson. With them are Yuri Malenchenko, Sergei Moschenko, and Edward Lu, the intended Expedition 7 crew of the International Space Station (ISS). During extravehicular activity (EVA) training in the virtual reality (VR) laboratory, crew members explore the exterior of the ISS, seen on a monitor. Suiting up with VR equipment is also shown. More EVA training takes place in the Neutral Buoyancy Laboratory (NBL). Here the astronauts are suited up for the NBL pool, and lowered into the water on a platform. After a crew photo session, the astronauts are seated in the Motion Base Simulator in their flight suits. The simulator is shown rocking side-to-side. The crew also hears a hands-on explanation of EVA preparations in the ISS airlock, and practices emergency egress from the CCT, a simulator shaped like an orbiter.
CASI
Space Shuttles; Spacecrews; Astronaut Training; Space Flight Training; Training Simulators

20030064063 Texas Univ. Health Science Center, Houston, TX, USA
User and Task Analysis of the Flight Surgeon Console at the Mission Control Center of the NASA Johnson Space Center
Johnson, Kathy A.; Shek, Molly; National Aeronautics and Space Administration (NASA)/American Society of Engineering Education (ASEE) Summer Faculty Fellowship Program - 2000; March 2003, pp. 6-1 - 6-12; In English; See also 20030064055
Contract(s)/Grant(s): NAG9-867; No Copyright; Avail: CASI; A03, Hardcopy

Astronauts in a space station are to some extent like patients in an intensive care unit (ICU). Medical support of a mission crew will require acquisition, transmission, distribution, integration, and archiving of significant amounts of data. These data are acquired by disparate systems and will require timely, reliable, and secure distribution to different communities for the execution of various tasks of space missions. The goal of the Comprehensive Medical Information System (CMIS) Project at Johnson Space Center Flight Medical Clinic is to integrate data from all Medical Operations sources, including the reference information sources and the electronic medical records of astronauts. A first step toward the full CMIS implementation is to integrate and organize the reference information sources and the electronic medical record with the Flight Surgeons console. In order to investigate this integration, we need to understand the usability problems of the Flight Surgeon's console in particular and medical information systems in general. One way to achieve this understanding is through the use of user and task analyses whose general purpose is to ensure that only the necessary and sufficient task features that match users capacities will be included in system implementations. The goal of this summer project was to conduct user and task analyses employing cognitive engineering techniques to analyze the task of the Flight Surgeons and Biomedical Engineers (BMEs) while they worked on Console. The techniques employed were user interviews, observations and a questionnaire to collect data for which a hierarchical task analysis and an information resource assessment were performed. They are described in more detail below. Finally, based on our analyses, we make recommendations for improvements to the support structure.
Author
Flight Surgeons; Information Systems; Space Stations; Consoles

20030065309 Range Commanders Council, White Sands Missile Range, NM, USA
Enhanced Flight Termination System Study Phase I - IV Reports
Nov. 2002; 244 pp.; In English; Original contains color illustrations
Report No.(s): AD-A413201; RCC/RSG-RS-38; No Copyright; Avail: CASI; A11, Hardcopy

The goal of the Enhanced Flight Termination System (EFTS) study was to investigate more robust command links for flight termination including message formats and modulation methods. This study was structured into four phases: Phase I. Requirements Definition/Range Infrastructure: The goal of this phase was to research current flight termination systems

(FTSs). The Phase I report was completed in September 2000. Phase II. Technology Assessment: This phase explored and analyzed current analog and digital modulation techniques available for FTS applications. Several manageable solutions were identified that would meet the guidelines and requirements established in Phase I. Based upon the best overall value, the modulation schemes that were determined to warrant additional analysis in Phase III were the continuous phase frequency shift keying (CPFSK) and modified high alphabet (MHA) schemes. The Phase II report was completed in March 2001. Phase III. Technology Demonstration: Based upon the information gathered from Phase I and II of the study, further analysis was conducted during Phase III to determine the optimal modulation scheme and the layout of the digital message to be sent from the ground transmitting system to the flight termination receiver. The Phase III report was completed in January 2002. Phase IV. RCC Standards Recommendations: The objectives of Phase IV were to wrap-up all tasks associated with RS-38 and to prepare and initiate the design validation phase. The tasks included generating the RCC tasks necessary to update the RCC standards affected by EFTS, addressing the TEMPEST requirements for security, implementing EFTS with different scenarios, developing new system performance specifications for validation and development, and estimating the costs for developing EFTS and upgrading the country's ground infrastructure.
DTIC
Flight Control; Range Safety; Abort Apparatus

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*.

20030064256 NASA Marshall Space Flight Center, Huntsville, AL, USA
An Overview of the Process for Pre-Launch Checkout and Transition Activities in Support of the International Space Station (ISS) Payload Operations Integration Center
Digesu, Sam V.; Glover, Valeta L.; Scheuermann, Kurt; Lankford, Kimberly W.; [2002]; 1 pp.; In English; 2003 IEEE Aerospace Conference, 8-15 Mar. 2003, Big Sky, MT, USA; No Copyright; Avail: Other Sources; Abstract Only

The objective of this paper is to provide future ISS scientists and/or engineers with an overview of the coordination process for the preparation and implementation of the pre-launch checkout and transition activities as observed from the Marshall Control Flight Center (MSFC) Payload Operations Integration Center perspective. This includes 4 major phases: (1) Verification and validation of the new command and telemetry databases that are needed for new payload experiments and new onboard formats; (2) Integration testing of the new ground control software and hardware; (3) Final internal and external pre-launch checkouts with cadre and experiment teams; (4) Performance of the actual synchronized transition between MSFC, Johnson Space Center (JSC), and ISS onboard configuration to new onboard software, ground software, and databases.
Derived from text
Ground Support Systems; International Space Station; Payload Integration; Applications Programs (Computers); Computer Programming; Software Engineering; Systems Integration; Software Reliability

20030064343 Federal Aviation Administration, Washington, DC
Commercial Space Transportation Forecasts: 2003
May 2003; In English
Report No.(s): PB2003-105725; No Copyright; Avail: National Technical Information Service (NTIS)

The Federal Aviation Administrations Associate Administrator for Commercial Space Transportation (FAA/AST) and the Commercial Space Transportation Advisory Committee (COMSTAC) have prepared forecasts of global demand for commercial space launch services for the period 2003 to 2012. The 2003 Commercial Space Transportation Forecasts report includes the following: the COMSTAC 2003 Commercial Geosynchronous Orbit Launch Demand Model, which projects demand for commercial satellites that operate in geosynchronous orbit (GSO) and the resulting launch demand to geosynchronous transfer orbit (GTO); and the FAA's 2003 Commercial Space Transportation Forecast for Non-Geosynchronous Orbits, which projects commercial launch demand for satellites in non-geosynchronous orbits (NGSO), such as low Earth orbit (LEO), medium Earth orbit (MEO), elliptical orbit (ELI), and external (EXT) orbit.
NTIS
Space Transportation; Geosynchronous Orbits; Forecasting

20030064977 Federal Aviation Administration, Washington, DC

Reusable Launch Vehicles and Spaceports: Programs and Concepts for 2001

January 2001; In English

Report No.(s): PB2003-105721; No Copyright; Avail: National Technical Information Service (NTIS)

This report provides technical and business information on U.S. commercial and government reusable launch vehicles (RLVs) and spaceports. The report describes operational vehicles and spaceports as well as efforts currently in development or proposal stages. The Federal Aviation Administration (FAA) Associate Administrator for Commercial Space Transportation (AST) first published this report in 1998. Now in its fourth edition, this publication is similar to its predecessors but contains some important additions and changes. Each individual RLV entry has been updated with the most recent publicly available information on the RLV's financial, technical, testing, and manufacturing situation. Each spaceport entry has been updated with respect to financing and infrastructure investment and upgrades. Other significant changes include a more narrow focus on U.S. RLV concepts and programs; except for those competing for the X PRIZE, international RLV concepts under consideration for development are not discussed in this report. Finally, the section on U.S. government RLV programs only focuses on concepts that are intended for space launch opposed to space flight. The resulting report is a comprehensive overview of the RLV industry in the USA.

NTIS

Reusable Launch Vehicles; Launching Bases; Spacecraft Launching; Launching Sites

20030065165 Air Force Center for Environmental Excellence, Brooks AFB, TX

Final Environmental Impact Statement Evolved Expendable Launch Vehicle Program

Apr. 1998; 671 pp.; In English

Report No.(s): AD-A413417; No Copyright; Avail: CASI; A99, Hardcopy

This FEIS has been prepared in accordance with the National Environmental Policy Act to analyze the potential environmental consequences of the Proposed Action and the No-Action Alternative. The Proposed Action is the development, deployment, and operation of EELV systems. EELV systems would replace current Atlas IIA, Delta II, and Titan IVB launch systems and are intended to meet the requirements of the U.S. government National Executable Mission Model (NMM), both medium and heavy lift, at a lower launch cost than the present expendable launch systems. The proposed launch locations for the program are Cape Canaveral Air Station (AS), Brevard County, Florida, and Vandenberg Air Force Base (AFB), Santa Barbara County, California. Under the Proposed Action, three concepts were examined. Concepts A and B depict each of the two EELV contractor concepts. The number of launches analyzed for each of these concepts includes the government NMM, plus 16 commercial launches per year. Under Concept A/B, there is no distinction between government and commercial flights. For the analysis, each contractor is assumed to launch 50 percent of the combined total of EELV flights.

DTIC

Launch Vehicles; Environment Effects

20030065190 Space and Missile Systems Organization, Los Angeles AFB, CA

Environmental Impact Analysis Process. Environmental Assessment for NAVSTAR Global Positioning System, Block IIR, and Medium Launch Vehicle III, Cape Canaveral Air Station, Florida

Nov. 1994; 171 pp.; In English

Report No.(s): AD-A413147; No Copyright; Avail: CASI; A08, Hardcopy

Pursuant to the National Environmental Policy Act, the Council on Environmental Quality regulations implementing the Act (40 CFR 1500-1508), Department of Defense Directive 6050.1, Air Force Regulation 19-2, which implements these regulations in the Environmental Impact Analysis Process (EIAP) , Air Force Regulation 19-9 regarding interagency coordination, and other applicable federal and local regulations, the US Air Force has conducted an assessment of the potential environmental consequences of the NAVSTAR Global Positioning System (GPS) Block IIR satellite constellation and the Medium Launch Vehicle III (MLV III) program. Proposed Action: The Air Force proposes to transport, process, launch, operate, and ultimately dispose of 21 NAVSTAR GPS block IIR Space Vehicles (SV) using the 21 Delta II Launch Vehicles (LV) proposed for acquisition under the MLV III program from Cape Canaveral Air Station (AS), Florida. The Block IIR SVs will replenish the current Block II/IIA SVs as their operational life ends.

DTIC

Global Positioning System; Launch Vehicles; Environment Management

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*.

20030064894 NASA Langley Research Center, Hampton, VA, USA
Wind Tunnel Testing of Various Disk-Gap-Band Parachutes
Cruz, Juan R.; Mineck, Raymond E.; Keller, Donald F.; Bobskill, Maria V.; [2003]; 17 pp.; In English; 17th AIAA Aerodynamics Decelerator Systems Technology Conference, 19-22 May 2003, Phoenix, AZ, USA
Report No.(s): AIAA Paper 2003-2129; No Copyright; Avail: CASI; A03, Hardcopy

Two Disk-Gap-Band model parachute designs were tested in the NASA Langley Transonic Dynamics Tunnel. The purposes of these tests were to determine the drag and static stability coefficients of these two model parachutes at various subsonic Mach numbers in support of the Mars Exploration Rover mission. The two model parachute designs were designated 1.6 Viking and MPF. These model parachute designs were chosen to investigate the tradeoff between drag and static stability. Each of the parachute designs was tested with models fabricated from MIL-C-7020 Type III or F-111 fabric. The reason for testing model parachutes fabricated with different fabrics was to evaluate the effect of fabric permeability on the drag and static stability coefficients. Several improvements over the Viking-era wind tunnel tests were implemented in the testing procedures and data analyses. Among these improvements were corrections for test fixture drag interference and blockage effects, and use of an improved test fixture for measuring static stability coefficients. The 1.6 Viking model parachutes had drag coefficients from 0.440 to 0.539, while the MPF model parachutes had drag coefficients from 0.363 to 0.428. The 1.6 Viking model parachutes had drag coefficients 18 to 22 percent higher than the MPF model parachute for equivalent fabric materials and test conditions. Model parachutes of the same design tested at the same conditions had drag coefficients approximately 11 to 15 percent higher when manufactured from F-111 fabric as compared to those fabricated from MIL-C-7020 Type III fabric. The lower fabric permeability of the F-111 fabric was the source of this difference. The MPF model parachutes had smaller absolute statically stable trim angles of attack as compared to the 1.6 Viking model parachutes for equivalent fabric materials and test conditions. This was attributed to the MPF model parachutes larger band height to nominal diameter ratio. For both designs, model parachutes fabricated from F-111 fabric had significantly greater statically stable absolute trim angles of attack at equivalent test conditions as compared to those fabricated from MILC-7020 Type III fabric. This reduction in static stability exhibited by model parachutes fabricated from F-111 fabric was attributed to the lower permeability of the F-111 fabric. The drag and static stability coefficient results were interpolated to obtain their values at Mars flight conditions using total porosity as the interpolating parameter.
Author
Wind Tunnel Tests; Parachutes; Drag; Static Stability; Parachute Fabrics; Design Analysis; Wind Tunnel Models; Aerodynamic Coefficients

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*.

20030064932 New Mexico State Univ., Las Cruces, NM, USA
The Center for Space Telemetering and Telecommunications Systems
Horan, S.; DeLeon, P.; Borah, D.; Lyman, R.; July 10, 2003; 45 pp.; In English
Contract(s)/Grant(s): NAG5-9323
Report No.(s): NMSU-ECE-03-003; No Copyright; Avail: CASI; A03, Hardcopy

This report comprises the final technical report for the research grant 'Center for Space Telemetering and Telecommunications Systems' sponsored by the National Aeronautics and Space Administration's Goddard Space Flight Center. The grant activities are broken down into the following technology areas: (1) Space Protocol Testing; (2) Autonomous Reconfiguration of Ground Station Receivers; (3) Satellite Cluster Communications; and (4) Bandwidth Efficient Modulation. The grant activity produced a number of technical reports and papers that were communicated to NASA as they were generated. This final report contains the final summary papers or final technical report conclusions for each of the project areas.

Additionally, the grant supported students who made progress towards their degrees while working on the research.
Derived from text
Communication Networks; Protocol (Computers); Space Communication; Multichannel Communication; Signal Processing; Wireless Communication; Satellite Constellations; Frequency Modulation

20030065227 Air Force Inst. of Tech., Wright-Patterson AFB, OH, USA
A Study of Control Laws for Microsatellite Rendezvous with a Noncooperative Target
Tschirhart, Troy A.; March 2003; 91 pp.; In English
Report No.(s): AD-A413016; AFIT/GAI/ENY/03-3; No Copyright; Avail: CASI; A05, Hardcopy

This study investigated the feasibility of using a microsatellite to accomplish an orbital rendezvous with a noncooperative target, with a focus on the control laws necessary for achieving such a rendezvous. The relative motions of the microsatellite and the target satellite are described using Hill's equations. The results of an investigation of two different controller methodologies show that an impulsive thrust controller based on the Clohessey-Wiltshire solution used little fuel, but was not very robust. A continuous thrust controller using a Linear Quadratic Regulator was found to be more robust, but used much more fuel. As a final solution, a hybrid controller was evaluated which uses the low thrust Clohessey-Wiltshire approach to cover most of the necessary distance, and then switches to the Linear Quadratic Regulator method for the final rendezvous solution. Results show that this approach achieves rendezvous with a reasonable amount of control input. (23 tables, 29 figures,
DTIC
Orbital Rendezvous; Microsatellites; Control Theory; Target Acquisition; Rendezvous Guidance

18
SPACECRAFT DESIGN, TESTING AND PERFORMANCE

Includes satellites; space platforms; space stations; spacecraft systems and components such as thermal and environmental controls; and spacecraft control and stability characteristics. For life support systems see *54 Man/System Technology and Life Support*. For related information see also *05 Aircraft Design, Testing and Performance; 39 Structural Mechanics*; and *16 Space Transportation and Safety*.

20030053054 NASA Kennedy Space Center, Cocoa Beach, FL, USA
Scale Model Experiments on Sound Propagation From a Mach 2.5 Cold Nitrogen Jet Flowing Through a Rigid-Walled Duct With a J-Deflector
Kandula, Max; Vu, Bruce; April 2003; 62 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): NAS10-03006
Report No.(s): NASA/TM-2003-211186; NAS 1.15: 211186; No Copyright; Avail: CASI; A04, Hardcopy

The Launch Systems Testbed (LST) represents the evolution of vibroacoustics research and development work performed at NASA John F. Kennedy Space Center (KSC) over the last 15 years. The LST is located at the Launch Equipment Test Facility (LETF) in the KSC industrial complex. The LETF is operated by Sierra Lobo, Inc., as a member of University-Affiliated Technology Development Contract (USTDC) to KSC Spaceport and Engineering and Technology Directorate (YA), with ASRC Aerospace Corporation as a the prime contractor. Trajectory Simulation Mechanism (TSM) is a major component of the LST, developed specifically to simulate nonstationary acoustic loads on launch pad structures, vehicles, and payloads. TSM enhances the capabilities within LST for simulating launch environments of future vehicles. The scaled launch environments will be used to predict the full-scale launch environment via an appropriate scaling procedure. Air Force Research Laboratory (AFRL) has tasked NASA KSC to perform a basic technology test program in support of developing a low-cost clean pad (incorporating passive mitigation techniques) for future launch vehicles. The overall goal of the program is to develop innovative launch exhaust management systems, which effectively reduce launch acoustic environment with innovative duct designs, while eliminating traditional sound suppression water systems. Passive techniques, such as nontraditional duct geometries, resonators, and diffusers, etc., will be investigated. The overall goals are to advance innovative concepts for a clean pad while developing ideas to reduce transmitted sound via investigation and modeling of jet exhaust acoustic and flow field characteristics. The series of tests outlined in this report represent baseline tests and are geared towards defining the acoustic load environment on the TSM pad for open and closed duct configurations. This report summarizes the cold jet acoustic testing for Mach 2.5 supersonic nitrogen jet issuing from a nozzle with 1-inch exit diameter. Acoustic data, including spectral sound power and Overall Sound Pressure Level (OASPL), are obtained both for a free jet and with the jet flowing through a rigid-walled duct with a J-deflector. The relative performance of closed duct and open duct

is evaluated. The results show that the closed duct is superior to the partially open duct, and results in about 3-decibel (dB) noise reduction (near the duct axis) relative to the free jet. The location of the nozzle exit plane (NEP) relative to the duct inlet plane (DIP) has a significant effect on the acoustic field. The results suggest that the location of NEP at 10 inches above the DIP results in reduced acoustic loads relative to 5 inches above the duct inlet and 1 inch into the duct inlet.
Author
Scale Models; Experimentation; Sound Propagation; Nitrogen; Acoustic Properties; Exhaust Systems; Noise Reduction

20030063100 North Carolina Agricultural and Technical State Univ., Greensboro, NC, USA
An Innovative Manufacturing of CCC Ion Thruster Grids by North Carolina A&T's RTM Carbon/Carbon Process
Haag, Thomas W., Technical Monitor; Shivakumar, Kunigal N.; HBCUs/OMUs Research Conference Agenda and Abstracts; February 2003, pp. 20; In English; See also 20030063082; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Electric ion thrusters are the preferred engines for deep space missions, because of very high specific impulse. The ion engine consists of screen and accelerator grids containing thousands of concentric very small holes. The xenon gas accelerates between the two grids, thus developing the impulse force. The dominant life-limiting mechanism in the state-of-the-art molybdenum thrusters is the xenon ion sputter erosion of the accelerator grid. Carbon/carbon composites (CCC) have shown to be have less than 1/7 the erosion rates than the molybdenum, thus for interplanetary missions CCC engines are inevitable. Early effort to develop CCC composite thrusters had a limited success because of limitations of the drilling technology and the damage caused by drilling. The proposed is an in-situ manufacturing of holes while the CCC is made. Special low CTE molds will be used along with the NC A&T s patented resin transfer molding (RTM) technology to manufacture the CCC grids. First, a manufacture process for 10-cm diameter thruster grids will be developed and verified. Quality of holes, density, CTE, tension, flexure, transverse fatigue and sputter yield properties will be measured. After establishing the acceptable quality and properties, the process will be scaled to manufacture 30-cm diameter grids. The properties of the two grid sizes are compared with each other.
Author
Manufacturing; Technology Assessment; Carbon-Carbon Composites

20030063107 NASA Glenn Research Center, Cleveland, OH, USA
Advanced Methods for Aircraft Engine Thrust and Noise Benefits: Nozzle-Inlet Flow Analysis
Morgan, Morris H.; Gilinsky, Mikhail; Patel, Kaushal; Coston, Calvin; Blankson, Isaiah M.; HBCUs/OMUs Research Conference Agenda and Abstracts; February 2003, pp. 17; In English; See also 20030063082
Contract(s)/Grant(s): CRDF-RE1-2068; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The research is focused on a wide regime of problems in the propulsion field as well as in experimental testing and theoretical and numerical simulation analyses for advanced aircraft and rocket engines. Results obtained are based on analytical methods, numerical simulations and experimental tests at the NASA LaRC and Hampton University computer complexes and experimental facilities. The main objective of this research is injection, mixing and combustion enhancement in propulsion systems. The sub-projects in the reporting period are: (A) Aero-performance and acoustics of Telescope-shaped designs. The work included a pylon set application for SCRAMJET. (B) An analysis of sharp-edged nozzle exit designs for effective fuel injection into the flow stream in air-breathing engines: triangular-round and diamond-round nozzles. (C) Measurement technique improvements for the HU Low Speed Wind Tunnel (HU LSWT) including an automatic data acquisition system and a two component (drag-lift) balance system. In addition, a course in the field of aerodynamics was developed for the teaching and training of HU students.
Author
Supersonic Combustion Ramjet Engines; Thrust; Noise Intensity; Inlet Flow; Flow Characteristics; Performance Tests; Numerical Analysis

20030063258 Martin Marietta Space Systems, Inc., Denver, CO, USA
Space Station Freedom Advanced Development Bimonthly Report for SSM/PMAD Automation: Power Management and Distribution Automation
Walls, Bryan; Beyond the Baseline: Proceedings of the Space Station Freedom Evolution Symposium. Volume 2: Space Station Freedom Advanced Development Program, Part 1; April 1990, pp. 37-58; In English; See also 20030063244
Contract(s)/Grant(s): NAS8-36433; UPN 476-81-07; No Copyright; Avail: CASI; A03, Hardcopy

This project consists of several tasks which are unified toward experimentally demonstrating the operation of a highly autonomous, user-supportive power management and distribution system for Space Station Freedom (SSF) hab/lab modules. This goal will be extended to a demonstration of autonomous, cooperative power system operation for the whole Space Station Freedom power system through a joint effort with LeRC using their Autonomous Power System. Short term goals for the space station module PMAD include having an operational breadboard reflecting current plans for Space Station Freedom, improving performance of the system communications, and improving the organization and mutability of the artificial intelligence (AI) systems. In the middle term, intermediate levels of autonomy will be added, user interfaces will be modified, and enhanced modeling capabilities will be integrated in the system. Long term goals involve conversion of all software into Ada, vigorous verification and validation efforts, and, finally, seeing an impact of this research on the operation of Space Station Freedom. Conversion of this system to a DC Star configuration is now in progress, and should be completed by the end of October, 1989. This configuration reflects the latest SSF module architecture. Hardware is now being procured which will improve system communications significantly. The Knowledge Base Management System (KBMS) is initially developed, and the rules from FRAMES have been implemented in the KBMS. Rules in the other two AI systems are also being grouped modularly, making them more tractable, and easier to eventually move into the KBMS. Adding intermediate levels of autonomy will require development of a planning utility, which will also be built using the KBMS. These changes will require having the user interface for the whole system available from one interface. An Enhanced Model will be developed, which will allow exercise of the system through the interface without requiring all of the power hardware to be operational. The functionality of the AI systems will continue to be advanced, including incipient failure detection. Ada conversion will begin with the Lowest Level Processor (LLP) code. Then selected pieces of the higher level functionality will be recorded in Ada and, where possible, moved to the LLP level. Validation and verification will be done on the Ada code, and will complete sometime after completion of the Ada conversion.

Author

Space Station Freedom; Artificial Intelligence; Autonomy; Management Systems; Space Station Modules; Space Station Power Supplies

20030063935 NASA Marshall Space Flight Center, Huntsville, AL, USA

Performance Testing of Thermal Interface Filler Materials in a Bolted Aluminum Interface Under Thermal/Vacuum Conditions

Glasgow, S. D.; Kittredge, K. B.; June 2003; 15 pp.; In English

Report No.(s): NASA/TM-2003-212500; NAS 1.15:212500; M-1075; No Copyright; Avail: CASI; A03, Hardcopy

A thermal interface material is one of the many tools often used as part of the thermal control scheme for space-based applications. Historically, at Marshall Space Flight Center, CHO-THERM 1671 has primarily been used for applications where an interface material was deemed necessary. However, numerous alternatives have come on the market in recent years. It was decided that a number of these materials should be tested against each other to see if there were better performing alternatives. The tests were done strictly to compare the thermal performance of the materials relative to each other under repeatable conditions and do not take into consideration other design issues, such as off-gassing, electrical conduction, isolation, etc. The purpose of this Technical Memorandum is to detail the materials tested, test apparatus, procedures, and results of these tests. The results show that there are a number of better performing alternatives now available.

Author

Temperature Control; Interfaces; Performance Tests

20030064012 NASA Ames Research Center, Moffett Field, CA, USA

The Plant Research Unit (PRU): A Plant Habitat for ISS

Morrow, Robert; Reiss-Bubenheim, Debra; Schaefer, Ronald L.; [2003]; 1 pp.; In English; American Society of Planet Biology Conference, 25-31 Jul. 2003, Honolulu, HI, USA; No Copyright; Avail: Other Sources; Abstract Only

The Plant Research Unit (PRU) is one of six life science habitats being developed as part of the Space Station Biological Research Program. The PRU is designed for plant experiments in microgravity and will utilize the ISS Centrifuge Facility to provide gravity levels between microgravity and 2g. The PRU will provide and control all aspects of a plant's needs in a nearly closed system. In other words, the shoot and root environments will not be open to the astronaut's environment except for experiment maintenance such as planting, harvesting and plant sampling. This also means that all lighting, temperature and humidity control, watering, and air filtering and cleaning must be done within strict limitations of volume, weight, power, and crew time while at the same time providing a very high of reliability and a service life in excess of 10 years. The PRU will contain two plant chambers 31.5 cm tall, each with independent control of temperature, humidity, light level and photoperiod, CO, level, nutrient and water delivery, and video and data acquisition. The PRU is currently in the preliminary design phase

and a number of subsystem components have been prototyped for testing, including the temperature and humidity control systems, the plant chambers, the LED lighting system, the atmospheric control system and a variety of nutrient delivery. The LED prototype provides independent feedback control of 5 separate spectral bands and variable output between 0 and 3000 mumo1m(exp -2)s(exp -1). The water and nutrient delivery system (WNDS) prototypes have been used to test particulate based, thin film, and gel-based WNDS configurations.
Author
International Space Station; Plants (Botany); Spaceborne Experiments; Microgravity; Aerospace Environments; Manned Orbital Laboratories

20030064017 Boeing Phantom Works, Huntington Beach, CA, USA
Boeing 2nd Generation Reusable Launch Vehicle Architecture
Bienhoff, Dallas; [2003]; 21 pp.; In English; Space Technology and Applications International Forum (STAIF 2003), 2-5 Feb. 2003, Albuquerque, NM, USA
Contract(s)/Grant(s): NAS8-01099; No Copyright; Avail: CASI; A03, Hardcopy
This paper presents viewgraphs on the Space Launch Initiative (SLI) space shuttle safety upgrades.
CASI
Reusable Launch Vehicles; Spacecraft Design; Space Shuttles; Space Transportation System

20030064052 NASA Marshall Space Flight Center, Huntsville, AL, USA
Ceramic Matrix Composite Cooled Nozzle Material Development Program
Lawrence, Tim; Eckel, Andy; Porter, John; Pichon, T.; Patterson, B.; Paquette, T.; [2002]; 2 pp.; In English; JANNAF 13th NDES Meeting, 27-29 Aug. 2002, San Antonio, TX, USA
Contract(s)/Grant(s): NAS8-00141; NAS8-99112; NAS8-00140; NAS8-00124; No Copyright; Avail: Other Sources; Abstract Only
The X-33 program initiated a risk reduction technology project to develop an actively cooled cermic matrix composite (CMC) nozzle ramp for the linear aerospike engine. The objective was to reduce the weight and increase the operating temperature capabilities of the nozzle ramp. A complement to this original project was subsequently supported by NASA's Second Generation Reusable Launch Vehicle Program to develop a high risk high payoff cooled composite nozzle ramp. This project focused on less mature technologies and concepts having the potential to achieve a significant weight reduction beyond those systems which were being considered in the original X-33 project. The aerospike engine was not selected under the initial Space Launch Initiative (SLI) Program research announcement. However, in recognition of the tremendous application opportunities of such technology to other areas and systems in the rocket industry, the effort was continued and is in the process of being transferred to the 3rd Generation Reusable Launch Vehicle (RLV) Program where it will be combined with the current cooled CMC panel project. The objective of the refocused project is to advance the material, design, and analysis work on the ramp concepts to a point that would allow the selection of the most promising candidate(s) for continued development. The concept(s) carried on in the 3rd Generation RLV Program will be modified to address the goals of this program. Originally, four contracts with different design concepts were initiated. Each contractor has performed design and analysis of their concept and submitted a subscale component for testing in the Cell 22 test rig at Glenn Research Center. This paper will discuss the results to date of each design concept and the potential applications to future rocket nozzle systems. The engineering technology challenges for each concept were determined and addressed during this phase of the effort. These challenges and the success in addressing them will also be discussed. High temperature, noneroding nozzle materials have the potential to significantly improve nozzle performance. The work performed under this effort is at the forefront of CMC material development and will give the rocket nozzle community a good view into the status of cooled CMC materials.
Author
Ceramic Matrix Composites; X-33 Reusable Launch Vehicle; Rocket Nozzles; Ramps (Structures)

20030064065 Texas A&M Univ., College Station, TX, USA
Robotic Mars Sample Return: Risk Assessment and Analysis Report
Lalk, Thomas R.; Spence, Cliff A.; National Aeronautics and Space Administration (NASA)/American Society of Engineering Education (ASEE) Summer Faculty Fellowship Program - 2000; March 2003, pp. 7-1 - 7-15; In English; See also 20030064055; Original contains black and white illustrations
Contract(s)/Grant(s): NAG9-867; No Copyright; Avail: CASI; A03, Hardcopy
A comparison of the risk associated with two alternative scenarios for a robotic Mars sample return mission was

conducted. Two alternative mission scenarios were identified, the Jet Propulsion Lab (JPL) reference Mission and a mission proposed by Johnson Space Center (JSC). The JPL mission was characterized by two landers and an orbiter, and a Mars orbit rendezvous to retrieve the samples. The JSC mission (Direct/SEP) involves a solar electric propulsion (SEP) return to earth followed by a rendezvous with the space shuttle in earth orbit. A qualitative risk assessment to identify and characterize the risks, and a risk analysis to quantify the risks were conducted on these missions. Technical descriptions of the competing scenarios were developed in conjunction with NASA engineers and the sequence of events for each candidate mission was developed. Risk distributions associated with individual and combinations of events were consolidated using event tree analysis in conjunction with Monte Carlo techniques to develop probabilities of mission success for each of the various alternatives. The results were the probability of success of various end states for each candidate scenario. These end states ranged from complete success through various levels of partial success to complete failure. Overall probability of success for the Direct/SEP mission was determined to be 66\% for the return of at least one sample and 58\% for the JPL mission for the return of at least one sample cache. Values were also determined for intermediate events and end states as well as for the probability of violation of planetary protection. Overall mission planetary protection event probabilities of occurrence were determined to be 0.002\% and 1.3\% for the Direct/SEP and JPL Reference missions respectively.
Author
Mars Sample Return Missions; Assessments; Risk; Interplanetary Spacecraft

20030064145 NASA Marshall Space Flight Center, Huntsville, AL, USA
X-37 C-SiC CMC Control Surface Components Development: Status of the NASA/Boeing/USAF Orbital Vehicle and Related Efforts
Valentine, Peter G.; Rivers, H. Kevin; Chen, Victor L.; 2003; 1 pp.; In English; 27th Annual Conference on Composites, Materials, and Structures, 27-30 Jan. 2003, Cape Canaveral, FL, USA; Copyright; Avail: Other Sources; Abstract Only

Carbon/Silicon-Carbide (C-SiC) ceramic matrix composite (CMC) flaperon and ruddervator control surface components are being developed for the X-37 Orbital Vehicle (OV). The results of the prior NASA LaRC led work, aimed at developing C-SiC flaperon and ruddervator components for the X-37, will be reviewed. The status of several on-going and/or planned NASA, USAF, and Boeing programs that will support the development of control surface components for the X-37 OV will also be reviewed. The overall design and development philosophy being employed to assemble a team(s) to develop both (a) C-SiC hot structure control surface components for the X-37 OV, and (b) carbon-carbon (C-C) hot structure components (a risk-reduction backup option for the OV), will be presented.
Author
Ceramic Matrix Composites; X-37 Vehicle; Silicon Carbides; Control Surfaces

20030065058 Texas Univ., Houston, TX, USA
Imaging Systems for Space Station Freedom
Wagner, Lou; Proceedings of the Space Station Freedom Clinical Experts Seminar; April 1991, pp. 55-57; In English; See also 20030065052; No Copyright; Avail: CASI; A01, Hardcopy

This paper presents a discussion on X-ray imaging systems for the Space Station Freedom. Lou Wagner, Ph.D., talks about the three preconsultation meetings held to determine if there should be x ray imaging in space. He also explains the outcome of these meetings and how these meetings had an impact on the development of x ray imaging on the space station.
CASI
Imaging Techniques; Space Station Freedom; X Rays

20030065279 Army Aviation and Missile Command, Redstone Arsenal, AL, USA
A MATLAB/Aerodynamic Analyzer System Tool
Auman, Lamar M.; Newby, Jonathan; Apr. 2003; 64 pp.; In English; Original contains color illustrations
Report No.(s): AD-A412972; AMSAM-RD-SS-TR-RD-SS-03-10; No Copyright; Avail: CASI; A04, Hardcopy

A MATLAB script has been developed that interfaces with the U. S. Army Aviation and Missile Command's Aerodynamic Analyzer System (AAS). This tool has the capability of automatically removing data biases, forcing delta symmetry, and plotting 3-Dimensional (3-D) data, A MATLAB script has been developed that interfaces with the U S Army Aviation and Missile Command's Aerodynamic Analyzer System (AAS). This tool has the capability of automatically removing data biases, forcing delta symmetry, and plotting 3-Dimensional (3-D) data,
DTIC
Wind Tunnel Tests; Aerodynamics; Missile Systems; Bias

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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*.

20030053057 NASA Ames Research Center, Moffett Field, CA, USA

An Autonomous Control System for an Intra-Vehicular Spacecraft Mobile Monitor Prototype

Dorais, Gregory A.; Desiano, Salvatore D.; Gawdiak, Yuri; Nicewarner, Keith; [2003]; 8 pp.; In English; 7th International Symposium on Artificial Intelligence, Robotics and Automation in Space, Nara, Japan; Original contains black and white illustrations; Copyright; Avail: CASI; A02, Hardcopy

This paper presents an overview of an ongoing research and development effort at the NASA Ames Research Center to create an autonomous control system for an internal spacecraft autonomous mobile monitor. It primary functions are to provide crew support and perform intra- vehicular sensing activities by autonomously navigating onboard the International Space Station. We describe the mission roles and high-level functional requirements for an autonomous mobile monitor. The mobile monitor prototypes, of which two are operational and one is actively being designed, physical test facilities used to perform ground testing, including a 3D micro-gravity test facility, and simulators are briefly described. We provide an overview of the autonomy framework and describe each of its components, including those used for automated planning, goal-oriented task execution, diagnosis, and fault recovery. A sample mission test scenario is also described.

Author

Autonomy; Automatic Control; Intravehicular Activity; Monitors; Prototypes; Robotics

20030053081 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Precision Pointing for the Laser Interferometer Space Antenna (LISA) Mission

Bauer, Frank H., Technical Monitor; Hyde, T. Tupper; Maghami, P.; [2003]; 1 pp.; In English; 2003 AAS Guidance and Control Conference, 5-9 Feb. 2003, CO, USA; No Copyright; Avail: Other Sources; Abstract Only

The Laser Interferometer Space Antenna (LISA) mission is a planned NASA-ESA gravity wave detector consisting of three spacecraft in heliocentric orbit. Lasers are used to measure distance fluctuations between the proof masses aboard the spacecraft to the picometer level over the 5 million kilometer spacing. Each spacecraft and it's two laser transmit/receive telescopes must be held stable in pointing to less than 8 nanoradians per root Hertz in the frequency band 0.1 mHz to 0.1 Hz. This is accomplished by sensing the pointing error in the received beam and controlling the spacecraft attitude with a set of micronewton thrusters. Requirements, sensors, actuators, control design, and simulations are described in this paper.

Author

Lisa (Observatory); Pointing Control Systems; Spacecraft Control; Spaceborne Telescopes; Spacecraft Orbits

20030064073 Tarleton State Univ., Stephenville, TX, USA

MiniAERCam Ranging

Talley, Tom; National Aeronautics and Space Administration (NASA)/American Society of Engineering Education (ASEE) Summer Faculty Fellowship Program - 2000; March 2003, pp. 16-1 - 16-14; In English; See also 20030064055

Contract(s)/Grant(s): NAG9-867; No Copyright; Avail: CASI; A03, Hardcopy

Johnson Space Center (JSC) is designing a small, remotely controlled vehicle that will carry two color and one black and white video cameras in space. The device will launch and retrieve from the Space Vehicle and be used for remote viewing. Off the shelf cellular technology is being used as the basis for communication system design. Existing plans include using multiple antennas to make simultaneous estimates of the azimuth of the MiniAERCam from several sites on the Space Station and use triangulation to find the location of the device. Adding range detection capability to each of the nodes on the Space Vehicle would allow an estimate of the location of the MiniAERCam to be made at each Communication And Telemetry Box (CATBox) independent of all the other communication nodes. This project will investigate the techniques used by the Global Positioning System (GPS) to achieve accurate positioning information and adapt those strategies that are appropriate to the design of the CATBox range determination system.

Author

Remotely Piloted Vehicles; Space Stations; Spacecraft Antennas; Rangefinding

20030064163 NASA Marshall Space Flight Center, Huntsville, AL, USA
Advanced Health Management of a Brushless Direct Current Motor/Controller
Pickett, R. D.; June 2003; 14 pp.; In English
Report No.(s): NASA/TM-2003-212502; M-1077; NAS 1.15:212502; No Copyright; Avail: CASI; A03, Hardcopy

This effort demonstrates that health management can be taken to the component level for electromechanical systems. The same techniques can be applied to take any health management system to the component level, based on the practicality of the implementation for that particular system. This effort allows various logic schemes to be implemented for the identification and management of failures. By taking health management to the component level, integrated vehicle health management systems can be enhanced by protecting box-level avionics from being shut down in order to isolate a failed computer.
Author
Health; Management Systems; Electromechanics; Controllers; Avionics

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SPACECRAFT PROPULSION AND POWER

Includes main propulsion systems and components, e.g., rocket engines; and spacecraft auxiliary power sources. For related information see also *07 Aircraft Propulsion and Power, 28 Propellants and Fuels, 15 Launch Vehicles and Launch Operations*, and *44 Energy Production and Conversion*.

20030053080 NASA Glenn Research Center, Cleveland, OH, USA
MEMS-Based Spinning Nozzle
Okojie, Robert S., Inventor; February 04, 2003; 9 pp.; In English
Patent Info.: Filed 21 Mar. 2001; US-Patent-6,513,730; US-Patent-Appl-SN-816722; NASA-Case-LEW-17110-1; No Copyright; Avail: CASI; A02, Hardcopy

A nozzle body and assembly for delivering atomized fuel to a combustion chamber. The nozzle body is rotatably mounted onto a substrate. One or more curvilinear fuel delivery channels are in flow communication with an internal fuel distribution cavity formed in the nozzle body. Passage of pressurized fuel through the nozzle body causes the nozzle body to rotate. Components of the nozzle assembly are formed of silicon carbide having surfaces etched by deep reactive ion etching utilizing MEMS (micro-electro-mechanical systems) technology. A fuel premix chamber is carried on the substrate in flow communication with a supply passage in the nozzle body.
Official Gazette of the U.S. Patent and Trademark Office
Microelectromechanical Systems; Nozzles; Rotation; Silicon Carbides; Etching

20030063086 Norfolk State Univ., VA, USA
Novel High Efficient Organic Photovoltaic Materials
Sun, Sam; Haliburton, James; Wang, Yi-Qing; Fan, Zhen; Taft, Charles; Maaref, Shahin; Bailey, Sheila, Technical Monitor; HBCUs/OMUs Research Conference Agenda and Abstracts; February 2003, pp. 19; In English; See also 20030063082; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Solar energy is a renewable, nonpolluting, and most abundant energy source for human exploration of a remote site or outer space. In order to generate appreciable electrical power in space or on the earth, it is necessary to collect sunlight from large areas and with high efficiency due to the low density of sunlight. Future organic or polymer (plastic) solar cells appear very attractive due to their unique features such as light weight, flexible shape, tunability of energy band-gaps via versatile molecular or supramolecular design, synthesis, processing and device fabrication schemes, and much lower cost on large scale industrial production. It has been predicted that supramolecular and nano-phase separated block copolymer systems containing electron rich donor blocks and electron deficient acceptor blocks may facilitate the charge carrier separation and migration due to improved electronic ultrastructure and morphology in comparison to polymer composite system. This presentation will describe our recent progress in the design, synthesis and characterization of a novel block copolymer system containing donor and acceptor blocks covalently attached. Specifically, the donor block contains an electron donating alkyloxy derivatized polyphenylenevinylene (RO-PPV), the acceptor block contains an electron withdrawing alkyl-sulfone derivatized polyphenylenevinylene (SF-PPV). The key synthetic strategy includes the synthesis of each individual block first, then couple the blocks together. While the donor block has a strong PL emission at around 560 nm, and acceptor block has a strong PL emission at around 520 nm, the PL emissions of final block copolymers are severely quenched. This verifies the expected electron transfer and charge separation due to interfaces of donor and acceptor nano phase separated blocks. The system

therefore has potential for variety light harvesting applications, including high efficient photovoltaic applications.
Author
Acceptor Materials; Organic Materials; Photovoltages; Fabrication

20030063951 Nauchno-Proizvodstvennoe Obedinenie Prikladnoi Mekhaniki, Krasnoyarsk, Russia
Hall Effect Thruster Interactions Data From the Russian Express-A2 and Express-A3 Satellites, Part 8, Acquire TM-Data for Type A and Type B Sensors for 'Express A' Number 3 Satellite for the Period of January 1, 2001 to and Including March 31, 2001, Task 27C
Dunning, John, Technical Monitor; Sitnikova, N.; Volkov, D.; Maximov, I.; Petrusevich, V.; Allen, D.; June 2003; 545 pp.; In English
Contract(s)/Grant(s): NAS3-99151; NAS3-99204; WBS 22-800-91-01
Report No.(s): NASA/CR-2003-212005/PT8; E-13691-8/PT8; NAS 1.26:212005/PT8; No Copyright; Avail: CASI; A23, Hardcopy

This 12-part report documents the data obtained from various sensor measurements taken aboard the Russian Express-A2 and Express-A3 spacecraft in Geosynchronous Earth Orbit (GEO). These GEO communications satellites, which were designed and built by NPO Prikladnoy Mekhaniki (NPO PM) of Zheleznogorsk, Russia, utilize Hall thruster propulsion systems for north-south and east-west stationkeeping and as of June 2002, were still operating at 80deg E. and 11deg W., respectively. Express-A2 was launched on March 12, 2000, while Express-A3 was launched on June 24, 2000. The diagnostic equipment from which these data were taken includes electric field strength sensors, ion current and energy sensors, and pressure sensors. The diagnostics and the Hall thruster propulsion systems are described in detail along with lists of tabular data from those diagnostics and propulsion system and other satellite systems. Space Power, Inc., now part of Pratt & Whitney's Chemical Systems Division, under contract NAS3 99151 to the NASA Glenn Research Center, obtained these data over several periods from March 12, 2000, through September 30, 2001. Each of the 12 individual reports describe, in detail, the propulsion systems as well as the diagnostic sensors utilized. Finally, parts 11 and 12 include the requirements to which NPO PM prepared and delivered these data.
Author
Propulsion System Configurations; Electric Field Strength; Hall Thrusters; Hall Effect; Geosynchronous Orbits; Earth Orbits

20030063959 Nauchno-Proizvodstvennoe Obedinenie Prikladnoi Mekhaniki, Krasnoyarsk, Russia
Hall Effect Thruster Interactions Data From the Russian Express-A2 and Express-A3 Satellites, Part 11, Express/T-160E Project Express A2 and A3 Data Agreement Document
Sitnikova, N.; Volkov, D.; Maximov, I.; Petrusevich, V.; Allen, D.; Dunning, John, Technical Monitor; June 2003; 26 pp.; In English
Contract(s)/Grant(s): NAS3-99151; NAS3-99204; WBS 22-800-91-01
Report No.(s): NASA/CR-2003-212005/PT11; E-13691--11/PT11; NAS 1.26:212005/PT11; No Copyright; Avail: CASI; A03, Hardcopy

This 12-part report documents the data obtained from various sensor measurements taken aboard the Russian Express-A2 and Express-A3 spacecraft in Geosynchronous Earth Orbit (GEO). These GEO communications satellites, which were designed and built by NPO Prikladnoy Mekhaniki (NPO PM) of Zheleznogorsk, Russia, utilize Hall thruster propulsion systems for north-south and east-west stationkeeping and as of June 2002, were still operating at 80deg E. and 11deg W., respectively. Express-A2 was launched on March 12, 2000, while Express-A3 was launched on June 24, 2000. The diagnostic equipment from which these data were taken includes electric field strength sensors, ion current and energy sensors, and pressure sensors. The diagnostics and the Hall thruster propulsion systems are described in detail along with lists of tabular data from those diagnostics and propulsion system and other satellite systems. Space Power, Inc., now part of Pratt & Whitney's Chemical Systems Division, under contract NAS3-99151 to the NASA Glenn Research Center, obtained these data over several periods from March 12, 2000, through September 30, 2001. Each of the 12 individual reports describe, in detail, the propulsion systems as well as the diagnostic sensors utilized. Finally, parts 11 and 12 include the requirements to which NPO PM prepared and delivered these data.
Author
Hall Thrusters; Propulsion System Configurations; Electric Field Strength; Geosynchronous Orbits; Earth Orbits; Hall Effect

20030063977 Nauchno-Proizvodstvennoe Obedinenie Prikladnoi Mekhaniki, Krasnoyarsk, Russia

Hall Effect Thruster Interactions Data From the Russian Express-A2 and Express-A3 Satellites, Part 10, Acquire TM-Data for Type A and Type B Sensors for 'Express-A' Number 3 Satellite for the Period of July 1, 2001 to and Including September 30, 2001, Task 27D

Dunning, John, Technical Monitor; Sitnikova, N.; Volkov, D.; Maximov, I.; Petrusevich, V.; Allen, D.; June 2003; 393 pp.; In English

Contract(s)/Grant(s): NAS3-99151; NAS3-99204; WBS 22-800-91-01

Report No.(s): NASA/CR-2003-212005/PT10; E-13691-10/PT10; NAS 1.26:212005/PT10; No Copyright; Avail: CASI; A17, Hardcopy

This 12-part report documents the data obtained from various sensor measurements taken aboard the Russian Express-A2 and Express-A3 spacecraft in Geosynchronous Earth Orbit (GEO). These GEO communications satellites, which were designed and built by NPO Prikladnoy Mekhaniki (NPO PM) of Zheleznogorsk, Russia, utilize Hall thruster propulsion systems for north-south and east-west stationkeeping and as of June 2002, were still operating at 80 E. and 11 W., respectively. Express-A2 was launched on March 12, 2000, while Express-A3 was launched on June 24, 2000. The diagnostic equipment from which these data were taken includes electric field strength sensors, ion current and energy sensors, and pressure sensors. The diagnostics and the Hall thruster propulsion systems are described in detail along with lists of tabular data from those diagnostics and propulsion system and other satellite systems. Space Power, Inc., now part of Pratt & Whitney's Chemical Systems Division, under contract NAS3 99151 to the NASA Glenn Research Center, obtained these data over several periods from March 12, 2000, through September 30, 2001. Each of the 12 individual reports describe, in detail, the propulsion systems as well as the diagnostic sensors utilized. Finally, parts 11 and 12 include the requirements to which NPO PM prepared and delivered these data.

Author

Hall Effect; Data Acquisition; Thrustors; Electric Field Strength; Geosynchronous Orbits; Hall Thrusters; Ion Currents

20030064034 NASA Marshall Space Flight Center, Huntsville, AL, USA

Shuttle Main Propulsion System LH2 Feed Line and Inducer Simulations

Dorney, Daniel J.; Rothermel, Jeffry; [2002]; 26 pp.; In English; NASA/MSFC Fluids Workshop, 19-21 Nov. 2002, Huntsville, AL, USA; No Copyright; Avail: CASI; A03, Hardcopy

This viewgraph presentation includes simulations of the unsteady flow field in the LH2 feed line, flow line, flow liner, backing cavity and inducer of Shuttle engine #1. It also evaluates aerodynamic forcing functions which may contribute to the formation of the cracks observed on the flow liner slots. The presentation lists the numerical methods used, and profiles a benchmark test case.

CASI

Space Shuttle Main Engine; Liquid Hydrogen; Feed Systems; Flow Distribution

20030064179 Nauchno-Proizvodstvennoe Obedinenie Prikladnoi Mekhaniki, Krasnoyarsk, Russia

Hall Effect Thruster Interactions Data From the Russian Express-A2 and Express-A3 Satellites, Part 7, Acquire Express-A3 SPT-100 Based Propulsion Subsystem and Other Subsystem Flight Operation TM-Data, Task 32

Sitnikova, N.; Volkov, D.; Maximov, I.; Petrusevich, V.; Allen, D.; June 2003; 68 pp.; In English

Contract(s)/Grant(s): NAS3-99151; NAS3-99204; WBS 22-800-91-01

Report No.(s): NASA/CR-2003-212005/PT7; E-13691-7/PT7; NAS 1.26:212005/PT7; No Copyright; Avail: CASI; A04, Hardcopy

This 12-part report documents the data obtained from various sensor measurements taken aboard the Russian Express-A2 and Express-A3 spacecraft in Geosynchronous Earth Orbit (GEO). These GEO communications satellites, which were designed and built by NPO Prikladnoy Mekhaniki (NPO PM) of Zheleznogorsk, Russia, utilize Hall thruster propulsion systems for north-south and east-west stationkeeping and as of June 2002, were still operating at 80 E. and 11 W., respectively. Express-A2 was launched on March 12, 2000, while Express-A3 was launched on June 24, 2000. The diagnostic equipment from which these data were taken includes electric field strength sensors, ion current and energy sensors, and pressure sensors. The diagnostics and the Hall thruster propulsion systems are described in detail along with lists of tabular data from those diagnostics and propulsion system and other satellite systems. Space Power, Inc., now part of Pratt & Whitney's Chemical Systems Division, to the NASA Glenn Research Center, obtained these data over several periods from March 12, 2000, through September 30, 2001. Each of the 12 individual reports describe, in detail, the propulsion systems as well as the

diagnostic sensors utilized. Finally, parts 11 and 12 include the requirements to which NPO PM prepared and delivered these data.
Author
Hall Effect; Hall Thrusters; Electric Propulsion; Communication Satellites; Russian Space Program; Spacecraft Propulsion

20030064183 Nauchno-Proizvodstvennoe Obedinenie Prikladnoi Mekhaniki, Krasnoyarsk, Russia
Hall Effect Thruster Interactions Data From the Russian Express-A2 and Express-A3 Satellites, Acquire Express-A3 SPT 100 Based Propulsion Subsystem and Other Subsystem Flight Operation TM-Data, Task 33
Sitnikova, N.; Volkov, D.; Maximov, I.; Petrusevich, V.; Allen, D.; June 2003; 71 pp.; In English
Contract(s)/Grant(s): NAS3-99151; NAS3-99204; WBS 22-800-91-01
Report No.(s): NASA/CR-2003-212005/PT9; E-13691/PT9; NAS 1.26:212005/PT9; No Copyright; Avail: CASI; A04, Hardcopy

This 12-part report documents the data obtained from various sensor measurements taken aboard the Russian Express-A2 and Express-A3 spacecraft in Geosynchronous Earth Orbit (GEO). These GEO communications satellites, which were designed and built by NPO Prikladnoy Mekhaniki (NPO PM) of Zheleznogorsk, Russia, utilize Hall thruster propulsion systems for north-south and east-west stationkeeping and as of June 2002, were still operating at 80 deg E and 11 deg W, respectively. Express-A2 was launched on March 12, 2000, while Express-A3 was launched on June 24, 2000. The diagnostic equipment from which these data were taken includes electric field strength sensors, ion current and energy sensors, and pressure sensors. The diagnostics and the Hall thruster propulsion systems are described in detail along with lists of tabular data from those diagnostics and propulsion system and other satellite systems. Space Power, Inc., now part of Pratt & Whitney's Chemical Systems Division, under contract NAS3-99151 to the NASA Glenn Research Center, obtained these data over several periods from March 12, 2000, through September 30, 2001. Each of the 12 individual reports describe, in detail, the propulsion systems as well as the diagnostic sensors utilized. Finally, parts 11 and 12 include the requirements to which NPO PM prepared and delivered these data.
Author
Hall Thrusters; Electric Propulsion; Hall Effect; Measuring Instruments; Spacecraft Configurations; Propulsion System Configurations; Systems Engineering; Satellite Design; Spacecraft Propulsion

20030064312 Nauchno-Proizvodstvennoe Obedinenie Prikladnoi Mekhaniki, Krasnoyarsk, Russia
Hall Effect Thruster Interactions Data From the Russian Express-A2 and Express-A3 Satellites, Part 3, Acquire Express-A3 SPT-100 Based Propulsion Subsystem and Other Subsystem Flight Operation TM-Data for the Period of June 24, 2000 to and Including September 30, 2000, Task 30
Sitnikova, N.; Volkov, D.; Maximov, I.; Petrusevich, V.; Allen, D.; June 2003; 199 pp.; In English
Contract(s)/Grant(s): NAS3-99151; NAS3-99204; WBS 22-800-91-01
Report No.(s): NASA/CR-2003-212005/PT3; E-13691-3/PT3; NAS 1.26:212005/PT3; No Copyright; Avail: CASI; A09, Hardcopy

This 12-part report documents the data obtained from various sensor measurements taken aboard the Russian Express-A2 and Express-A3 spacecraft in Geosynchronous Earth Orbit (GEO). These GEO communications satellites, which were designed and built by NPO Prikladnoy Mekhaniki (NPO PM) of Zheleznogorsk, Russia, utilize Hall thruster propulsion systems for north-south and east-west stationkeeping and as of June 2002, were still operating at 80 E. and 11 W., respectively. Express-A2 was launched on March 12, 2000, while Express-A3 was launched on June 24, 2000. The diagnostic equipment from which these data were taken includes electric field strength sensors, ion current and energy sensors, and pressure sensors. The diagnostics and the Hall thruster propulsion systems are described in detail along with lists of tabular data from those diagnostics and propulsion system and other satellite systems. Space Power, Inc., now part of Pratt & Whitney's Chemical Systems Division, under contract NAS3 99151 to the NASA Glenn Research Center, obtained these data over several periods from March 12, 2000, through September 30, 2001. Each of the 12 individual reports describe, in detail, the propulsion systems as well as the diagnostic sensors utilized. Finally, parts 11 and 12 include the requirements to which NPO PM prepared and delivered these data.
Author
Hall Effect; Data Acquisition; Stationkeeping; Electric Field Strength; Hall Thrusters; Pressure Sensors

20030064472 Engineering Research and Consulting, Inc., Edwards AFB, CA, USA

Propulsion Instrument Electronics and Sensor Package

Adkison, Paul B.; Dulligan, Michael J.; Spanjers, Greg; Bromaghim, Daron; Harrison, Rick; Jan. 21, 2003; 14 pp.; In English

Contract(s)/Grant(s): F04611-00-C-0055; Proj-6340

Report No.(s): AD-A411549; AFRL-PR-ED-TP-2002-316; No Copyright; Avail: CASI; A03, Hardcopy

Spacecraft operators and designers need to understand the interaction between thrusters and spacecraft, and the limitations of ground test facilities make it important to validate models with data obtained from on-orbit conditions. Toward this end, a sensor package will be manifested aboard future spacecraft for the purpose of developing a predictive capability for how electric propulsion thrusters interact with typical spacecraft. A small Hall thruster and a micro-PPT will be operated in orbit and several instruments will characterize the environment induced by the thrusters. An ion probe will determine the energy and species distributions and a Langmuir probe will characterize the electron density and temperature of the back-flow region of the thruster plume. These data are intended for comparison with detailed numerical models in this region. Other instruments directly measure the effects of thruster operation on spacecraft thermal control surfaces, optical surfaces and solar arrays. Specifically, radiometric, photometric and solar-cell-based sensors are under development.

DTIC

Electric Propulsion; Detectors; Instrument Packages; Spacecraft Propulsion; Onboard Equipment

20030064961 NASA Marshall Space Flight Center, Huntsville, AL, USA

The Plasmoid Thruster Experiment (PTX)

Eskridge, R.; Martin, Adam; Lee, Michael; Smith, James; Koelfgen, Syri; [2003]; 23 pp.; In English; 14th Annual NASA/MSFC/JPL Advanced Space Propulsion Workshop, 15-17 Apr. 2003, Huntsville, AL, USA; Copyright; Avail: CASI; A03, Hardcopy

This viewgraph presentation describes the overall Plasma Thruster Experiment (PTX), it's purpose and design, compact toroid propulsion, advantages and requirements of a plasmoid thruster, the projected efficiency, theta-pinch formation, a simulation of the PTX Coil/Bank Circuit using SPICE, the test firing of the PTX Capacitor Bank, PTX diagnostics, the excluded flux array, thruster simulations using MOQUI, and future work on the PTX.

CASI

Magnetoplasmadynamic Thrusters; Magnetoplasmadynamics; Plasma Propulsion

20030065049 Science Applications International Corp., Huntsville, AL, USA

Factors Influencing Solar Electric Propulsion Vehicle Payload Delivery for Outer Planet Missions

Cupples, Michael; Green, Shaun; Coverstone, Victoria; [2003]; 16 pp.; In English; 2003 Space Flight Mechanics Meeting, 9-13 Feb. 2003, Ponce, Puerto Rico

Contract(s)/Grant(s): NASA Order H-35186-D

Report No.(s): AAS-03-123; Copyright; Avail: CASI; A03, Hardcopy

Systems analyses were performed for missions utilizing solar electric propulsion systems to deliver payloads to outer-planet destinations. A range of mission and systems factors and their affect on the delivery capability of the solar electric propulsion system was examined. The effect of varying the destination, the trip time, the launch vehicle, and gravity-assist boundary conditions was investigated. In addition, the affects of selecting propulsion system and power systems characteristics (including primary array power variation, number of thrusters, thruster throttling mode, and thruster Isp) on delivered payload was examined.

Author

Solar Electric Propulsion; Systems Analysis; Outer Planets Explorers; Payloads; Delivery

20030065212 Hubbs-Sea World Research Inst., San Diego, CA

Potential Impact of USAF Atmospheric Interceptor Technology (ait) Launches from the Kodiak Launch Complex, Kodiak Island, Alaska. Monitoring of Noise Levels During the Launch of ait-2

Bowles, Ann E.; Sep. 5, 2000; 46 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W62N6M-9243-8992

Report No.(s): AD-A413402; No Copyright; Avail: CASI; A03, Hardcopy

The U.S. Air Force (USAF) atmospheric interceptor technology (ait) program must conduct protected species monitoring during periods immediately before and after ait rocket launches from the Kodiak Launch Complex. Monitoring and mitigation efforts for two protected species, the endangered Steller sea lion (Eumetopias jubatus) and the threatened Steller's eider

(Polysticta stelleri), are a condition of the FONSI for the program and were conducted by the University of Alaska's Environment and Natural Resources Institute (ENRI) in the days before and after the ait-2 launch. The study reported herein was conducted from 12-15 September, 1999, before, during, and immediately after the ait-2 launch on 15 September. It ran in parallel with the ENRI effort and was designed to provide the USAF with detailed information about the acoustic characteristics of the ait-2 launch, in part for future prediction of animal impacts and in part for comparison with RNOISE model outputs. Opportunistic observations of animal behaviors were obtained during this effort as well. Larson-Davis sound monitors (LD 820, 824) were deployed to collect noise data automatically at four sites within the Safety Exclusion Zone (SEZ) for the launch, including two sites on Narrow Cape, the portion of Kodiak Island extending closest to Ugak Spit. A fifth monitor on Ugak Spit failed. A real-time DAT recording was collected just outside the SEZ, close to the Launch Control Complex (LCC). HSWRI and AFSMC cooperators were able to count and observe the behavior of marine mammals on 9/ 12 from Narrow Cape using a Meade ETX-9OEC Telescope (Lang 2000). They also collected behavioral observations during helicopter approaches and landings on Ugak Island 9/14 (2000-2130 hours) and 9/15 (1330-1350 hours). Sea lions were observed at Ugak Spit after the launch from 1345 to 1500 hours on 9/15 using the Meade telescope. There were no Steller's eiders in the area at the time of the launch. (6 tables, 12 figures, 20 refs.) 7

DTIC

Endangered Species; Acoustic Measurement; Surface To Air Missiles; Noise Pollution; Rocket Engine Noise; Seals (Animals); Stress (Physiology)

20030065247 NASA Glenn Research Center, Cleveland, OH, USA

Overview of GRC's C/SiC and SiC/SiC Ceramic Matrix Composite (CMC) Materials Development

Kiser, J. D.; DiCarlo, J. A.; Eckel, A J.; Freedman, M. R.; Levine, S. R.; [2001]; 25 pp.; In English; 2001 NASA Seal/Secondary Air System Workshop, 30-31 Oct. 2001, Cleveland, OH, USA; No Copyright; Avail: CASI; A03, Hardcopy

Ceramic matrix composite materials (CMCs) are being developed by an interdisciplinary team at the NASA Glenn Research Center for a wide variety of aeropropulsion and space transportation applications. Composites such as carbon fiber reinforced silicon carbide (C/SiC) and silicon carbide fiber reinforced silicon carbide (SiC/SiC) have the potential to enable higher efficiency propulsion systems and advanced airframe structures due to their high specific strength and their ability to operate at higher temperatures than superalloys. Glenn researchers with expertise in ceramic/CMC materials are teaming with propulsion and airframe specialists to address composite processing, microstructural and mechanical properties characterization, environmental durability, life prediction (including NDE), and component design, processing, and testing issues. The team builds on the strong materials foundation in ceramics and environmental durability that was developed at GRC in major aeronautics and space transportation programs. Team members work closely with university, NASA (MSFC, LaRC, and ARC), DoD, and industrial partners to develop, demonstrate, and transfer ceramics and CMC technology. While our research is application oriented, it also addresses the need for a fundamental understanding of processing-microstructure-property relationships.

Author

Ceramic Matrix Composites; Research And Development; Materials Science; Mechanical Properties; Microstructure; Life (Durability); Ceramics

20030065315 NASA Marshall Space Flight Center, Huntsville, AL, USA

Design Development Analyses in Support of a Heatpipe-Brayton Cycle Heat Exchanger

Steeve, Brian; VanDyke, Melissa; Majumdar, Alok; Nguyen, Dalton; Corley, Melissa; Guffee, Ray M.; Kapernick, Richard J.; [2003]; 1 pp.; In English; Space Technology and Applications International Forum, 2-5 Feb. 2003, Albuquerque, NM, USA; Copyright; Avail: Other Sources

One of the power systems under consideration for nuclear electric propulsion or as a planetary surface power source is a heatpipe-cooled reactor coupled to a Brayton cycle. In this system, power is transferred from the heatpipes to the Brayton gas via a heat exchanger attached to the heatpipes. This paper discusses the fluid, thermal and structural analyses that were performed in support of the design of the heat exchanger to be tested in the SAFE-100 experimental program at Marshall Space Flight Center. A companion paper, 'Mechanical Design and Fabrication of a SAFE-100 Heat Exchanger for use in NASA s Advanced Propulsion Thermal-hydraulic Simulator', presents the fabrication issues and prototyping studies that, together with these analyses, led to the development of this heat exchanger. An important consideration throughout the design development of the heat exchanger was its capability to be utilized for higher power and temperature applications. This paper also discusses this aspect of the design and presents designs for specific applications that are under consideration.

Author

Heat Exchangers; Brayton Cycle; Design Analysis; Nuclear Electric Propulsion; Structural Analysis

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*.

20030063097 Wilberforce Univ., OH, USA

Student Outreach With Renewable Energy Technology

Clark, Eric B., Technical Monitor; Buffinger, D.; Fuller, C.; Kalu, A.; HBCUs/OMUs Research Conference Agenda and Abstracts; February 2003, pp. 31; In English; See also 20030063082; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The Student Outreach with Renewable Energy Technology (SORET) program is a joint grant that involves a collaboration between three HBCU's (Central State University, Savannah State University, and Wilberforce University) and NASA John H. Glenn Research Center at Lewis Field. The overall goal of the grant is to increase the interest of minority students in the technical disciplines, to encourage participating minority students to continue their undergraduate study in these disciplines, and to promote graduate school to these students. As a part of SORET, Central State University has developed an undergraduate research associates program over the past two years. As part of this program, students are required to take special laboratory courses offered at Wilberforce University that involve the application of renewable energy systems. The course requires the students to design, construct, and install a renewable energy project. In addition to the applied renewable energy course, Central State University provided four undergraduate research associates the opportunity to participate in summer internships at Texas Southern University (Renewable Energy Environmental Protection Program) and the Cleveland African-American Museum (Renewable Energy Summer Camp for High School Students) an activity co sponsored by NASA and the Cleveland African-American Museum. Savannah State University held a high school summer program with a theme of the Direct Impact of Science on Our Every Day Lives. The purpose of the institute was to whet the interest of students in science, mathematics, engineering, and technology (SMET) by demonstrating the effectiveness of science to address real world problems. The 2001 institute involved the design and installation of a PV water pumping system at the Center for Advanced Water Technology and Energy Systems at Savannah State. Both high school students and undergraduates contributed to this project. Wilberforce University has used NASA support to provide resources for an Applied Renewable Energy Laboratory offered to both Central State and Wilberforce students. In addition, research endeavors for high school and undergraduates were funded during the summer. The research involved attempts to layer photovoltaic materials on a conducting polymer (polypyrrole) substrate. Two undergraduate students who were interested in polymer research originated this concept. Finally, the university was able to purchase a meteorological station to assist in the analysis of the solar/wind hybrid power system operating at the university.

Author

Renewable Energy; Energy Technology; Research And Development; Students

20030063992 Sarnoff Corp., Princeton, NJ

Protein-Assisted Redox Sensing at Biomimetic Electrode

Tian, Yongchi; Chen, Jia; Feb. 2003; 20 pp.; In English

Contract(s)/Grant(s): F49620-02-C-0082

Report No.(s): AD-A412000; AFRL-SR-AR-TR-03-0023; No Copyright; Avail: CASI; A03, Hardcopy

Sarnoff is developing a biomimetic protein-assisted redox sensing system based on the organized molecular pathways found in nature. This system makes use of a biomimetic membrane coated on a gold electrode as a bio-electronic interface. This membrane will enable the nondissipative conversion of a redox event occurring in an aqueous medium to an electrical signal. The nondissipative conversion is enabled by lipid chains functionalized with prosthetics groups that are organized to mimic concerted, vectorial electron transfer. In this program, Sarnoff has designed and synthesized electron transfer molecules, and engineered them into an organized self-assembled membrane (SAM). We have demonstrated the vectorial transfer of electrons from a biofluid (aqueous) solution to an electrode using this membrane. We also functionalized the SAM with proteins to demonstrate the sensing of redox reaction in aqueous solution.

DTIC

Electrodes; Biomimetics; Oxidation-Reduction Reactions

20030064032 University of Southern Mississippi, Hattiesburg, MS, USA
Frontal Polymerization in Microgravity Summary of Research
Pojman, John A.; [2002]; 74 pp.; In English
Contract(s)/Grant(s): NAG8-1466; No Copyright; Avail: CASI; A04, Hardcopy

The project began with frontal polymerization (FP). We studied many aspects of FP on the ground and performed two successful weeks of flying on the KC-135. The project evolved into the current flight investigation, Transient Interfacial Phenomena in Miscible Polymer Systems (TIPMPS), as we recognized that an essential question could best be studied using a non-frontal approach. We present detailed results from our ground-based work on FP, KC-135 results and the background, justification and numerical work for the TIPMPS project.
Author
Polymerization; Buoyancy-Driven Flow; Surface Tension Driven Convection; Microgravity

20030064249 Sandia National Labs., Albuquerque, NM
Quantitative Analysis of Microstructure in Polysiloxanes Using High Resolution 29Si NMR Spectroscopy: Investigation of Lot Variability in the LVM97 and HVM97 PDMS/PDPS Copolymers
Alam, T. M.; Nov. 2002; 27 pp.; In English
Report No.(s): DE2003-805875; SAND2002-3785; No Copyright; Avail: Department of Energy Information Bridge

The quantitative analysis of microstructure and sequence distribution in polysiloxane copolymers using high-resolution solution 29Si NMR is reported. Copolymers containing dimethylsiloxane (DMS) and diphenysiloxane (DPS) monomer units prepared with either high vinyl content (HVM) or low vinyl content (LVM) were analyzed. The average run length (Rexp), the number average sequence length (lA, lB), along with the various linkage probabilities (pAA, pAB, pBA, and pBB) were determined for different production lots of the LVM97 and HVM97 samples to address the lot variability of microstructure in these materials.
NTIS
Spectroscopy; Nuclear Magnetic Resonance; Probability Theory; Polysiloxanes; Copolymers

20030064258 Sandia National Labs., Albuquerque, NM
New Architectures for Micro-Total-Analytical Systems
Galambos, P. C.; James, C. D.; Pohl, K. R.; Pontau, A. E.; Kirby, B. J.; Dec. 2002; In English
Report No.(s): DE2003-805882; SAND2002-3988; No Copyright; Avail: National Technical Information Service (NTIS)

In this LDRD we developed new architectures (technologies, devices, and methodologies) that enhance our ability to apply electrokinetic phenomena in Microsystems. The application of these phenomena makes on-chip microHPLC (Micro High Performance Liquid Chromatography) systems possible and can be useful in a wide variety of microTAS applications. The use of silica packed glass microchannels to electrokinetically generate pressures of 3500 psi (1.1 psi/V) was demonstrated. Metal electrodes were incorporated in these glass channels for use as electrochemical sensors, and electrokinetic sample pinch-off loading procedures were developed. Photodefinable porous polymer plugs were fabricated in-place in transparent channels and a voltage drop across these plugs was used to develop a new class of electrokinetic pumps (over 1500 psi generated - 0.4 psi/V) . Electrokinetic flow phenomena were demonstrated on a silicon chip - to our knowledge the first on-silicon electrokinetic devices - by using surface micromachining to create transparent and insulating silicon nitride channels with in-channel photo-defined polysilicon electrodes.
NTIS
Electrokinetics; Electric Potential; Liquid Chromatography; Micromachining

20030064270 California Univ., Lawrence Berkeley National Lab., Berkeley, CA, USA, Yale Univ., New Haven, CT, USA
Breakthrough in Precision (0.3\%) of Neutron Activation Analyses Applied to Provenience Studies of Obsidian
Asaro, F.; Stross, F. H.; Burger, R. L.; 2002; 12 pp.; In English
Report No.(s): DE2003-807418; No Copyright; Avail: Department of Energy Information Bridge

A gamma ray spectrometer at LBNL (the Luis W. Alvarez Iridium Coincidence Spectrometer), that was specifically designed for high sensitivity measurements of iridium abundances, has been significantly modified in order to provide precisions of measurement in neutron activation analysis of obsidian significantly better than previously obtained (about 1\%). Repeated measurements on a single sample of obsidian from a deposit near Chivay, Arequipa, Peru, showed a precision (average coefficient of variation) of 0.19\% for the 6 best-measured elements, the value anticipated from the known random errors of measurement. In measurement of samples made from 7 different obsidian nodules from two locations near Chivay,

a group of 5 had a spread of 0. 30\% for the 6 elements measured with counting statistics of better than 0.3\% (and 1.8\% for the remaining 6 elements).
NTIS
Neutron Activation Analysis; Gamma Ray Spectrometers; Iridium

20030064467, California Univ., Santa Barbara, CA, USA
Atomistic Simulation of Vacancy and Self-Interstitial Diffusion in Fe-Cu Alloys
Marian, J.; Wirth, B. D.; Perlado, J. M.; Odette, G. R.; DiazdelaRubia, T.; Jan. 25, 2001; In English
Report No.(s): DE2003-15003262; UCRL-JC-139405; No Copyright; Avail: National Technical Information Service (NTIS)

Neutron hardening and embrittlement of pressure vessel steels is due to a high density of nanometer scale features, including Cu-rich precipitates which form as a result of radiation enhanced diffusion. High-energy displacement cascades generate large numbers of both isolated point defects and clusters of vacancies and interstitials. The subsequent clustering, diffusion and ultimate annihilation of primary damage is inherently coupled with solute transport and hence, the overall chemical and microstructural evolutions under irradiation. In this work, we present atomistic simulation results, based on many-body interatomic potentials, of the migration of vacancies, solute and self-interstitial atoms (SIA) in pure Fe and binary Fe-0.9 and 1.0 at.% Cu alloys. Cu diffusion occurs by a vacancy mechanism and the calculated Cu diffusivity is in good agreement with experimental data. Strain field interactions between the oversized substitutional Cu solute atoms and SIA and SIA clusters are predominantly repulsive and result in both a decreased activation energy and diffusion pre-factor for SIA and small (N less than 5) SIA cluster migration, which occurs by three-dimensional motion.
NTIS
Diffusion; Simulation; Copper Alloys; Iron Alloys; Steels; Atomic Clusters

20030065128 California Univ., Santa Barbara, CA
Structures and Energetics of Clusters and Macromolecules
Bowers, Michael T.; Apr. 28, 2003; 10 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F49620-99-1-0048; Proj-2303
Report No.(s): AD-A413430; AFRL-SR-AR-TR-03-0154; No Copyright; Avail: CASI; A02, Hardcopy

Virtually all of the progress and accomplishments have been described in detail in previous annual progress reports. These will not be repeated here. Only those few new results initiated in the last few months of the grant will be listed. POSS Systems: In the annual report submitted in September, 2002, we showed mass spectra of the StyxEpyT8 system synthesized at Edwards AFB, where x + y = 8, Sty stands for styrene and Ep for styrene with the vinyl group epoxidated. The pure Sty8T8 system had been discussed in previous reports and the work has recently been written up for publication. We showed preliminary arrival time distributions and averaged cross sections for Sty7EpT8 and Sty6Ep2T8 in the September, 2002, progress report. Since then we have also been able to obtain ATDs for the Sty5Ep3T8 species and have taken all 3 systems to 110 K to improve resolution. In each case we can resolve 3 isomers in the ATDs. Examples are given in Fig. 1 for Sty7EpT8 and Sty6Ep2T8. In Sty7EpT8 the isomers occur due to pairing of the non epoxided styryl capping groups (0 pairs, 1 pairs) while in Sty6Ep2T8 and Sty5Ep3T8 the isomers are due to different arrangements of the Ep capping groups on the T8 cage. The 3 possibilities for the Sty6Ep2T8 system were shown in the September, 2002 progress report. In Fig. 2 we show the 3 possibilities for the Sty5Ep3T8 system, the experimental cross sections and the cross sections from our theoretical modeling. Sty-Sty pairs are shown in blue. Clearly the agreement is excellent giving confidence in the results. It is interesting that Sty-Sty pairing is only observed in cases where there is no epoxide adjacent to the styryl capping agent.
DTIC
Styrenes; Macromolecules; Clusters

20030065293 Auburn Univ., AL, USA
A Novel N-Halamine Monomer for Preparing Biocidal Polyurethane Coatings
Worley, S. D.; Li, F.; Wu, R.; Kim, J.; Wei, C. I.; Mar. 31, 2002; 11 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F08637-01-C-6004
Report No.(s): AD-A413190; AFRL-ML-TY-TP-2002-4629; No Copyright; Avail: CASI; A03, Hardcopy

A novel N-halamine monomer has been prepared which can be copolymerized with a commercial waterborne acrylic polyol and a commercial isocyanate to produce a polyurethane coating which can be applied to a broad variety of surfaces. After curing, the coating can be chlorinated with a source of free chlorine, such as bleach, to render it biocidal. Once the coating loses its chlorine loading, and hence its biocidal activity, regeneration is possible by further exposure to free chlorine.

In one experimental observation a coating on a wall has retained its biocidal activity for more than six months. The biocidal coating should have many applications, including in medical facilities, in food preparation areas, in prevention of biofouling in aqueous and humid environments, etc.
DTIC
Monomers; Polyurethane Resins; Protective Coatings; Contamination; Pesticides

20030065317 Air Force Inst. of Tech., Wright-Patterson AFB, OH, USA
Theoretical Comparison of the Excited Electronic States of the Uranyl and Uranate Ions Using Relativistic Computational Methods
Beck, Eric V.; Mar. 2003; 128 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DE-A107-021D14328
Report No.(s): AD-A413026; AFIT/GNE/ENP/03-01; No Copyright; Avail: CASI; A07, Hardcopy

This thesis examines the ground and excited electronic states of the uranyl (UO2+) and uranate (UO4-2) ions using Hartree-Fock self-consistent field (HF SCF), multi-configuration self-consistent field (MCSCF) and multi-reference single and double excitation configuration interaction (MR- CISD) methods. The MR-CISD SD calculation included spin-orbit operators. Molecular geometries were obtained from self-consistent field (SCF) second-order perturbation theory (MP2), and density functional theory (DFT) geometry optimizations using the NWChem 4.01 massively parallel ab initio software package. COLUMBUS version 5.8 was used to perform in-depth analysis on the HF SCF MCSCF and MR-CISD potential energy surfaces. Excited state calculations for the uranyl ion were performed using both a large- and small-core relativistic effective core potential (RECP) in order to calibrate the method. This calibration included comparison to previous theoretical and experimental work on the uranyl ion. Uranate excited states were performed using the small-core RECP as well as the methodology developed using the uranyl ion.
DTIC
Electron States; Configuration Interaction; Self Consistent Fields

24
COMPOSITE MATERIALS

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

20030063087 Prairie View Agricultural and Mechanical Coll., TX, USA
Research to Significantly Enhance Composites Survivability at 550 F in Oxidative Environments
Meador, Michael A., Technical Monitor; Guinn, L.; Tewoldeberhan, A.; Inkurnsah, M.; Makori, F.; Carty, A.; Carson, L.; HBCUs/OMUs Research Conference Agenda and Abstracts; February 2003, pp. 23; In English; See also 20030063082; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Methylene dianiline (MDA) and its derivatives have been used in the synthesis of polyimides to yield polymers with characteristic low-density, high tensile strength, improved solubility in organic solvents, low-melt viscosities and high thermal stability (greater than 550 F) in air. Polyimides with such properties are desirable for use in aerospace systems, e.g., jet engines, airframe, missiles, and rockets where weight is critical. Recent research at Prairie View A&M University is focused on developing monomers to generate polyimides with enhanced performance over that of NASA s PMR-15. The objective of this work is to synthesize three ring aromatic diamines which are non-toxic and when reacted with the appropriate dianhydrides will yield polyimides with lower viscosity, improve processability, good retention of mechanical properties, and oxidative stability at high environmental temperatures. Modifications of the three ring aromatic diamines include replacing the methylene linkages with aromatic ethers by nucleophilic aromatic substitution reactions and incorporating mono- and di-substituents to the center aromatic ring. An update of current reactions involved in synthesis efforts to generate three ring aromatic monomers for polyimides with methylene, carbonyl, and ether linkages separating the aromatic moieties will be displayed.
Author
Carbonyl Compounds; Molecular Structure; Mechanical Properties; Thermal Stability; Polyimides

20030063103 City Coll. of the City Univ. of New York, NY, USA
Ultrasonic Assessment of Impact-Induced Damage and Microcracking in Polymer Matrix Composites
Gyekanyesi, John, Technical Monitor; Liaw, Benjamin; Villars, Esther; Delmont, Frantz; HBCUs/OMUs Research Conference Agenda and Abstracts; February 2003, pp. 10; In English; See also 20030063082; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The main objective of this NASA Faculty Awards for Research (FAR) project is to conduct ultrasonic assessment of impact-induced damage and microcracking in fiber-metal laminated (FML) composites at various temperatures. It is believed that the proposed study of impact damage assessment on FML composites will benefit several NASA's missions and current interests, such as ballistic impact testing of composite fan containment and high strain rate deformation modeling of polymer matrix composites. Impact-induced damage mechanisms in GLARE and ARALL fiber-metal laminates subject to instrumented drop-weight impacts at various temperatures were studied. GLARE and ARALL are hybrid composites made of alternating layers of aluminum and glass- (for GLARE) and aramid- (for ARALL) fiber reinforced epoxy. Damage in pure aluminum panels impacted by foreign objects was mainly characterized by large plastic deformation surrounding a deep penetration dent. On the other hand, plastic deformation in fiber-metal laminates was often not as severe although the penetration dent was still produced. The more stiff fiber-reinforced epoxy layers provided better bending rigidity; thus, enhancing impact damage tolerance. Severe cracking, however, occurred due to the use of these more brittle fiber-reinforced epoxy layers. Fracture patterns, e.g., crack length and delamination size, were greatly affected by the lay-up configuration rather than by the number of layers, which implies that thickness effect was not significant for the panels tested in this study. Immersion ultrasound techniques were then used to assess damages generated by instrumented drop-weight impacts onto these fiber-metal laminate panels as well as 2024-T3 aluminum/cast acrylic sandwich plates adhered by epoxy. Depending on several parameters, such as impact velocity, mass, temperature, laminate configuration, sandwich construction, etc., various types of impact damage were observed, including plastic deformation, radiating cracks emanating from the impact site, ring cracks surrounding the impact site, partial and full delamination, and combinations of these damages.
Author
Ultrasonic Tests; Impact Damage; Microcracks; Epoxy Matrix Composites; Damage Assessment; Hybrid Composites; Metal Matrix Composites; Aramid Fiber Composites

20030063899 Lockheed Martin Engineering and Sciences Co., Hampton, VA, USA
Characterization of Thin Film Polymers Through Dynamic Mechanical Analysis and Permeation
Herring, Helen; June 2003; 18 pp.; In English
Contract(s)/Grant(s): NAS1-00135; 762-30-51-03
Report No.(s): NASA/CR-2003-212422; NAS 1.26:212422; No Copyright; Avail: CASI; A03, Hardcopy

Thin polymer films are being considered, as candidate materials to augment the permeation resistance of cryogenic hydrogen fuel tanks such as would be required for future reusable launch vehicles. To evaluate performance of candidate films after environmental exposure, an experimental study was performed to measure the thermal/mechanical and permeation performance of six, commercial-grade materials. Dynamic storage modulus, as measured by Dynamic Mechanical Analysis, was found over a range of temperatures. Permeability, as measured by helium gas diffusion, was found at room temperature. Test data was correlated with respect to film type and pre-test exposure to moisture, elevated temperature, and cryogenic temperature. Results indicated that the six films were comparable in performance and their resistance to environmental degradation.
Author
Thin Films; Permeability; Polymeric Films; Cryogenic Fluid Storage; Hydrogen Fuels

20030064041 NASA Langley Research Center, Hampton, VA, USA
Polyimide Nanocomposites Prepared from High-Temperature, Reduced Charge Organoclays
Delozier, D. M.; Orwoll, R. A.; Cahoon, J. F.; Ladislaw, J. S.; Smith, J. G., Jr.; Connell, J. W.; Polymer; [2003]; ISSN 0032-3861; Volume 44, pp. 2231-2241; In English; Original contains black and white illustrations; Copyright; Avail: Other Sources

Montmorillonite clays modified with the dihydrochloride salt of 1,3-bis(3-aminophenoxy)benzene (APB) were used in the preparation of polyimide/organoclay hybrid films. Organoclays with varying surface charge based upon APB were prepared and examined for their dispersion behavior in the polymer matrix. High molecular weight poly(amide acid) solutions were prepared in the presence of the organoclays. Films were cast and subsequently heated to 300C to cause imidization. The resulting nanocomposite films, containing 3 wt% of organoclay, were characterized by transmission electron microscopy and X-ray diffraction. The clay's cation exchange capacity (CEC) played a key role in determining the extent of dispersion in the polyimide matrix. Considerable dispersion was observed in some of the nanocomposite films. The most effective organoclay was found to have a CEC of 0.70 meq/g. Nanocomposite films prepared with 3-8 wt% of this organoclay were characterized by transmission electron microscopy (TEM), X-ray diffraction (XRD), and thin-film tensile testing. High levels of clay dispersion could be achieved even at the higher clay loadings. Results from mechanical testing revealed that while the moduli

of the nanocomposites increased with increasing clay loadings, both strength and elongation decreased.
Author
Montmorillonite; Thin Films; Nanocomposites; Polymer Matrix Composites; Nanostructure (Characteristics); Mechanical Properties; Particle Interactions

20030064094 NASA Marshall Space Flight Center, Huntsville, AL, USA
Permeability After Impact Testing of Composite Laminates
Nettles, Alan T.; [2003]; 14 pp.; In English; SAMPE 2003 Symposium and Exhibition, 11-15 May 2003, Long Beach, CA, USA; No Copyright; Avail: CASI; A03, Hardcopy

Since composite laminates are beginning to be identified for use in reusable launch vehicle propulsion systems, an understanding of their permeance is needed. A foreign object impact event can cause a localized area of permeability (leakage) in a polymer matrix composite and it is the aim of this study to assess a method of quantifying permeability-after-impact results. A simple test apparatus is presented and variables that could affect the measured values of permeability-after-impact were assessed. Once it was determined that valid numbers were being measured, a fiber/resin system was impacted at various impact levels and the resulting permeability measured, first with a leak check solution (qualitative) then using the new apparatus (quantitative). The results showed that as the impact level increased, so did the measured leakage. As the pressure to the specimen was increased, the leak rate was seen to increase in a non-linear fashion for almost all of the specimens tested.
Author
Laminates; Permeability; Impact Tests; Leakage; Polymer Matrix Composites

20030064098 NASA Glenn Research Center, Cleveland, OH, USA
A Limited Comparison of the Thermal Durability of Polyimide Candidate Matrix Polymers With PMR-15
Bowles, Kenneth J.; Papadopoulos, Demetrios S.; Scheiman, Daniel A.; Inghram, Linda L.; McCorkle, Linda S.; Klans, Ojars V.; May 2003; 33 pp.; In English; 35th International Technical Conference, 28 Sep. - 2 Oct. 2003, Dayton, OH, USA; Original contains black and white illustrations
Contract(s)/Grant(s): WBS-22-708-31-13
Report No.(s): NASA/TM-2003-211878; NAS 1.15-211878; E-13560; Copyright; Avail: CASI; A03, Hardcopy

Studies were conducted with six different candidate high-temperature neat matrix resin specimens of varied geometric shapes to investigate the mechanisms involved in the thermal degradation of polyimides like PMR-15. The metrics for assessing the quality of these candidates were chosen to be glass transition temperature (T(sub g)), thermo-oxidative stability, dynamic mechanical properties, microstructural changes, and dimensional stability. The processing and mechanical properties were not investigated in the study reported herein. The dimensional changes and surface layer growth were measured and recorded. The data were in agreement with earlier published data. An initial weight increase reaction was observed to be dominating at the lower temperatures. However, at the more elevated temperatures, the weight loss reactions were prevalent and probably masked the weight gain reaction. These data confirmed the findings of the existence of an initial weight gain reaction previously reported. Surface- and core-dependent weight losses were shown to control the polymer degradation at the higher temperatures.
Author
Polymer Matrix Composites; Fatigue Life; Thermal Degradation; Thermodynamic Properties; Polymer Chemistry; Shapes; Thermal Stability

20030064446 Lawrence Livermore National Lab., Livermore, CA
Celotex (Trade Mark) Replacement Study
Couture, S.; Hafner, R.; Oct. 01, 2002; In English
Report No.(s): DE2003-15003276; UCRL-ID-151168; No Copyright; Avail: National Technical Information Service (NTIS)

The AL-R8 is the pit storage container in most widespread use at Pantex. The AL-R8 container family consists of standard 20-in.-diameter steel drums, 30 to 60 in. in height, with insulation inserts made of Celotex -a fiberboard product made from processed sugar cane. Celotex is an acceptable material for inserts in many radioactive material shipping and storage containers. It is a good shock mitigator/insulator, does a fair job in fire protection (when oxygen is excluded), shielding, and criticality, and is inexpensive and easily available. However, the fiberboard absorbs water in humid environments which, when combined with chemical residues in the fiberboard, forms corrosive compounds that can shorten the life of the container and affect container contents. To protect the contents from this potentially damaging environment, the AL-R8 SI was developed to isolate the contents within a sealed stainless steel vessel inside the AL-R8. Although the SI protected the contents, corrosion

studies indicated the SI lid bolts might corrode over time and surveillance showed that areas of the outer drum were still subject to corrosion. To address this potential problem, DOE/Albuquerque sponsored bolt and Celotex replacement studies. The bolt replacement study was assigned to Mason and Hanger's Pantex Facility and this Celotex Replacement Study to Lawrence Livermore National Laboratory.
NTIS
Composite Materials; Replacing; Structural Analysis; Containers

20030064481 Army Construction Engineering Research Lab., Champaign, IL, USA
Biaxial Loading and Failure Behavior of Brick Triplets With Fiber-Reinforced Polymer Composite Upgrades
Berman, J. B.; Al-Chaar, G. K.; Dutta, P. K.; Dec. 2002; 62 pp.; In English
Contract(s)/Grant(s): DA Proj. 401-62784-AT-41
Report No.(s): AD-A410920; ERDC-TR-02-7; No Copyright; Avail: CASI; A04, Hardcopy

To facilitate both engineering research and the design of unreinforced masonry (URM) structures, a standardized procedure for testing small-scale brick panel specimens would be beneficial. Some researchers have conducted simple monoaxial shear tests on brick triplet specimens, but these have tended to be unrealistic because they do not account for the effects of normal gravity loads. However, a triplet test that properly accounts for normal loading effects could be as useful to the construction industry as standard concrete cylinder and mortar cube tests. In support of a larger study on URM seismic rehabilitation techniques, the authors developed a triplet shear test that accounts for normal loads. One hundred brick triplets were tested. About one-third were strengthened on one side with fiber-reinforced polymer (FRP) material, and another third were strengthened on two sides. The remaining triplets were not reinforced. Each type of triplet was shear-tested to failure under one of six different percentages of ultimate normal capacity. The results were analyzed, compared and incorporated into the results of the larger study. It is concluded that the triplet test can provide a useful estimate of the shear capacity and failure modes of masonry wall systems in the field.
DTIC
Axial Loads; Failure Modes; Bricks; Reinforcing Fibers; Composite Materials; Shear Stress

20030064924 NASA Langley Research Center, Hampton, VA, USA
Design and Characterization of Carbon Nanotube Nanocomposites
Siochi, Emilie J.; Lillehei, Peter T.; Wise, Kristopher E.; Park, Cheol; Rouse, Jason H.; [2003]; 4 pp.; In English; 4th International Symposium on MEMS and Nanotechnology, 2-4 Jun. 2003, Charlotte, NC, USA; Copyright; Avail: CASI; A01, Hardcopy

Revolutionary design concepts in future aerospace vehicles will depend on extraordinary material properties to permit significant reduction of mass and size of components, while imparting intelligence. Due to their combination of remarkable electrical and mechanical properties, carbon nanotubes (CNT) are expected to enable this paradigm shift in design concepts. However, significant challenges still exist in translating these CNT properties into the macrostructures required for future generations of aerospace vehicles. While an accepted route for making the leap from nanostructures to useful macrostructures has not been fully charted, this paper will give an overview of the approach taken by some researchers at NASA Langley Research Center to sort out issues involved in the development of CNT nanocomposites for multifunctional structures. Specifically, the dispersion of carbon nanotubes in polymer matrices, characterization of nanocomposites, the role of quantum computation in providing guidance for processing and the use of computational analysis in data interpretation will be covered. Significant improvements in mechanical and electrical properties of CNT nanocomposites with very low loadings of CNTs are described and lend credence to the potential for using CNTs in achieving technological leaps in composite development.
Author
Carbon Nanotubes; Nanocomposites; Microscopy; Mechanical Properties; Electrical Properties; Quantum Computation; Research And Development

20030064976 Rockwell Scientific Co., LLC, Thousand Oaks, CA, USA
C-SiC Composite Structures for Active Cooling
Marshall, D. B.; Cox, B. N.; Berbon, M. Z.; Porter, J. R.; [2003]; 18 pp.; In English; 27th Annual Conference on Ceramic, Metal and Carbon Composites, 27-30 Jan. 2003, Cocoa Beach, FL, USA
Contract(s)/Grant(s): NAS8-00141; Copyright; Avail: CASI; A03, Hardcopy

This viewgraph presentation provides an overview of research being conducted on the use of C-SiC composite structures for actively cooling rocket nozzles. Potential payoffs and design constraints are discussed. Other topics covered include:

testing parameters, material selection, thermal analysis of joined tube structure, pressure containment, H2O2 combustion testing, and cooled re-entry.
CASI
Composite Structures; Rocket Nozzles; Design Analysis; Cooling; Weight Reduction

20030065173 Institute for Computer Applications in Science and Engineering, Hampton, VA, USA
Space Durable Polyimide/Carbon Nanotube Composite Films for Electrostatic Charge Mitigation
Watson, Kent A.; Smith, Joseph G., Jr.; Connell, John W.; [2003]; 11 pp.; In English; SAMPE 2003, 11-15 May 2003, Long Beach, CA, USA
Contract(s)/Grant(s): NAS1-97046; No Copyright; Avail: CASI; A03, Hardcopy

Low color, space environmentally durable polymeric films with sufficient electrical conductivity to mitigate electrostatic charge (ESC) build-up have been under investigation as part of a materials development activity. These materials have potential applications on advanced spacecraft, particularly on large, deployable, ultra-light weight Gossamer spacecraft. The approach taken to impart sufficient electrical conductivity into the polymer film is based on the use of single walled carbon nanotubes (SWNT) as conductive additives. Earlier approaches investigated in our lab involved both an in-situ polymerization approach and addition of SWNT to an oligomer containing reactive end-groups as methods to improve SWNT dispersion. The work described herein is based on the spray coating of a SWNT/solvent dispersion onto the film surface. Two types of polyimides were investigated, one with reactive end groups that can lead to bond formation between the oligomer chain and the SWNT surface and those without reactive end-groups. Surface conductivities (measured as surface resistance) in the range sufficient for ESC mitigation were achieved with minimal effects on the mechanical, optical, thermo-optical properties of the film as compared to the other methods. The chemistry and physical properties of these nanocomposites will be discussed.
Author
Carbon Nanotubes; Polymeric Films; Electrostatic Charge; Electrical Resistivity; Electric Conductors; Polyimides; Nanocomposites

20030065176 Michigan Univ., Ann Arbor, MI
Compressive Failure of Fiber Reinforced Composites
Waas, Anthony M.; Apr. 15, 2003; 287 pp.; In English
Contract(s)/Grant(s): DAAG55-98-1-0317
Report No.(s): AD-A413396; ARO-P-38086.1-EG; No Copyright; Avail: CASI; A13, Hardcopy

This final technical report was prepared by the University of Michigan, in Ann Arbor, Michigan, on ARO Orant DAAG55-98-1-0317, for the Army Research Office, Solid Mechanics Branch. The research reported herein was accomplished under the grant title 'COMPRESSIVE FAILURE OF FIBER REINFORCED COMPOSITE,' under the technical cognizance of Dr. Bruce LaMattina of the Solid Mechanics Branch of ARO. The authors gratefully acknowledge the able assistance of instrument maker Terry Larrow and Electronics Technician Tom Griffin of the Aerospace Engineering Department workshop. We also thank Masters Students Amit Salvi and Joe Gianetti for their assistance in various stages of the prcject. This report consists of the doctoral thesis of Chandra S. Yerramalli, whose research work constituted the project supported through the ARO.
DTIC
Fiber Composites; Mechanical Properties; Compressive Strength

20030065213 Dayton Univ. Research Inst., OH
Life Prediction Methodologies for Aerospace Materials
Ashbaugh, N. E.; Brockman, R. A.; Buchanan, D. J.; Hartman, G. A.; Hutson, A. L.; Jun. 2001; 246 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F33615-98-C-5214; Proj-4347
Report No.(s): AD-A413469; AFRL-ML-WP-TR-2001-4153; No Copyright; Avail: CASI; A11, Hardcopy

Damage tolerance investigations of gamma-TiAl alloys have involved assessments of lamellar lath orientations of colonies and defects in large-scale production ingots. An investigation of elastic properties of colonies has continued with conjoint efforts in the experimental evaluation of test specimens containing large colonies and in finite element analysis of modeling of the contiguous colony locations and orientations within the test specimens. Experimental behavior of Nextel TM720/AS ceramic matrix composite was determined under tensile, creep, and thermal exposure conditions. Fracture and creep rupture behavior of MI SiC/SiC and high-cycle fatigue behavior of CVI Cf/SiC have been conducted. Analyses of CMC

were conducted to predict strains at notch tips and heat transfer and stresses in a conceptual combustor design and to design rings that were tested on a combustor rig. Fretting fatigue investigations of Ti-64 have focused on the effects of coating fitting pads: the use of dissimilar materials for the fitting pads: the fatigue crack nucleation in fitting pads: the application of an ultrasonic shear wave technique to detect crack initiation: and the effects of specimen thickness and ratios of nominal normal stress to shear stress. High-cycle fatigue tests have continued to evaluate the influence of foreign object damage, mean stress, and previous loading history. A fractographic assessment of load sequences has revealed some surprising results for fatigue crack growth and load interaction in two aluminum alloys. For the engine rotor life extension program. A broad study of the behavior of residual stresses in nickel-base superalloys has begun. These efforts currently involve the determination of the compressive behavior of materials of interest, the correlation between predicted and measured inelastic strains in bend specimens. and the relaxation of residual stresses due to thermal exposure.
DTIC
Aircraft Construction Materials; Aluminum Alloys; Life (Durability); Aerospace Systems; Ceramic Matrix Composites

20030065251 Florida Agricultural and Mechanical Univ., Tallahassee, FL
The Effects of Physical Composite Particle Parameters on The Efficacy of a Proprietary Sound-Attenuation Technology and it's Application to Advanced Structural Composites
Zhang, Chuck; Mar. 28, 2003; 6 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): N00014-00-1-0548
Report No.(s): AD-A413107; No Copyright; Avail: CASI; A02, Hardcopy

Two principal objectives were proposed in this research: (1) determine the acoustical effects of the filler materials with different sound impedance in composites fabricated according to a proprietary technology, and (2) determine the feasibility of applying the proprietary technology to continuous fiber-reinforced advanced structural composites. The sequential experimental approach began by attempting to apply the acoustical technology with neat epoxies using off-the-shelf filler materials possessing a range of physical characteristics. The selected filler materials were successfully used in rubber-type materials to achieve acoustic attenuation properties of the past.
DTIC
Fiber Composites; Acoustic Attenuation; Acoustic Impedance

20030065262 North Carolina State Univ., Raleigh, NC, USA
Micromechanics Failure of Fiber Reinforced Composite Laminates
Yuan, F. G.; Dec. 2002; 13 pp.; In English
Contract(s)/Grant(s): F49620-99-1-0110
Report No.(s): AD-A413356; AFRL-SR-AR-TR-03-0130; No Copyright; Avail: CASI; A03, Hardcopy

The work in this project focused on multiscale modeling of composite laminates between the homogenized layer model and fiber/matrix micro-scale model in the region of high stress gradients. The goal was to develop a macroscopic theory, which can provide the connection between macromechanics (ply level) and micro mechanics (fiber/matrix), especially in characterizing the micro-stress of composite laminates near edges and holes.
DTIC
Micromechanics; Composite Materials

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*.

20030063920 NASA Marshall Space Flight Center, Huntsville, AL, USA
Changes in the Molar Ellipticities of HEWL Observed by Circular Dichroism and Quantitated by Time Resolved Fluorescence Anisotropy Under Crystallizing Conditions
Sumida, John; [2002]; 1 pp.; In English; 47th Annual Biophysical Society Meeting, 1-5 Mar. 2003, San Antonio, TX, USA; No Copyright; Avail: Other Sources; Abstract Only

Fluid models for simple colloids predict that as the protein concentration is increased, crystallization should occur at some sufficiently high concentration regardless of the strength of attraction. However, empirical measurements do not fully support

this assertion. Measurements of the second virial coefficient (B22) indicate that protein crystallization occurs only over a discrete range of solution parameters. Furthermore, observations of a strong correlation between protein solubility and B22, has led to an ongoing debate regarding the relationship between the two. Experimental work in our lab, using Hen Egg White Lysozyme (HEWL), previously revealed that the rotational anisotropy of the protein under crystallizing conditions changes systematically with pH, ionic strength and temperature. These observations are now supported by recent work revealing that small changes in the molar ellipticity also occur systematically with changes in ionic strength and temperature. This work demonstrates that under crystallization conditions, the protein native state is characterized by a conformational heterogeneity that may prove fundamental to the relationship between protein crystallization and protein solubility.
Author
Eggs; Lysozyme; Dichroism; Protein Crystal Growth; Crystallization

20030064038 Southwest Texas State Univ., San Marcos, TX, USA
High Performance Polymers
Venumbaka, Sreenivasulu R.; Cassidy, Patrick E.; [2003]; 9 pp.; In English
Contract(s)/Grant(s): NCC1-02030; No Copyright; Avail: CASI; A02, Hardcopy

This report summarizes results from research on high performance polymers. The research areas proposed in this report include: 1) Effort to improve the synthesis and to understand and replicate the dielectric behavior of 6HC17-PEK; 2) Continue preparation and evaluation of flexible, low dielectric silicon- and fluorine- containing polymers with improved toughness; and 3) Synthesis and characterization of high performance polymers containing the spirodilactam moiety.
CASI
High Polymers; Synthesis (Chemistry); Dielectrics; Monomers; Ketones

20030064083 Universities Space Research Association, Huntsville, AL, USA, NASA Marshall Space Flight Center, Huntsville, AL, USA
Countering Solutal Buoyant Convection with High Magnetic Fields
Ramachandran, N.; Leslie, F. W.; [2002]; 1 pp.; In English; 41st Aerospace Sciences Meeting and Exhibit, 6-9 Jan. 2003, Reno, NV, USA; No Copyright; Avail: Other Sources; Abstract Only

An important component in biotechnology, particularly in the area of protein engineering and rational drug design is the knowledge of the precise three-dimensional molecular structure of proteins. The quality of structural information obtained from X-ray diffraction methods is directly dependent on the degree of perfection of the protein crystals. As a consequence, the growth of high quality macromolecular crystals for diffraction analyses has been the central focus for biochemist, biologists, and bioengineers. Macromolecular crystals are obtained from solutions that contain the crystallizing species in equilibrium with higher aggregates, ions, precipitant, other possible phases of the protein, foreign particles, the walls of the container, and a likely host of other impurities. By changing transport modes in general, i.e., reduction of convection and sedimentation, as is achieved in microgravity, we have been able to dramatically effect the movement and distribution of macromolecules in the fluid, and thus their transport, formation of crystal nuclei, and adsorption to the crystal surface. While a limited number of high quality crystals from space flights have been obtained, as the recent National Research Council (NRC) review of the NASA microgravity crystallization program pointed out, the scientific approach and research in crystallization of proteins has been mainly empirical yielding inconclusive results. We postulate that we can reduce convection in ground-based experiments and we can understand the different aspects of convection control through the use of strong magnetic fields and field gradients. We postulate that limited convection in a magnetic field will provide the environment for the growth of high quality crystals. The approach exploits the variation of fluid magnetic susceptibility with concentration for this purpose and the convective damping is realized by appropriately positioning the crystal growth cell so that the magnetic susceptibility force counteracts terrestrial gravity. The general objective is to test the hypothesis of convective control using a strong magnetic field and magnetic field gradient and to understand the nature of the various forces that come into play. Specifically we aim to delineate causative factors and to quantify them through experiments, analysis and numerical modeling. The paper will report on the current status of the investigation and discuss results from the experimental and modeling efforts.
Author
Bioengineering; Biotechnology; Proteins; Macromolecules; Molecular Structure; Crystal Growth; Convection

20030064347 Lawrence Livermore National Lab., Livermore, CA
Potential-Dependence of the Aqueous Oxidation of Alloy 22 in Simulated Concentrated Well Water
Bedrossian, P. J.; Nov. 01, 2000; 18 pp.; In English
Report No.(s): DE2003-15003407; UCRL-ID-142349; No Copyright; Avail: Department of Energy Information Bridge

Using x-ray photoemission spectroscopy (XPS), we have identified elemental oxidation state shifts in the passive films of coupons of Alloy 22 polarized anodically at various potentials below the passive-transpassive transition in 90 C in a concentrated version of 5-13 water. The data suggest a general trend toward higher oxidation states and a narrowing in the distribution of oxidation states of Ni, Cr, and Mo with increasing potential. The relative proportion of Mo in the passive film increases at the highest potentials tested.
NTIS
Oxidation; Photoelectric Emission; Photoelectron Spectroscopy; Wells; Alloys; Surface Water

20030064403 Hughes Technical Center, Atlantic City International Airport, NJ, USA
Ground Tests of Aircraft Flight Deck Smoke Penetration Resistance
Blake, D.; Apr. 2003; 18 pp.; In English
Report No.(s): PB2003-105503; DOT/FAA/AR-TN03/36; No Copyright; Avail: CASI; A03, Hardcopy
This report documents a series of tests to determine the amount of positive pressure differential between the flight deck and surrounding areas necessary to prevent smoke from penetrating into the flight deck. The testing also explored methods to demonstrate the effectiveness of those ventilation conditions. The tests were conducted on the ground in a Boeing 727-100 freighter and a 747SP aircraft. A thin plastic sheet covering the flight deck door opening and a theatrical smoke generator were successfully used to demonstrate a positive pressure differential that was effective at preventing the penetration of theatrical smoke into the flight deck of the B-727. The 747SP ventilation system was not capable of preventing smoke penetration during these ground tests.
NTIS
Boeing 727 Aircraft; Ground Tests; Smoke; Penetration

20030064413 California Univ., Lawrence Livermore Lab., Livermore, CA, USA, Illinois Univ. at Urbana-Champaign, Urbana, IL, USA
Observation of Dislocation Dynamics in the Electron Microscope
Lagow, B. W.; Robertson, I. M.; Jouiad, M.; Lassila, D. H.; Lee, C.; Aug. 21, 2001; 22 pp.; In English
Report No.(s): DE2003-15003396; UCRL-ID-142180; No Copyright; Avail: Department of Energy Information Bridge
Deformation experiments performed in-situ in the transmission electron microscope have led to an increased understanding of dislocation dynamics. To illustrate the capability of this technique two examples will be presented. In the first example, the processes of work hardening in Mo at room temperature will be presented. These studies have improved our understanding of dislocation mobility, dislocation generation, and dislocation-obstacle interactions. In the second example, the interaction of matrix dislocations with grain boundaries will be described. From such studies predictive criteria for slip transfer through grain boundaries have been developed.
NTIS
Electron Microscopes; Mobility; Deformation; Dislocations (Materials)

20030064469 Lawrence Livermore National Lab., Livermore, CA
Reaction of LiD with Water Vapor: Thermogravimetric and Scanning Electron Microscopy Studies
Dinh, L. N.; Balooch, M.; Lemay, J. D.; Sep. 01, 2000; In English
Report No.(s): DE2003-15003263; UCRL-JC-140651; No Copyright; Avail: National Technical Information Service (NTIS)
The kinetics of hydroxide film growth on LiD have been studied by the thermogravimetric method in nitrogen saturated with water vapor and by scanning electron microscopy (SEM) of samples that have been exposed to air with 50\% relative humidity. The reaction probability is estimated to be 4x10 to the minus 7th power for LiD exposed to ambient air with 50 % relative humidity, suggesting that the diffusion through the hydroxide film is not the limiting step on the overall process at high moisture levels. The rate of growth is drastically reduced when the temperature is increased to 60 C.
NTIS
Scanning Electron Microscopy; Thermogravimetry; Water Vapor; Reaction Kinetics; Hydroxides

20030064931 National Advisory Committee for Aeronautics. Langley Aeronautical Lab., Langley Field, VA, USA
Thermal Theory of Combustion and Explosion, 3, Theory of Normal Flame Propagation
Semenov, N. N.; Progress of Physical Science; September 1942; Volume 24, No. 4, pp. 433-486; In English
Report No.(s): NACA-TM-1026; No Copyright; Avail: CASI; A05, Hardcopy
The technical memorandum covers experimental data on flame propagation, the velocity of flame propagation, analysis

of the old theoretical views of flame propagation, confirmation of the theory for simple reactions (theory of combustion of explosive substances and in particular nitroglycol), and check of the theory by example of a chain oxidizing reaction (theory of flame propagation in carbon monoxide, air and carbon monoxide - oxygen mixtures).
CASI
Flame Propagation; Propagation Velocity; Gas Mixtures; Chemical Reactions

20030065095 Pennsylvania State Univ., University Park, PA
Transport and Storage of Metals in Fractured and Karstic Rock Aquifers
White, William B.; Mar. 31, 2003; 123 pp.; In English
Contract(s)/Grant(s): DAAD19-01-1-0707
Report No.(s): AD-A413261; ARO-41582.3-EV; No Copyright; Avail: CASI; A06, Hardcopy

The objective of this project was to evaluate the movement of metals in karst aquifers, including metal accumulation, release, and transport under low flow and storm conditions. Metals investigated include aluminum, arsenic, chromium, lead, and nickel. Measurements were made of variations in metal concentration from base flow to storm flow using three springs before, during, and after storm events to study metal transport and release. Sediment samples from 10 springs were analyzed for metals and characterized by bulk mineral identification. The metals were subjected to a selective extraction procedure that evaluated the form of the accumulated metal, which in turn controls the availability of the metal to humans and ecological receptors. Results indicate that metals are transported as adsorbates on clays and other small particles which are mobilized during storms, leading to a peak in metal concentration coincident with the peak of the storm hydrograph. Trace metals are stored in the spring sediments mainly bound onto iron or manganese oxide coatings on the silicate grains. Appendixes contain the following research papers by Dorothy J. Vesper and William B. White: 'Storm Pulse Chemographs of Saturation Index and Carbon Dioxide Pressure: Implications for Shifting Recharge Sources During Storm Events in Karst Aquifers'; Metal Transport to Karst Springs During Storm Flow: An Example from Fort Campbell, Kentucky/Tennessee, U.S.A.'; Comparative Storm Response of Ground Water and Contaminant Chemistry in a Carbonate Aquifer, Fort Campbell, Kentucky-Tennessee, U.S.A.'; and 'Spring and Conduit Sediments as Storage Reservoirs for Metal Contaminants in Karst Aquifers.'
DTIC
Aquifers; Karst; Fractures (Materials); Metals; Soil Science; Rocks

20030065137 National Advisory Committee for Aeronautics. Langley Aeronautical Lab., Langley Field, VA, USA
Thermal Theory of Combustion and Explosion
Semenov, N. N.; Progress of Physical Science; August 1942; Volume 23, No. 3, pp. 251-292; In English
Report No.(s): NACA-TM-1024; No Copyright; Avail: CASI; A04, Hardcopy

This paper discusses the thermal theory of combustion and explosion, and conditions of ignition: transformation accompanied by heat liberation, transformation rate and temperature dependence.
CASI
Combustion; Explosions; Ignition

20030065151 Northeastern Univ., Boston, MA
Development of Artificial Y-Type Hexaferrites
Vittoria, C.; May 2003; 2 pp.; In English
Contract(s)/Grant(s): DAAD19-01-1-0583
Report No.(s): AD-A413423; ARO-41490.1-MS; No Copyright; Avail: CASI; A01, Hardcopy

We have developed a technique to orient particles of Y-type hexaferrite in which the c-axis of the particles are oriented perpendicular to a plane As such, that plane becomes necessarily the easy plane of magnetization. For microwave device application the easy plane of magnetization is chosen as the plane to deposit a metallic microstrip and related circuit patterns. The technique entails the rotation of an external magnetic field in the easy plane, as the particles are pressed into a disc shape. We have succeeded on the orientation of particles of Ba2MnZnFe12O22 in an easy plane of magnetization which exhibited the following properties: 4piMs=2300 Oe, Ha = 9500 Oe, and Hc = 60 Oe ,where 4piMs is the saturation magnetization, Ha the uniaxial anisotropy field and Hc the coercive field. The coercive field and remanence can be varied by refiring the oriented particles . Maximum remanence of 27.5 % was obtained for refiring temperature of 1000 C. Much higher remanence is possible for thin film plane structure, where the aspect ratio exceeding 1000. These results imply that it is possible to orient the saturation magnetization in any direction within the plane of a device and the effective magnetization can be as high as 11800 Oe. The microwave properties indicate that the ferrimagnetic resonance linewidth at 27 GHz is 350 Oe and the g-factor

approximately equal to 2, see fig .1. In fig.2 the vibrating sample magnetization (VSM) measurements for ZnMnY-type are shown for the external field applied parallel and perpendicular to easy plane of magnetization. We have also been working on Co2Y-type, our experiments show 4PIMs=2.2k Oe, Ha=42 k Oe and linewidth around 2000 Oe at 38 GHz. Potential microwave applications are fabrication of IC circuits and microwave ferrite devices.
DTIC
Microwave Equipment; Ferrites; Magnetic Fields

20030065196 Air Force Inst. of Tech., Wright-Patterson AFB, OH
Luminescence Studies of Ion-Implanted Gallium Nitride and Aluminum Gallium Nitride
Claunch, Erin N.; Mar. 2003; 63 pp.; In English; Original contains color illustrations
Report No.(s): AD-A413035; AFIT/GAP/ENP/03-02; No Copyright; Avail: CASI; A04, Hardcopy

Recently, research on the wide bandgap semiconductors such as GaN and Al(x) Ga(1-x)N became very popular for their applications on various devices. Therefore comprehensive and systematic luminescence studies of Si implanted Al(x)Ga(1-x)N, Mg doped GaN, and Si+N implanted GaN grown on sapphire substrates by molecular beam epitaxial method have been made as a function of ion dose and anneal temperature.
DTIC
Luminescence; Gallium Nitrides; Aluminum Nitrides; Doped Crystals; Semiconductors (Materials)

20030065225 Florida Univ., Gainesville, FL
Nanotubule Membranes - Fundamentals and Applications in Electrochemical Energy and Stochastic Sensing
Martin, Charles R.; Nov. 14, 2002; 5 pp.; In English
Contract(s)/Grant(s): N00014-00-1-0108
Report No.(s): AD-A413001; No Copyright; Avail: CASI; A01, Hardcopy

The objectives are: (1) To develop the measurement technology that will allow us to determine if the a-hemolysin channel has been successfully immobilized, (2) To develop ultrathin film channel immobilization technology, and (3) To develop methods for isolating a single nanotubule in an Au nanotubule membrane For the Electrochemistry Division the objectives are (1) To develop new classes of nanotubule membranes whose transport properties can be modulated electrochemically by applying a potential to the membrane, (2) To show that surface chemistry of these nanotubule membranes can varied by simple chemical and electrochemical derivatization schemes, (3) To study electroosmotic flow phenomena in these new membranes.
DTIC
Stochastic Processes; Composite Materials; Electrochemistry; Chemical Reactions

20030065264 Illinois Univ., Champaign, IL, USA
Processing Technologies for Al(x)Ga(1-x)N Photodetector Arrays
Adesida, Ilesanmi; Oct. 2002; 92 pp.; In English
Contract(s)/Grant(s): DAAD19-99-1-0011
Report No.(s): AD-A413407; UIUC/ARO-0001; ARO-P-40007.3-EL; No Copyright; Avail: CASI; A05, Hardcopy

Processing technologies for Al(x)Ga(1-x)N have been developed. Inductively-coupled-plasma reactive ion etching (ICP-RIE) is shown to be capable of etching AlGaN materials at high etch rates and high anisotropy Plasma-induced damage in n-GaN is shown to depend mainly on the ion energy to which samples are exposed during ICP-RIE The damage can be annealed at 700 degrees C with samples recovering to their unetched states. Photoelectrochemical etching of n-GaN is shown to be useful for material characterization and this process may be exploited as a rapid method for quantification of defects in GaN Auger analysis and x-ray photoelectron spectroscopy have been utilized for studying the cleaning of Al(x)Ga(1-x)N surfaces; it is shown that buffered oxide etch is more effective in removing surface adventitious oxides of Al(x)Ga(1-x)N than ammonium hydroxide and hydrochloric acid. Schottky contacts on Al(x)Ga(1-x)N for various metals have been characterized. The barrier heights depend on metal work function which may show that Al(x)Ga(1-x)N surfaces are not completely dominated by surface states. Low contact ohmic resistances were achieved on p-GaN and p-Al(x)Ga(1-x)N /GaN superlattices using Ti/Pt/Au metallization. Ti/Al/Mo/Au metallization was developed as a robust ohmic contact metallization for n- Al(x) Ga(1-x)N with x up to 0.6.
DTIC
Gallium Nitrides; Photometers; Aluminum Nitrides

20030065310 Massachusetts Univ., Lowell, MA
Macromolecular Assemblies for Optical and Electronic Applications
Sandman, Daniel; Jun. 2002; 4 pp.; In English
Contract(s)/Grant(s): F49620-01-1-0396; Proj-2303
Report No.(s): AD-A413203; AFRL-SR-AR-TR-03-0106; No Copyright; Avail: CASI; A01, Hardcopy

The symposium 'Macromolecular Assemblies for Optical and Electronic Applications' was held at the American Chemical Society National Meeting on August 26 and 28, 2001. The American Chemical Society Division of Polymer Chemistry held in four sessions sponsored it. The themes of the four sessions were Optical Properties (3 sessions) and Macromolecular Assemblies (2 session). The program for the symposium is appended to this report. The symposium consisted of 32 invited papers, including a contribution from 2000 Nobel Laureate in Chemistry Alan J. Heeger, and the sessions were well attended. There was considerable discussion after most of the papers. The symposium was dedicated to the memory of Professor Sukant Tripathy who died in a drowning accident in Hawaii in December 2000.
DTIC
Conferences; Optical Properties; Polymer Chemistry; Macromolecules

26
METALS AND METALLIC MATERIALS

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

20030053002
Development of Submerged Entry Nozzles that Resist Clogging
Smith, J. D.; Peaslee, K. D.; 2002; 162 pp.; In English
Report No.(s): DE2002-805824; No Copyright; Avail: Department of Energy Information Bridge

Accretion formation and the associated clogging of SEN's is a major problem for the steel industry leading to decreased strand speed, premature changing of SEN's or strand termination and the associated reductions in productivity, consistency, and steel quality. The program to evaluate potentially clog resistant materials was initiated at the University of Missouri-Rolla. The main objective of the research effort was to identify combinations of steelmaking and refractory practices that would yield improved accretion resistance for tundish nozzles an submerged entry nozzles.
NTIS
Nozzles; Plugging; Steels; Refractory Materials; Metals

20030063938 NASA Marshall Space Flight Center, Huntsville, AL, USA
Selection and Evaluation of An Alloy for Nozzle Application
Pandey, Awadh; Shah, Sandeep; Shadoan, Mike; May 22, 2003; 23 pp.; In English; Aeromat Conference 2003, 9-12 Jun. 2003, Dayton, OH, USA; Copyright; Avail: CASI; A03, Hardcopy

The goal was to select and characterize a material with superior weldability and hydrogen resistance for nozzle application under Second Generation Reusable Launch Vehicle (2GRLV) program funded by NASA_MSFC. Currently standard A-286 is used for SSME nozzle.Howewer, material with superior weldability and hydrogen resistance will be desired for (2GRLV). Derived from text
Product Development; Alloys; Hydrogen; Weldability

20030063949 NASA Glenn Research Center, Cleveland, OH, USA
The Effect of Stabilization Heat Treatments on the Tensile and Creep Behavior of an Advanced Nickel-Based Disk Alloy
Gayda, John; June 2003; 84 pp.; In English; Original contains black and white illustrations
Contract(s)/Grant(s): WU 522-83-32
Report No.(s): NASA/TM-2003-212372; E-13948; NAS 1.15:212372; No Copyright; Avail: CASI; A05, Hardcopy

As part of NASA s Advanced Subsonic Technology Program, a study of stabilization heat treatment options for an advanced nickel-base disk alloy, ME 209, was performed. Using a simple, physically based approach, the effect of stabilization heat treatments on tensile and creep properties was analyzed in this paper. Solutions temperature, solution cooling rate, and stabilization temperature/time were found to have a significant impact on tensile and creep properties. These effects were readily quantified using the following methodology. First, the effect of solution cooling rate was assessed to determine its impact on a given property. The as-cooled property was then modified by using two multiplicative factors which assess the impact of solution temperature and stabilization parameters. Comparison of experimental data with predicted values showed

this physically based analysis produced good results that rivaled the statistical analysis employed, which required numerous changes in the form of the regression equation depending on the property and temperature in question. As this physically based analysis uses the data for input, it should be noted that predictions which attempt to extrapolate beyond the bounds of the data must be viewed with skepticism. Future work aimed at expanding the range of the stabilization/aging parameters explored in this study would be highly desirable, especially at the higher solution cooling rates.
Author
Heat Treatment; Nickel Alloys; Stabilization; Tensile Creep; Creep Properties

20030063958 NASA Marshall Space Flight Center, Huntsville, AL, USA
Thermal Exposure Effects on Properties of Al-Li Alloy Plate Products
Shah, Sandeep; Wells, Douglas; Wagner, John; Babel, Henry; May 22, 2003; 20 pp.; In English; Aeromat 2003, 9-12 Jun. 2003, Dayton, OH, USA; Copyright; Avail: CASI; A03, Hardcopy

The objective of this viewgraph representation is to evaluate the effects of thermal exposure on the mechanical properties of both production mature and developmental Al-Li alloys. The researchers find for these alloys, the data clearly shows that there is no deficit in mechanical properties at lower exposure temperatures in some cases, and a signficant deficit in mechanical properties at higher exposure temperatures in all cases. Topics considered include: Al-Li alloys composition, key characteristics of Al-Li alloys and thermal exposure matrix.
CASI
Aluminum Alloys; Lithium Alloys; Mechanical Properties; Temperature Effects; Metal Plates

20030064088 NASA Marshall Space Flight Center, Huntsville, AL, USA
Minimizing Segregation during the Controlled Directional Solidification of Dendric Alloys
Grugel, Richard N.; Fedoseyev, Alex; Kim, Shin-Woo; Metallurgical and Materials Transactions; January 2003; Volume 33A, pp. 3876-3881; In English; Copyright; Avail: Other Sources

Gravity-driven convection induced in the liquid by density gradients of temperature or composition disrupts uniform dendritic growth during controlled directional solidification and promotes severe macrosegregation. The solute-rich region about the dendrite tip appears to play a pivotal role in channel initiation. Allen and Hunt referred to this region as an 'initial transient' or dynamic region constituting steep concentration gradients. Experimental investigation also point to the role the tip region plays in developing microstructure. Hellawell and co-workers showed that flow-through dendritic channels could be effectively disrupted, and segregation minimized, during the gradient freezing of bulk castings by rotating the melt through a slight angle with respect to Earth's gravity vector. Adapting this principle to controlled directional solidification, it has been shown' that segregation in dendritic alloys can be minimized, and properties improved, by processing the sample near horizontal in conjunction with a slow axial rotation of the crucible. It is postulated that the observed microstructural uniformity arises by maintaining the developing solute field about the dendrite tip. Solute rejected during vertical directional solidification will rise or sink parallel to the primary dendrite arms during axial rotation setting the stage for accumulation, instabilities, and segregation. In contrast, during horizontal growth, the rejected solute will sink or rise perpendicular to the primary dendrite. Now, in the presence of a slight axial rotation, solute that was initially sinking (or rising) will find itself above (or below) its parent dendrite, i.e., still about the tip region. The following is intended to experimentally demonstrate the viability of this concept in coordination with a model that gives predictive insight regarding solute distribution about growing dendrites. Alloys based on the lead-tin eutectic system were used in this study. The system is well characterized, the constituent metals are available in a very pure form, and the thermophysical properties are well known. During solidification of hypoeutectic alloys, e.g., 55 wt pct Pb, the primary dendrites reject the less dense tin, and for the hypereutectic alloys, e.g., 75 wt pct Sn, the primary dendrites reject denser lead. Alloys were prepared by melting appropriate amounts of lead and tin in a glass crucible after which the homogeneous liquid was sucked directly into 5-mm i.d. glass tubes. The sample tube, containing approximately 30 cm of alloy, was then mechanically driven into the directional solidification furnace assembly and positioned such that approx. 20 cm of the sample was remelted. Subsequently, directional solidification was initiated by withdrawing the sample through a water-cooled jacket at a constant growth velocity of 2 ,microns/s. After 5 to 6 cm of growth, the sample was quickly removed from the furnace and quenched in a water bath to preserve the solid-liquid interface. Samples were directionally solidified vertically upward, nearly horizontally, and some in conjunction with an applied axial rotation of the crucible. Temperature gradients at the solid-liquid interface were measured with an in-siru K-type thermocouple. Solidified samples were cut perpendicular and parallel to the growth direction and conventionally prepared for microscopic examination.
Derived from text
Dendritic Crystals; Alloys; Directional Solidification (Crystals); Eutectic Alloys

20030064189 National Advisory Committee for Aeronautics. Lewis Flight Propulsion Lab., Cleveland, OH, USA
The Crystal Structure at Room Temperature of Six Cast Heat-Resisting Alloys
Rosenbaum, Burt M.; June 3, 1947; 7 pp.; In English
Report No.(s): NACA-RM-E7D23; No Copyright; Avail: CASI; A02, Hardcopy

The crystal structures of alloys 61, X-40,X-50, 422-19, 6059, and Vitallium, derived from x-ray diffraction, are discussed. The alloys have been, or are being considered for use in gas turbine applications. The predominant phase was a solid solution of the face centered cubic type of the principal constituent elements.The lattice parameters were found to be between 3.5525 and 3.5662.

CASI
Heat Resistant Alloys; Crystal Structure; Lattice Parameters; Gas Turbines; Face Centered Cubic Lattices; Cobalt Alloys; Chromium Alloys; Nickel Alloys; Tungsten Alloys

20030064368 Westinghouse Savannah River Co., Aiken, SC, USA
Corrosion Testing of Carbon Steel in Acid Cleaning Solutions (U)
Wiersma, B. J.; Subramanian, K. H.; Sep. 2002; 19 pp.; In English
Report No.(s): DE2003-805803; WSRC-TR-2002-00427; No Copyright; Avail: Department of Energy Information Bridge

High level waste is stored in carbon steel tanks at the Savannah River Site (SRS). The site is currently in the process of waste removal from, and ultimately closure of, these tanks. One of the most time consuming steps in the waste removal process is cleaning the sludge heel from the bottom of the tanks to an acceptable residual quantity. The sludge consists primarily of metal oxides that formed after waste from the canyons was neutralized with sodium hydroxide. Since the canyon waste was originally a nitric acid solution, this acid is a prime candidate for sludge heel dissolution. A series of exploratory tests were performed to investigate the hypothesis that the corrosion rate of carbon steel in nitric acid could be inhibited with oxalic acid. These tests were performed at two nitric acid concentrations (0.3 and 3 M) and three oxalic acid concentrations (4 wt. %, 8 wt. %, and 12 wt. %) and were limited to the expected contact time for sludge dissolution (approximately 3 days). Carbon steels (ASTM A285 and A537) utilized in the construction of Type I, II and IIIA tanks were tested. The general corrosion rate, as well pit depths, were measured and compared.

NTIS
Carbon Steels; Corrosion Tests; Metal Oxides

20030064387 Michigan Technological Univ., Houghton, MI, USA
Recycling and Reuse of Aluminum Wastes
Dec. 31, 2002; In English
Report No.(s): DE2003-806899; No Copyright; Avail: National Technical Information Service (NTIS)

This research effort demonstrated that major inroads have been made in establishing the viability of utilizing aluminum smelting by-product waste materials in lightweight concrete product applications. The research identified key elements of producing various forms of lightweight concrete products through utilizing various procedures and mixture components with the by-product materials. A process was developed through pilot plant testing that results in additional aluminum recovery at finer sizes, a clean returnable salt product through spray drying technology, and a low-salt-content oxide product with enough aluminum metal content that it can be used to form lightweight cementitious mixtures. Having three distinct products aids in generating favorable process economics. Revenue projections from aluminum recovery and salt recovery are enough to cover processing costs and create a cost-free oxide product to market for lightweight concrete applications.

NTIS
Aluminum; Smelting; Recycling; Concretes; By-Products

20030064457 Lawrence Livermore National Lab., Livermore, CA, California Univ., Davis, CA, USA
Mitigation of Tensile Weld Stresses in Alloy 22 Using Laser Peening
Chen, H. L.; Evans, K. J.; Hackel, L. A.; Rankin, J. E.; Yamamoto, R. M.; Nov. 27, 2002; 40 pp.; In English
Report No.(s): DE2003-15003132; UCRL-ID-151055; No Copyright; Avail: Department of Energy Information Bridge

Ensuring the structural integrity of the waste package (WP) closure weld is a major development task in support of the Yucca Mountain Project (YMP). A series of tests were performed at the Lawrence Livermore National Laboratory (LLNL) in cooperation with the University of California, Davis (UC Davis) on Alloy 22 base metal and weld coupons to characterize the effects the Laser Peening (LP) process has on these material configurations. The test results show that the laser peening process produces peak values of compressive residual stress of several hundred mPa. Residual stress remains compressive to a depth

on the order of 5 mm into Alloy 22 parent and weld material. This will significantly improve the materials resistance to stress corrosion cracking. In addition, accelerated corrosion tests show that an Alloy 22 laser peened surface corrodes at a much-reduced rate as compared to an untreated surface. The development at LLNL of very high-energy pulsed laser systems has allowed the laser peening process to advance from a laboratory tool to a true production equipment status.
NTIS
Shot Peening; Weld Tests; Tensile Tests; Pulsed Lasers; Nickel Alloys

20030065050 Boeing Co., USA
Aging Optimization of Aluminum-Lithium Alloy C458 for Application to Cryotank Structures
Sova, B. J.; Sankaran, K. K.; Babel, H.; Farahmand, B.; Rioja, R.; [2003]; 2 pp.; In English; AeroMat 2003, 9-12 Jun. 2003, Dayton, OH, USA; Copyright; Avail: Other Sources; Abstract Only

Compared with aluminum alloys such as 2219, which is widely used in space vehicle for cryogenic tanks and unpressurized structures, aluminum-lithium alloys possess attractive combinations of lower density and higher modulus along with comparable mechanical properties. These characteristics have resulted in the successful use of the aluminum-lithium alloy 2195 (Al-1.0 Li-4.0 Cu-0.4 Mg-0.4 Ag-0.12 Zr) for the Space Shuttle External Tank, and the consideration of newer U.S. aluminum-lithium alloys such as L277 and C458 for future space vehicles. These newer alloys generally have lithium content less than 2 wt. % and their composition and processing have been carefully tailored to increase the toughness and reduce the mechanical property anisotropy of the earlier generation alloys such 2090 and 8090. Alloy processing, particularly the aging treatment, has a significant influence on the strength-toughness combinations and their dependence on service environments for aluminum-lithium alloys. Work at NASA Marshall Space Flight Center on alloy 2195 has shown that the cryogenic toughness can be improved by employing a two-step aging process. This is accomplished by aging at a lower temperature in the first step to suppress nucleation of the strengthening precipitate at sub-grain boundaries while promoting nucleation in the interior of the grains. Second step aging at the normal aging temperature results in precipitate growth to the optimum size. A design of experiments aging study was conducted for plate. To achieve the T8 temper, Alloy C458 (Al-1.8 Li-2.7 Cu-0.3 Mg- 0.08 Zr-0.3 Mn-0.6 Zn) is typically aged at 300 F for 24 hours. In this study, a two-step aging treatment was developed through a comprehensive 24 full factorial design of experiments study and the typical one-step aging used as a reference. Based on the higher lithium content of C458 compared with 2195, the first step aging temperature was varied between 175 F and 250 F. The second step aging temperatures was varied between 275 F and 325 F, which is in the range of the single-step aging temperature. The results of the design of experiments used for the T8 temper as well as a smaller set of experiments for the T6 temper will be presented. The process of selecting the optimum aging treatment, based on the measured mechanical properties at room and cryogenic temperature as well as the observed deformation mechanisms, will be presented in detail. The implications for the use of alloy C458 in cryotanks will be discussed.
Author
Aluminum-Lithium Alloys; Aging (Metallurgy); Optimization; Cryogenic Fluid Storage; Storage Tanks

20030065229 Air Force Research Lab., Wright-Patterson AFB, OH
Joining of Gamma Titanium Aluminides
Baeslack, William A., III; Sep. 2002; 114 pp.; In English; Original contains color illustrations
Report No.(s): AD-A413052; AFRL-ML-WP-TR-2003-4036; No Copyright; Avail: CASI; A06, Hardcopy

This report summarizes, interprets and comparatively discusses the results of research and development performed on the joining of gamma titanium aluminides during the past two decades. Although organized and presented by joining process, many of the observations made and relationships developed, particularly those regarding the weldability and welding metallurgy of gamma titanium aluminides, are broadly applicable. Generally, the basic welding processes and techniques utilized in the fusion and solid -state friction welding of conventional titanium alloys can also be applied to the welding of gamma titanium aluminides. However, the welding process parameters must be optimized, and in some instances the welding system significantly modified, to provide a comparatively slow weld cooling rate that minimize the potential for solid-state weld cracking, and that promotes the formation of a weld zone micro structure that exhibits suitable mechanical properties. Control of the weld cooling rate and the application of a postweld heat treatment can be used to generate a wide range of crack-free weld zone microstructures that correspondingly offer a range of mechanical property combinations. Gamma titanium aluminides can also be effectively joined using diffusion welding and conventional and diffusion brazing techniques.
DTIC
Titanium Aluminides; Weldability

27
NONMETALLIC MATERIALS

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

20030063083 NASA Glenn Research Center, Cleveland, OH, USA

Developing Novel Fluorescent Materials with Near Infrared Emission by Using m-Phenylene

Pang, Yi; Liao, Ling; Meador, Michael A.; HBCUs/OMUs Research Conference Agenda and Abstracts; February 2003, pp. 11; In English; See also 20030063082; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Our research focuses on development of novel p-conjugated polymers with desired emission. In the current study, the structure of a highly green-emitting poly[(m-phenylenevinylene)- alt-(p-phenylenevinylene)] has been modified by increasing the content of p-phenylene to achieve red- and infrared-emission. The polymer is synthesized via Wittig-Horner condensation, which is known to lead to trans-olefin linkage. The polymer is soluble in common organic solvents such as toluene, chloroform and THF. The spectroscopic properties of the polymer in both solution and film states will be discussed in comparison with its model compound.

Author

Fluorescence; Product Development; Near Infrared Radiation

20030063084 NASA Glenn Research Center, Cleveland, OH, USA

Carbon Nanotube Purification and Functionalization

Lebron, Marisabel; Mintz, Eric; Smalley, Richard E.; Meador, Michael A.; HBCUs/OMUs Research Conference Agenda and Abstracts; February 2003, pp. 12; In English; See also 20030063082; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Carbon nanotubes have the potential to significantly enhance the mechanical, thermal, and electrical properties of polymers. However, dispersion of carbon nanotubes in a polymer matrix is hindered by the electrostatic forces that cause them to agglomerate. Chemical modification of the nanotubes is necessary to minimize these electrostatic forces and promote adhesion between the nanotubes and the polymer matrix. In a collaborative research program between Clark Atlanta University, Rice University, and NASA Glenn Research Center several approaches are being explored to chemically modify carbon nanotubes. The results of this research will be presented.

Author

Carbon Nanotubes; Purification; Thermodynamic Properties; Mechanical Properties

20030063094 Tuskegee Inst., AL, USA

Structural Evolution and Mechanical Properties of PMR-15/Layered Silicate Nanocomposites

Campbell, Sandi, Technical Monitor; Dean, Derrick; Abdalla, Mohamed; Green, Keith; Small, Sharee; HBCUs/OMUs Research Conference Agenda and Abstracts; February 2003, pp. 27; In English; See also 20030063082; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

In the first year of this research, we successfully synthesized and characterized Polymer/ Layered Silicate nanocomposite using the polyimide PMR-15 as the polymer and several layered silicate nanoparticles. We have scaled up the process to allow fabrication of monoliths using these nanocomposites. The morphology of these systems was found to evolve during processing to an exfoliated structure for one system and intercalated for the rest. Correlation with Transmission Electron Microscopy studies is underway. Dynamic mechanical analysis (DMA) results showed a significant increase in the thermomechanical properties (E' and E'') of 2.5 wt.% clay loaded nanocomposites in comparison to the neat polyimide. Increasing the clay loading to 5 wt.% decreased these properties. Higher glass transition temperatures were observed for 2.5 wt.% nanocomposites compared to the neat polyimide. A lower coefficient of thermal expansion was observed only for the PGV/PMR-15 nanocomposite. An improvement in the flexural properties (modulus, strength and elongation) was observed for the 2.5 wt.% nanocomposite but not for the 5 wt.% nanocomposites. The improved barrier properties polymer/ silicate nanocomposites suggest that moisture uptake should be decreased for PMR-15 nanocomposites. The results of some recent experiments to examine delineate the ability of the silicate nanoparticles in improving the hydrolytic degradation of PMR-15 will be discussed.

Author

Polyimides; Nanocomposites; Thermal Expansion; Silicates; Fabrication

20030063101 North Carolina Agricultural and Technical State Univ., Greensboro, NC, USA

Carbon Fiber Reinforced Ceramic Composites for Propulsion Applications

Freedman, Marc, Technical Monitor; Shivakumar, Kunigal N.; HBCUs/OMUs Research Conference Agenda and Abstracts; February 2003, pp. 21; In English; See also 20030063082; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Fiber reinforced ceramic composites are materials of choice for gas turbine engines because of their high thermal efficiency, thrust/weight ratio, and operating temperatures. However, the successful introduction of ceramic composites to hot structures is limited because of excessive cost of manufacturing, reproducibility, nonuniformity, and reliability. Intense research is going on around the world to address some of these issues. The proposed effort is to develop a comprehensive status report of the technology on processing, testing, failure mechanics, and environmental durability of carbon fiber reinforced ceramic composites through extensive literature study, vendor and end-user survey, visits to facilities doing this type of work, and interviews. Then develop a cooperative research plan between NASA GRC and NCA&T (Center for Composite Materials Research) for processing, testing, environmental protection, and evaluation of fiber reinforced ceramic composites.

Author

Ceramic Matrix Composites; Carbon Fibers; Environment Protection; Fiber Composites

20030063104 Clark-Atlanta Univ., GA, USA

Characterization of Polyimide Foams for Ultra-Lightweight Space Structures

Meador, Michael, Technical Monitor; Hillman, Keithan; Veazie, David R.; HBCUs/OMUs Research Conference Agenda and Abstracts; February 2003, pp. 13; In English; See also 20030063082; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Ultra-lightweight materials have played a significant role in nearly every area of human activity ranging from magnetic tapes and artificial organs to atmospheric balloons and space inflatables. The application range of ultra-lightweight materials in past decades has expanded dramatically due to their unsurpassed efficiency in terms of low weight and high compliance properties. A new generation of ultra-lightweight materials involving advanced polymeric materials, such as TEEK (TM) polyimide foams, is beginning to emerge to produce novel performance from ultra-lightweight systems for space applications. As a result, they require that special conditions be fulfilled to ensure adequate structural performance, shape retention, and thermal stability. It is therefore important and essential to develop methodologies for predicting the complex properties of ultra-lightweight foams. To support NASA programs such as the Reusable Launch Vehicle (RLV), Clark Atlanta University, along with SORDAL, Inc., has initiated projects for commercial process development of polyimide foams for the proposed cryogenic tank integrated structure (see figure 1). Fabrication and characterization of high temperature, advanced aerospace-grade polyimide foams and filled foam sandwich composites for specified lifetimes in NASA space applications, as well as quantifying the lifetime of components, are immensely attractive goals. In order to improve the development, durability, safety, and life cycle performance of ultra-lightweight polymeric foams, test methods for the properties are constant concerns in terms of timeliness, reliability, and cost. A major challenge is to identify the mechanisms of failures (i.e., core failure, interfacial debonding, and crack development) that are reflected in the measured properties. The long-term goal of the this research is to develop the tools and capabilities necessary to successfully engineer ultra-lightweight polymeric foams. The desire is to reduce density at the material and structural levels, while at the same time maintaining or increasing mechanical and other properties.

Author

Foams; Polyimides; Technology Utilization; Costs; Fabrication

20030063105 Clark-Atlanta Univ., GA, USA

Effects of Impact Damage in Midplane Asymmetric Sandwich Composites

Meador, Michael, Technical Monitor; Webb, M. Mensah; Veezie, David R.; HBCUs/OMUs Research Conference Agenda and Abstracts; February 2003, pp. 14; In English; See also 20030063082; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Several structural sandwich composites arc in service on military and commercial aerospace vehicles, however, these components have been limited to secondary structures partly because the impact damage and damage tolerance of these composites have not been extensively characterized. To improve durability, safety, and life cycle performance of PMCs while reducing maintenance costs, combined analysis, and test methods that provide a means of predicting critical engineering properties after impact damage of the structure, must be developed. A key enabling technology here is the establishment of the correlation between the impact test results conducted in the laboratory and the mechanics-based phenomenological solutions. This research was undertaken to investigate the compression and flexural properties following low velocity impact

of a nomex/phenolic honeycomb core, fiberglass/epoxy facesheet, midplane asymmetric sandwich composite. One facesheet (thin side) was composed of two plies of the fiberglass/epoxy (0/90), while the other facesheet (thick side) was composed of four plies (0/90/0/90) of fiberglass/epoxy. Due to the differences in facesheet thickness, impact damage was separately induced on the thick side as well as the thin side. The compression and flexural strength properties for each damage arrangement were compared using different levels of impact energy ranging from 0 to 452 Joules. In all cases, higher impact energy resulted in decreased compression and flexural strength. Impact on the thin side showed slightly more retention of compression strength at low impact levels, whereas higher residual compressive strength was observed from impact on the thick side at higher impact levels. Different facesheet thicknesses or midplane asymmetry, played an important role in the flexural strength, however, low velocity impact on the both the thick and thin fiberglass/epoxy facesheet side showed an almost linear loss of flexural strength to saturation.
Author
Impact Damage; Sandwich Structures; Compressive Strength; Glass Fiber Reinforced Plastics; Life (Durability)

20030064066 NASA Johnson Space Center, Houston, TX, USA
Diagnostics of Carbon Nanotube Formation in a Laser Produced Plume: An Investigation of the Metal Catalyst by Laser Ablation Atomic Fluorescence Spectroscopy
deBoer, Gary; Scott, Carl; National Aeronautics and Space Administration (NASA)/American Society of Engineering Education (ASEE) Summer Faculty Fellowship Program - 2000; January 2003, pp. 2-1-2-13; In English; See also 20030064055
Contract(s)/Grant(s): NAG9-867; No Copyright; Avail: CASI; A03, Hardcopy

Carbon nanotubes, elongated molecular tubes with diameters of nanometers and lengths in microns, hold great promise for material science. Hopes for super strong light-weight material to be used in spacecraft design is the driving force behind nanotube work at JSC. The molecular nature of these materials requires the appropriate tools for investigation of their structure, properties, and formation. The mechanism of nanotube formation is of particular interest because it may hold keys to controlling the formation of different types of nanotubes and allow them to be produced in much greater quantities at less cost than is currently available. This summer's work involved the interpretation of data taken last summer and analyzed over the academic year. The work involved diagnostic studies of carbon nanotube formation processes occurring in a laser-produced plume. Laser ablation of metal doped graphite to produce a plasma plume in which carbon nanotubes self assemble is one method of making carbon nanotube. The laser ablation method is amenable to applying the techniques of laser spectroscopy, a powerful tool for probing the energies and dynamics of atomic and molecular species. The experimental work performed last summer involved probing one of the metal catalysts, nickel, by laser induced fluorescence. The nickel atom was studied as a function of oven temperature, probe laser wavelength, time after ablation, and position in the laser produced plume. This data along with previously obtained data on carbon was analyzed over the academic year. Interpretations of the data were developed this summer along with discussions of future work. The temperature of the oven in which the target is ablated greatly influences the amount of material ablated and the propagation of the plume. The ablation conditions and the time scale of atomic and molecular lifetimes suggest that initial ablation of the metal doped carbon target results in atomic and small molecular species. The metal atoms survive for several milliseconds while the gaseous carbon atoms and small molecules nucleate more rapidly. Additional experiments and the development of in situ methods for carbon nanotube detection would allow these results to be interpreted from the perspective of carbon nanotube formation.
Author
Carbon Nanotubes; Nanostructure Growth; Laser Ablation; Laser Spectroscopy; Laser Induced Fluorescence; Plumes

20030064092 ATK-Thiokol Propulsion, Brigham City, UT, USA
Bond Sensitivity to Silicone Contamination
Caldwell, G. A.; Hudson, W. D.; Hudson, W. D.; Cash, Stephen F., Technical Monitor; [2003]; 3 pp.; In English; 26th Annual Meeting of the Adhension society, 23-26 Feb. 2003, Myrtle Beach, SC, USA
Contract(s)/Grant(s): NAS8-97238; No Copyright; Avail: CASI; A01, Hardcopy

Currently during fabrication of the Space Shuttle booster rocket motors, the use of silicone and silicone-containing products is prohibited in most applications. Many shop aids and other materials containing silicone have the potential, if they make contact with a bond surface, to transfer some of the silicone to the substrates being bonded. Such transfer could result in a reduction of the bond strength or even failure of the subsequent bonds. This concern is driving the need to understand the effect of silicones and the concentration needed to affect a given bond-line strength. Additionally, as silicone detection methods used for materials acceptance improve what may have gone unnoticed earlier is now being detected. Thus, realistic

silicone limits for process materials (below which bond performance is satisfactory) are needed rather than having an absolute no silicone permitted policy.
Author
Silicones; Metal Bonding; Contamination; Mechanical Properties; Substrates; Bonded Joints; Adhesive Bonding

20030064216 Georgia Inst. of Tech., Atlanta, GA, USA
Microstructure and Dynamic Behavior Correlation in Two-Phase TiB2+Al2O3 Ceramic
Thadhani, Naresh N.; Zhou, Min; Oct. 2002; 104 pp.; In English
Contract(s)/Grant(s): DAAG55-98-1-0454
Report No.(s): AD-A412647; ARO-37763.1-MS; No Copyright; Avail: CASI; A06, Hardcopy

The high-strain-rate deformation and damage response of four types of microstructurally-biased two-phase (nominally 30:70) TiB2+Al2O3 ceramics, produced by SHS or mechanical milling techniques, have been investigated in this work. The microstructural-bias includes differences in phase (grain) size and phase distribution, such that in one case a continuous (interconnected) TiB2 network surrounds the Al2O3 phase (qualitatively termed TA'), and in the other case the TiB2 and Al2O3 phases are interdispersed and uniformly inter-twined with each other (qualitatively termed TinA'). The work performed has focused on correlation of time-resolved measurements of dynamic spall and compressive yield strengths obtained from gas gun experiments and from split-Hopkinson bar experiments, with quantitative determination of the two-phase biased microstructure. Micromechanical modeling based on a cohesive surface formulation model that provides explicit account for arbitrary microstructures and arbitrary fracture patterns has also been developed to study the deformation and damage sub-structure evolution during impact loading. Deterministic and stochastic characterization of fracture resistance has also been performed and implemented.
DTIC
Aluminum Oxides; Ceramics; Dynamic Characteristics; Microstructure; Titanium Borides; Mechanical Engineering

20030064277 Westinghouse Savannah River Co., Aiken, SC, USA
DWPF Melter Air-Lift Bubbler: Physical Testing with Glycerin
Guerrero, H. N.; Bickford, D. F.; Jan. 2003; In English
Report No.(s): DE2003-807912; WSRC-TR-2002-00421; No Copyright; Avail: National Technical Information Service (NTIS)

The objectives of the Airlift Bubbler Physical Testing are to investigate the flow characteristics of the bubbler as an aid to finalize the prototype bubbler design.
NTIS
Performance Tests; Glycerols; Design

20030064292 Westinghouse Savannah River Co., Aiken, SC, USA
Large Scale Vitrification of 241-AN-102 (Envelope C) Sample
Zamecnik, J. R.; Crawford, C. L.; Koopman, D. C.; Aug. 21, 2002; In English
Report No.(s): DE2003-805885; WSRC-TR-2002-00093; SRT-RPP-2001-00190; No Copyright; Avail: National Technical Information Service (NTIS)

This task, the Large Scale Vitrification of 241-AN-102 (Envelope C) Sample (Large C Vitrification), was to vitrify a large (7-30 liter) sample of pretreated Envelope C sample in a small-scale continuously-fed melter, herein referred to as the 'Large C Melter' or 'LC Melter' The sample that was vitrified had been subjected to the complete pretreatment sequence (current at the time of the experimental work) at SRTC: (1) Sr/TRU precipitation; (2) filtration to remove entrained solids and solids from Sr/TRU precipitation; (3) Cs removal by ion exchange (IX); (4) Tc removal by ion exchange; and (5) concentration by evaporation. Glass formers, specified by the Vitreous State Laboratory at the Catholic University of America and approved by BNFL Inc., were then added to makeup the melter feed. This melter feed was then melted in the melter.
NTIS
Vitrification; Glass; Ion Exchanging; Filtration

20030064293
DWPF Melter Air-Lift Bubbler: Development and Testing for Increasing Glass Melt Rates and Waste Dissolution
May 2002; In English
Report No.(s): DE2003-805887; WSRC-TR-2002-00196; No Copyright; Avail: National Technical Information Service (NTIS)

A DOE Tank Focus Area program to assess possible means of increasing Defense Waste Processing Facility Melter melt rate was initiated in FY01. A lumped parameter comparison of DWPF data with earlier pilot scale data indicated that melter capacity for a given feed was limited by overheating of the glass immediately under the reacting feed (cold cap). Bubblers were considered as a means of increasing glass circulation and opening a vent in the cold cap to allow increased electrode power, and thus increased melter total power.
NTIS
Ceramics; Dissolving; Radioactive Wastes

20030064311 SOUTHAMPTON UNIV (UNITED KINGDOM), UK
New Bioanodes: Truncated Hydride Carrier Coenzymes and Electrochemistry
Simon, Evelyne; Bartlett, Philip N.; Jan. 1998; 68 pp.; In English
Contract(s)/Grant(s): N00014-98-0898
Report No.(s): AD-A411737; ONREUR/FPOAE-98PR098127-00; No Copyright; Avail: CASI; A04, Hardcopy

The long-term goal of this project was to develop novel biofuel cells suitable for energy harvesting and low-level power generation. The original objectives, in collaboration with Cass (Imperial College, UK), Ellington (Texas) , and Bugg (Warwick University, UK), were to develop synthetic, cost-effective and more stable analogs of NADH which could be used in conjunction with a protein-engineered dehydrogenase enzyme to provide the electrochemical basis of a novel bioanode for use in a biofuel cell. The plan was to synthesize a series of NADH analogs of increasing complexity (Bugg) and then use this series of analogs in conjunction with protein evolution studies to develop engineered dehydrogenase enzymes that are capable of utilizing these molecules in place of NADH (Cass and Ellington). The mechanism of the electrochemical oxidation of these NADH analogs at chemically modified electrodes was studied and efficient electrodes developed for use in conjunction with the modified enzymes as the anode of a biofuel cell. Methods for the immobilization of the NADH analogs onto electrode surfaces and the resulting electrochemistry of the immobilized molecules also were studied. (4 tables, 51 figures, 41 refs.)
DTIC
Cell Anodes; Fuel Cells; Electrochemical Oxidation

20030064329 Air Force Research Lab., Edwards AFB, CA, USA
Synthesis and Atomic Oxygen Erosion Testing of Space-Survivable POSS (polyhedral Oligomeric Silsesquioxane) Polyimides
Gonzalez, Rene L.; Tomczak, Sandra J.; Hoflund, Gar B.; Minton, Timothy K.; Brunsvold, Amy; Dec. 16, 2002; 4 pp.; In English
Contract(s)/Grant(s): Proj-2303
Report No.(s): AD-A411707; AFRL/PRS-ED-AB-2002-312; No Copyright; Avail: CASI; A01, Hardcopy

The harsh environment present in both low-earth and geosynchronous orbit combined with the need for lighter weight and lower cost man-made orbiting bodies necessitates the design of multi-functional, space-survivable materials. Over the last two decades it has been well established that conventional polymers used in the construction of space vehicles undergo severe degradation resulting in reduced spacecraft lifetimes. In particular, the polyimide Kapton has been studied at length since it is widely used as a flexible substrate for lightweight high power solar arrays because of its inherent strength and desirable thermal properties. In addition to Kapton, thin films of fluorinated polymers such as Teflon FEP are used as the outer layer of multi-layer thermal control insulation because of their superior optical properties, including low solar absorptance and high thermal reflectance. These polymeric materials degrade because spacecraft surfaces must endure a high incident fluences of atomic oxygen (AO), bombardment by low and high-energy charged particles, and thermal cycling along with the full spectrum of solar radiation. Hybrid inorganic/organic polymers have the potential to meet the requirements of space-survivable materials by bridging the gap between ceramics and plastics, resulting in the prevention of AO and radiation damage that has hampered the widespread application of organic polymers in space. The Polymer Working Group at the Air Force Research Laboratory at Edwards AFB has incorporated inorganic POSS (Polyhedral Oligomeric Silsesquioxane) frameworks into traditional polymer systems resulting in hybrid POSS-polymers with dramatic property enhancements. Addition of these POSS nanostructured frameworks into polymers results in increased use and decomposition temperatures, improved mechanical properties, and oxidation resistance.
DTIC
Mechanical Properties; Spacecraft Components; Organic Materials; Polyimides

20030065193 California Univ., Los Angeles, CA

Characterization and Improvement of Polymer Solution Light-Emitting Devices

Yang, Yang; Wudl, Fred; Mar. 3, 2003; 19 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): F49620-00-1-0103; Proj-2303

Report No.(s): AD-A413397; AFRL-SR-AR-TR-03-0093; No Copyright; Avail: CASI; A03, Hardcopy

Our original objective was the understanding of polymer solution light-emitting devices (SLED), from device mechanism to materials. After a two-year intense research on SLEDs, we have expanded our project to other areas, from SLEDs, to phosphorescent PLEDs, and high performance photovoltaic devices. It is realized that our SLED has a similar mechanism as the ECL process. The electrogenerated chemiluminescence (ECL) process usually involves at least two species (or two reactions). One reaction is the oxidation process in which a species is oxidized near the anode to form a radical cation and the other species is reduced near the cathode to form a radical anion. The radical species with lower molecular weight will move to the counter-electrode. When the radical anions and radical cations encounter within the charge hopping distance, charge transfer will occur. The electron transition is from the high-energy excited state (Eex) to the low-energy state. In the case of poly 9,9-BIS(3,6-DIOXAHEPTYL)-FLUORENE-2, 7-DIYL (BDOH-PF) and 1,2-dichlorobenzene (DCB), Eex(BDOH-PF < Eex(DCB) and the radical cation of DCB will transfer its positive charge to the radical anions of BDOH-PF (actually an electron hops from the radical anion to the DCB radical cation) to form the excited state of BDOH-PF and blue light emission will take place when the excited state decays to its ground state.

DTIC

Anodes; Light Emitting Diodes; Polymers; Fluorine Organic Compounds; Chlorobenzenes

20030065237 California Univ., San Diego, La Jolla, CA

Damage Tolerant Lightweight Armor Materials

Nemat-Nasser, S.; Benson, D.; Meyers, M. A.; Nesterenko, V.; Vecchio, K. S.; Apr. 9, 2003; 27 pp.; In English

Contract(s)/Grant(s): DAAH04-96-1-0376

Report No.(s): AD-A413051; ARO-P-35888-MS-MUR.32; No Copyright; Avail: CASI; A03, Hardcopy

To develop a fundamental understanding and quantitative assessment of the dynamic response and failure modes of highly heterogeneous and anisotropic composites of ceramics, cermets, metals, and fiber-reinforced polymeric composites, various specific complementary scientific tasks have been initiated by the participating team members, based on their strengths and expertise. These tasks include development of novel experimental techniques, preliminary experiments, development of micromechanically-based models, and computational tools. As research progresses, these efforts will be continued and will be integrated, in order to effectively achieve the basic goals of this MUH. While the team members have collaborated with each other in various relevant research areas, each one has emphasized one or two necessary research areas, as follows: Sia Nernat-Nasser: Dynamic experiments (Hopkinson/gas gun); dynamic failure of fiber-reinforced polymer composites; micromechanical modeling of compression-induced failure modes of anisotropic heterogeneous ceramics; and modeling of anisotropic effects in pulverized, initially heterogeneous, ceramic layers; Marc Meyers: Synthesis and processing of TiC-NiTi and TiBsub2-NiTi composites; constitutive description of porous ceramics; and quasi-static and dynamic testing of composites; VitaliNesterenko: Thick- walled cylinder experiments on various grades of SiC; experimental investigation on nonexplosive, shear-induced chemical reactions in various relevant compounds; and micromechanical modeling of hot isostatic pressing of metallic alloys; Ken Vecchio: Fabrication of titanium-aluminide composites; microstructural characterization; and preliminary modeling; Dave Benson: Computational techniques to efficiently integrate various coupling physics into computational codes, including reactive flow models, statistical crack mechanics, and improved integration of finite deformations.

DTIC

Composite Materials; Armor; Ceramics

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*.

20030064072 Texas Woman's Univ., Denton, TX, USA
Interactions of Hydrazine and Blowby Gases
Meagher, Nancy E.; National Aeronautics and Space Administration (NASA)/American Society of Engineering Education (ASEE) Summer Faculty Fellowship Program - 2000; March 2003, pp. 23-13-15; In English; See also 20030064055
Contract(s)/Grant(s): NAG9-867; No Copyright; Avail: CASI; A03, Hardcopy

The interactions between hydrazine and blowby gases from pyrovalves was explored in this research project. Investigating the decomposition chemistry of hydrazine through detailed chemical kinetic modeling is a project started last summer while participating in the Summer Faculty Fellowship program. During the 1999-2000 academic year, the chemical kinetic mechanism for hydrazine decomposition developed while a SFF at NASA's White Sands Test Facility was further revised and validated against the limited experimental data in the literature. This mechanism was then used in assessing the effects of blowby gas species on hydrazine decomposition. The combustion products introduced into the fuel line by pyrovalve actuation consist primarily of hydrogen gas. Hydrogen is also a product of the decomposition of hydrazine. Additional gaseous chemical species are introduced into the fuel, as well as metals and metal salts that deposit onto the walls of the fuel line. The deposition process is undoubtedly very rapid, and exothermic. Therefore, the major focus of this summer's work was examining the effects of hydrogen presence on hydrazine decomposition, with some representative calculations including the remaining gaseous species found to exist in blowby gases. Since hydrogen is a product of hydrazine decomposition, all reactions necessary to evaluate its effect on hydrazine decomposition chemistry were in the original mechanism developed. However, the mechanism needed to be considerably expanded to include the reactions of the other gaseous blowby species with hydrazine, all the intermediate species formed in its decomposition, and each other. The expanded mechanism consists of 70 species interacting via a network of 452 reactions. Calculations with molecular hydrogen introduced into hydrazine gas in an inert bath gas indicate that H2 presence as an initial reactant in substantial amounts can dramatically impact the decomposition process for hydrazine. The other gaseous blowby species (CO, CO2, H2O, CH4, O2, and N2) were found to have little effect compared to the inclusion of hydrogen itself as an initial reagent. This result is undoubtedly due, in part, to the fact that the blowby gas used in these calculations consisted of 94.6\% H2. A more rigorous examination of the behavior of the full detailed mechanism under a variety of conditions was not performed.
Author
Hydrazines; Valves; Combustion Products; Decomposition; Reaction Kinetics

20030064252 National Defence Research Establishment, Linkoeping
Penguin Gasgenerator Refurbishment Program PGRP
Stroem, L.; Eiderfors, B.; Olsson, S.; Sanden, R.; Pettersson, A.; 2002; 26 pp.; In English
Report No.(s): PB2003-103230; FOI-R-0484-SE; No Copyright; Avail: CASI; A03, Hardcopy

By commission from FMV:KC Vapen, a study concerning the refurbishing old gas generator charges for RBS12 gas generator has been carried out by FOI Weapons and Protection Division, Department of Warheads and Propulsion. The following has been investigated: the removal of old propellant charges and their replacement with novel charges consisting of ammonium nitrate/HTPB propellant; the igniter system; methods for testing the new propellants; methods for producing and testing new propellant charges; testing of the complete gas generation assemblies; and qualification program.
NTIS
Gas Generators; Solid Rocket Propellants; Propulsion; Charge Efficiency

20030064464 Lawrence Livermore National Lab., Livermore, CA
Grain-Scale Dynamics Explosives
Reaugh, J. E.; Sep. 30, 2002; 68 pp.; In English
Report No.(s): DE2003-15003150; UCRL-ID-150388; No Copyright; Avail: Department of Energy Information Bridge

High explosives can have reactions to external stimuli that range from mild pressure bursts to full detonation. The ability to predict these responses is important for understanding the performance as well as the safety and reliability of these important materials. At present, we have only relatively simple phenomenological computational models for the behavior of high explosives under these conditions. These models are limited by the assumption that the explosive can be treated as

homogeneous. In reality the explosive is a highly heterogeneous composite of irregular crystallites and plastic binder. The heterogeneous nature of explosives is responsible for many of their unique mechanical and chemical properties.
NTIS
Detonation; Explosives; Mathematical Models; Phenomenology; Grain Size

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*.

20030064120 NASA Marshall Space Flight Center, Huntsville, AL, USA
Simulations of Ground and Space-Based Oxygen Atom Experiments
Minton, T. K.; Cline, J. A.; Braunstein, M.; October 24, 2002; 2 pp.; In English; 9th International Conference on Materials in a Space Environment, 16-20 Jun. 2003, Noordwijk, Netherlands
Contract(s)/Grant(s): NAS8-00201; No Copyright; Avail: Other Sources; Abstract Only

Fast, pulsed atomic oxygen sources are a key tool in ground-based investigations of spacecraft contamination and surface erosion effects. These technically challenging ground-based studies provide a before and after picture of materials under low-earth-orbit (LEO) conditions. It would be of great interest to track in real time the pulsed flux from the source to the surface sample target and beyond in order to characterize the population of atoms and molecules that actually impact the surface and those that make it downstream to any coincident detectors. We have performed simulations in order to provide such detailed descriptions of these ground-based measurements and to provide an assessment of their correspondence to the actual LEO environment. Where possible we also make comparisons to measured fluxes and erosion yields. To perform the calculations we use a detailed description of a measurement beam and surface geometry based on the W, pulsed apparatus at Montana State University. In this system, a short pulse (on the order of 10 microseconds) of an O/O2 beam impacts a flat sample about 40 cm downstream and slightly displaced &om the beam s central axis. Past this target, at the end of the beam axis is a quadrupole mass spectrometer that measures the relative in situ flux of 0102 to give an overall normalized erosion yield. In our simulations we use the Direct Simulation Monte Carlo (DSMC) method, and track individual atoms within the atomic oxygen pulse. DSMC techniques are typically used to model rarefied (few collision) gas-flows which occur at altitudes above approximately 110 kilometers. These techniques are well suited for the conditions here, and multi-collision effects that can only be treated by this or a similar technique are included. This simulation includes collisions with the surface and among gas atoms that have scattered from the surface. The simulation also includes descriptions of the velocity spread and spatial profiles of the O/O2 beam obtained from separate measurements. These computations use basic engineering models for the gas-gas and gas-surface scattering and focus on the influence of multi-collision effects. These simulations characterize many important quantities of interest including the actual flux of atoms that reach the surface, the energy distribution of this flux, as well as the direction of the velocity of the flux that strikes the surface. These quantities are important in characterizing the conditions which give rise to measured surface erosion. The calculations also yield time- snapshots of the pulse as it impacts and flows around the surface. These snapshots reveal the local environment of gas near the surface for the duration of the pulse. We are also able to compute the flux of molecules that travel downstream and reach the spectrometer, and we characterize their velocity distribution. The number of atoms that reach the spectrometer can in fact be influenced by the presence of the surface due to gas-gas collisions from atoms scattered h m the surface, and it will generally be less than that with the surface absent. This amounts to an overall normalization factor in computing erosion yields. We discuss these quantities and their relationship to the gas-surf$ce interaction parameters. We have also performed similar calculations corresponding to conditions (number densities, temperatures, and velocities) of low-earth orbit. The steady-state nature and lower overall flux of the actual space environment give rise to differences in the nature of the gas-impacts on the surface from those of the ground-based measurements using a pulsed source.
Author
Oxygen Atoms; Spaceborne Experiments; Molecular Beams; Computerized Simulation; Spacecraft Contamination

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*.

20030063092 Tennessee State Univ., Nashville, TN, USA
Research Project for Increasing the Pool of Minority Engineers
Gott, Susan F., Technical Monitor; Rogers, Decatur B.; HBCUs/OMUs Research Conference Agenda and Abstracts; February 2003, pp. 25; In English; See also 20030063082; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The NASA Glenn Research Center (GRC) funded the 2001-2002 Tennessee State University (TSU) Research Project for increasing the pool of minority engineers. The NASA GRC/TSU Research Project is designed to develop a cadre of SMET professionals who have academic and research expertise in technical areas of interest to NASA, in addition to having some familiarity with the mission of the NASA Glenn Research Center. The goal of increasing minority participation in SMET disciplines was accomplished by: (1) introducing and exposing 96 minority youth to Science, Math, Engineering, and Technology (SMET) careers and to the required high school preparation necessary to make high school graduation, college attendance and engineering careers a reality through the campus based pre-college SMET program: Minority Introduction to Engineering (MITE); (2) by providing financial support through scholarships for four (4) TSU engineering students to NASA; (3) familiarization with the SMET profession and with NASA through summer internships at NASA GRC for two TSU NASA Glenn Research Scholars; and experiences through research internships at NASA GRC.
Author
Engineers; Minorities; Students; Education; NASA Programs; University Program

20030064090 Research Inst. for Advanced Computer Science, Moffett Field, CA, USA, NASA Ames Research Center, Moffett Field, CA, USA
(Almost) Featureless Stereo: Calibration and Dense 3D Reconstruction Using Whole Image Operations
Smelyanskiy, V. N.; Morris, R. D.; Maluf, D. A.; Cheeseman, P.; October 2001; 18 pp.; In English; Original contains black and white illustrations
Contract(s)/Grant(s): NCC2-1006
Report No.(s): RIACS-TR-01.26; Copyright; Avail: CASI; A03, Hardcopy

The conventional approach to shape from stereo is via feature extraction and correspondences. This results in estimates of the camera parameters and a typically spare estimate of the surface. Given a set of calibrated images, a dense surface reconstruction is possible by minimizing the error between the observed image and the image rendered from the estimated surface with respect to the surface model parameters. Given an uncalibrated image and an estimated surface, the camera parameters can be estimated by minimizing the error between the observed and rendered images a function of the camera parameters. We use a very small dense set of matched features to provide camera parameter estimates for the initial dense surface estimate. We then re-estimate the camera parameters as described above, and then re-estimate the surface. This process is iterated. Whilst it can not be proven to converge, we have found that around three iterations results in excellent surface and camera parameters estimates.
Author
Calibrating; Cameras; Errors; Three Dimensional Models; Stereophotography

20030064949 Air Force Inst. of Tech., Wright-Patterson AFB, OH
JPEG 2000 Compression of Direct Digital Images: Effects on the Detection of Periapical Radiolucencies and Perceived Image Quality
Massey, Mark A.; Jan. 31, 2003; 107 pp.; In English
Report No.(s): AD-A410733; No Copyright; Avail: CASI; A06, Hardcopy

Radiographic evaluation is an essential component of endodontic diagnosis. In recent years, direct digital imaging (DDI) has been introduced to replace or augment radiographic film. Studies comparing diagnostic accuracy of DDI and conventional film for detection of artificially created periapical lesions have revealed comparable results. Advantages of DDI have been reported as: 1) lower radiation exposure to patients, 2) elimination of chemical processing, 3) computer storage capability, 4) electronic transportation of images and 5) instantaneous capture of images.
DTIC
Radiography; Films

20030065311 Dayton Univ., OH, USA

Wavelength Agile Spectroscopic Sources Based on Quasi-Phase Matched Structures

Yaney, Perry P.; Jun. 30, 1998; 6 pp.; In English

Contract(s)/Grant(s): F49620-97-1-0446; Proj-3484

Report No.(s): AD-A413204; AFRL-SR-AR-TR-03-0099; No Copyright; Avail: CASI; A02, Hardcopy

With the equipment requested in the associated DURIP proposal (DURIP Topic #4, same title as above) and the graduate student support requested herein, we envision several new avenues of research. The tunable, narrow bandwidth output of the injection seeded system will serve as a near-infrared spectroscopic source for imaging combustion products at Wright Patterson Air Force Base (WPAFB). The anticipated energy output (30 mJ, 10 ns pulses) will allow multi-point or line measurements that provide much better diagnostic information than the currently used single point methods. We also envision utilizing the source for atmospheric pollutant sensing in laser radar/differential absorption lidar sensors or in multispectral laser radar target identification systems. Exhaust plumes, even oil pipeline leaks, and targets hidden in foliage can be easily detected by such systems. The pulsed source permits retrieval of range information as well. Finally we suggest some fundamentally new methods of building and tuning wavelength agile sources based on QPM materials structures. One example is a single crystal frequency tripler.

DTIC

Combustion Products; Differential Absorption Lidar; Laser Spectroscopy; Oscillators; Spectroscopy

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*.

20030053035 Physics and Electronics Lab. TNO, The Hague, Netherlands

EOV Scenario System for Schooling and Training, Aspects for a New System

Punt, J. B.; December 2002; 34 pp.; In Dutch; Original contains color illustrations

Contract(s)/Grant(s): TNO Proj. 31802

Report No.(s): FEL-02-A184; TD01-0331; Copyright; Avail: Other Sources

Development in military communications and an aging EW training system have resulted in a need for improved EW training capacity for the RNLA. This report investigates the possibilities for a new EW scenario system that can train EW operators at various levels, by supplying an abundantly filled electromagnetic spectrum. Output of the information, embedded in a scenario needs to be possible at different levels of aggregation, in order to be able to train personnel independently. The types and number of signals present in an emulated spectrum must conform to the spectrum found in a modem electronic battlefield, requiring many signals from many radio-types, including digital ones. Support for the training staff is considered as well, creating a scheme for a scenario system that is flexible and powerful.

Author

Electronic Warfare; Education; Simulators; Broadband; Electromagnetic Radiation

20030064024 NASA Marshall Space Flight Center, Huntsville, AL, USA

Remote Instrumentation AMPATH Astronomy Working Group

Bradford, Robert N.; [2003]; 30 pp.; In English; AMPATH Workshop Joint Astronomy Working Group, 29 Jan. - 1 Feb. 2003, Miami, FL, USA; No Copyright; Avail: CASI; A03, Hardcopy

This viewgraph representation presents an overview of the Telescience Resource Kit (TReK) and the Internet Voice Distribution System (IVoDS) applications which are being used to provide support for science experiments aboard the International Space Station (ISS). Operational logistics, structural design, technical capabilities for both systems are discussed. Additional topics covered include: general discussion of remote instrumentation and tools, and hypothetical examples where these tools are used.

CASI

Spaceborne Experiments; Remote Control; Communication Networks; Telemetry; Signal Processing; Control Systems Design; Applications Programs (Computers); Wireless Communication

20030064235 Sandia National Labs., Albuquerque, NM

Approach to Wireless Communications at Sandia National Laboratories

Witzke, E. L.; October 2002; 46 pp.; In English

Report No.(s): DE2003-805838; SAND2002-3312; No Copyright; Avail: Department of Energy Information Bridge

Wireless communication plays an increasing role in military, industrial, public safety, and academic computer networks. Although in general, radio transmitters are not currently permitted in secured areas at Sandia, wireless communications would open new opportunities, allowing mobile and pervasive user access. Without wireless communications, we must live in a 'non-mainstream' world of fixed, wired networks, where it becomes ever more difficult to attract and retain the best professionals. This report provides a review of the current state of wireless communications, which direction wireless technology is heading, and where wireless technology could be employed at Sandia. A list of recommendations on harnessing the power of wireless communications is provided to aid in building a state-of-the-art communication environment for the 21st century at Sandia.

NTIS

Radio Transmitters; Wireless Communication

20030064401 Texas A&M Univ., College Station, TX

Requirements Specification for DMS Message Optimization Software Tool (MOST)

Davis, P.; Sunkari, S.; Dudek, C.; Balke, K.; Sep. 2002; 116 pp.; In English

Report No.(s): PB2003-104633; RR-4023-2; No Copyright; Avail: CASI; A06, Hardcopy

Composing a message for a dynamic message sign requires managers and supervisors at TxDOT Traffic Management Centers to consider numerous factors. For example, they must consider the content and length of the message as well as memory load for motorists. Following documented guidelines about formatting and phrasing of messages, the requirements for a software system called the DMS Message Optimization Software Tool, or MOST, are discussed. The system is designed to accept input data through a graphical user interface, to allow selection of terms, and to produce a message suitable for display in a DMS. The application automatically applies principles of good message design and allows users to customize their messages. The design of the system follows work done previously in TxDOT Project 0-4023.

NTIS

Software Engineering; Graphical User Interface; Messages; Traffic

20030065119 Brigham Young Univ., Provo, UT

Full L-S Band Telemetry System

Jensen, Michael A.; Apr. 29, 2003; 18 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): F49620-01-1-0101

Report No.(s): AD-A413473; No Copyright; Avail: CASI; A03, Hardcopy

Recent changes in spectrum availability as well as higher demands for spectrum have motivated the development of telemetry transmit systems capable of fully operating over both L and S telemetry bands. However, enabling operation within these two bands poses new problems in system design. This report presents a prototype system capable of operating between 1.4 and 2.4 GHz, which supports continuous phase modulation (CPM) waveforms such as pulse code modulation (PCM), frequency modulation (FM), and shaped offset quadrature phase shift keying (SOQPSK). The system architecture is detailed, and the prototype performance is discussed. The report also details a transmission scheme that overcomes the detrimental interference created when two antennas are used on an aeronautical telemetry transmitter, a common practice for overcoming signal obstruction that can occur during air vehicle maneuvering. The development leads to symbol error probability expressions that can be applied to assess the performance of the scheme relative to that of traditional schemes. Representative computational examples demonstrate the potential of the method.

DTIC

Frequency Modulation; Transmitters; Telemetry; Phase Modulation; Antennas

20030065127 California Inst. of Tech., Pasadena, CA

Progress in Grid Amplifiers

Cheung, Chun-Tung; Deckman, Blythe; Rosenberg, James J.; Rutledge, David B.; May 2003; 4 pp.; In English

Report No.(s): AD-A413414; No Copyright; Avail: CASI; A01, Hardcopy

In view of the growth in demand in high data rate communications, satellite communications, radar imaging and detection applications and astronomical applications, microwave and millimeter wave power amplifiers capable of providing tens of

watts are in need. The recent improvements in III-V solid-state technology provide high yield reliable transistors that can be fabricated in a large quantity. This capability allows the development of grid amplifiers combining power of more than 500 transistors. This paper presents the recent achievements in grid amplifiers. In particular a 5W, 8dB gain, 15\% power added efficiency (PAE) monolithic grid amplifier and a 1W monolithic grid oscillator with tuning range from 37.54lGHz are going to be presented. The associated calibration, measurement and packaging techniques are discussed as well.
DTIC
Grids; Amplifiers; Transistors; Communication Satellites; Microwave Amplifiers; Power Amplifiers

20030065189 Alabama Univ., Huntsville, AL, USA
Depscor-95 Agile Optical Phased Arrays for Microspacecraft
Fork, Richard L.; Nov. 30, 1999; 20 pp.; In English
Contract(s)/Grant(s): F49620-96-1-0206; Proj-3484
Report No.(s): AD-A413383; AFRL-SR-AR-TR-03-0096; No Copyright; Avail: CASI; A03, Hardcopy

The introduction of ultrafast technology into space offers novel opportunities. Agile optical phased arrays that allow rapid forming and redirection of high average power beams with little or no mechanical movement are especially interesting. Recent advances in semiconductor and optical fiber lasers suggest lightweight compact optical phased arrays suitable for microspacecraft are feasible. Double clad fiber offers an opportunity to provide average powers of order ten watts in single mode fibers. Modelocked laser technology we are now addressing provides means for combining these high average power single mode lasers into phased arrays. Related photonic band gap research we are pursuing identifies an approach we believe will provide opto-electronically controlled true time delays for the array elements. We propose to develop this technology and test the results in space missions. Agile optical phased arrays with the average power, spatial resolution, and high data rate suitable for an advanced global information network based on microsatellites would have an extraordinary impact on military capability. We combine our ongoing work on ultrafast technology with an earlier DEPSCoR funded program in microsatellites, both at the University of Alabama in Huntsville, to explore this possibility. We leverage this effort with existing investments, relationships with strong research partners, and the favorable location of the University of Alabama in Huntsville. We are consequently able to offer a program of national significance for relatively modest cost.
DTIC
Microsatellites; Photonics; Phased Arrays

20030065224 Army Research Lab., Adelphi, MD
Frequency-Hopping Communication Systems
Torrieri, Don; Mar. 2003; 183 pp.; In English
Report No.(s): AD-A412987; ARL-TR-2949; No Copyright; Avail: CASI; A09, Hardcopy

This report presents a current review and analysis of the most important aspects of frequency-hopping communication systems. Frequency synthesis and other implementation issues are discussed. The effects and suitability of various modulations is examined. The impact of error-correcting codes on the performance of frequency-hopping systems is analyzed.
DTIC
Telecommunication; Frequency Hopping; Radio Transmission

20030065230 Ohio State Univ., Columbus, OH
Simulation of Electromagnetic Scattering Experiments in the NSWC Carderock MASK Facility
Burkholder, Robert J.; Jamil, Khalid; Feb. 2003; 68 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): N00014-02-1-0727
Report No.(s): AD-A413054; ESL-742962-1; No Copyright; Avail: CASI; A04, Hardcopy

Radar scattering experiments performed in the NSWC Carderock Maneuvering And Sea-Keeping (MASK) wavetank facility are simulated using computational and analytic solutions. Forward scattering over a rough sea surface is simulated. as well as the backscatter from plate targets suspended over the rough surface. The generalized forward backward method is used to simulate the measurements with a 2D model and a reduced order iterative physical optics method is used for a 3D model. Monte Carlo data sets for multiple surface realizations are generated to extract the coherent and incoherent scattering from the computer simulations.
DTIC
Surface Roughness; Monte Carlo Method; Integral Equations; Radar Measurement; Radar Echoes; Radar Scattering

20030065249 Range Commanders Council, White Sands Missile Range, NM

Telemetry Systems Radio Frequency (RF) Handbook

Dec. 2001; 115 pp.; In English; Original contains color illustrations

Report No.(s): AD-A413101; No Copyright; Avail: CASI; A06, Hardcopy

The Radio Frequency (RF) Systems Committee of the Range Commanders Council Telemetry Group (RCC-TG) has prepared this document to assist in the development of improved RF telemetry transmitting and receiving systems in use on RCC-member ranges. The RCC-TG expects that improved system design, operation, and maintenance will result from a better understanding of the factors that affect RF systems performance and, consequently, overall system effectiveness. Additional information can be found in RCC Document 1 19-88, Telemetry Applications Handbook. This document is not intended to be a tutorial or textbook on the theory of RF systems design. It is intended to be a living document used to convey ideas, suggestions, lessons learned and other items of importance to the new telemetry systems engineer or technician working in the field of RF telemetry. This document is arranged into three sections according to the basic telemetry RF system model below.

DTIC

Systems Engineering; Handbooks; Radio Frequencies; Telemetry

20030065285 Monterey Technologies, Inc., Monterey, CA, USA

Advanced Interfaces and Testbed for Space Operator Consoles SBIR Phase II, Final Report

Starkey, Thomas J.; Marlow, Thomas W.; Remington, Robert J.; Ianni, John D.; Apr. 2002; 571 pp.; In English

Contract(s)/Grant(s): F33615-00-C-6006; Proj-3005

Report No.(s): AD-A412986; AFRL-HE-WP-TR-2002-0188; No Copyright; Avail: CASI; A24, Hardcopy

This report summarizes the development of an improved Human-System Interface (HSI) for space operators, and the development of a testbed for evaluating this and other new HSI concepts. This work was performed under a Small Business Innovation Research (SBIR) contract to Monterey Technologies, Inc. A task analysis was performed to identify bottlenecks in the current HSI. It was found that controllers were limited by the number of manual and visual actions required, by the organization and presentation of the data from the satellite, and limited availability of tools that aid the controller. The design of the HSI focused on elimination of these bottlenecks. The HSI developed to address these issues is multi-modal. It features voice synthesis and recognition, touchscreen capabilities, as well as a conventional keyboard and mouse interface. This HSI was implemented in a testbed that allows collection of controller performance data during a simulated support of a DSCS type satellite. The testbed architecture was designed to facilitate integration and evaluation of new, emerging HSI concepts and devices.

DTIC

Test Stands; Data Acquisition; Controllers

20030065289 Range Commanders Council, White Sands Missile Range, NM, USA

Radar Cross Section (RCS) Certification for Static and Dynamic RCS measurement Facilities. Volume 2: DOD RCS Demonstration Program Results

Aug. 2001; 36 pp.; In English; Original contains color illustrations

Report No.(s): AD-A413055; RCC/SMSG-804-01-VOL-1-REV; No Copyright; Avail: CASI; A03, Hardcopy

In January 1997, the Range Commanders Council Signature Measurement Standards Group (RCC/SMSG), in coordination with the RCC Taskmaster, established RCC/SMSG Task #08 titled, 'DoD RCS Certification Feasibility Demonstration for Static and Dynamic RCS Measurement Facilities.' Referred to herein as the DoD RCS Demonstration Program, the task assessed the feasibility of establishing common documentation standards to describe and certify the operation and capabilities of the DoD's diverse RCS measurement facilities located throughout the USA. Through the mutual efforts of the USA Air Force (USAF) 46 Test Group, in cooperation with the RCC/SMSG Radar Committee, the demonstration program described herein was entirely successful and should lay the groundwork for similar technical or laboratory calibration certification efforts throughout the DoD RCS measurement community.

DTIC

Radar Cross Sections; Radar Signatures; Certification

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*.

20030063089 Texas Univ., El Paso, TX, USA

Characterizing Non-Uniformity of Performance of Thin-Film Solar Cells

Clark, Eric B., Technical Monitor; Lush, Gregory B.; HBCUs/OMUs Research Conference Agenda and Abstracts; February 2003, pp. 29; In English; See also 20030063082; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Thin-film Solar Cells are being actively studied for terrestrial and space applications because of their potential to provide low-cost, lightweight, and flexible electric power system. Currently, thin-film solar cell performance is limited partially by the nonuniformity of performance that they typically exhibit. This nonuniformity of performance necessitates more detailed characterization techniques than the well-known macroscopic measurements such as current-voltage and efficiency. This project seeks to explore methods of characterization that take into account the spatial nonuniformity of thin-film solar cells. In this presentation we show results of electroluminescence images, short-circuit maps, and Kelvin Probe maps. All these mapping characterization and analysis tools show that the non-uniformities can correlated with device performance and efficiency.

Author

Electroluminescence; Nonuniformity; Solar Cells; Technology Utilization; Thin Films

20030064077 NASA Marshall Space Flight Center, Huntsville, AL, USA

Design of a Ferroelectric Programmable Logic Gate Array

MacLeod, Todd C.; Ho, Fat Duen; January 09, 2003; 1 pp.; In English; 14th International Symposium on Integrated Ferroelectrics, 12 Mar. 2003, Colordao Springs, CO, USA

Contract(s)/Grant(s): 406-07-00; Copyright; Avail: Other Sources; Abstract Only

A programmable logic gate array has been designed utilizing ferroelectric field effect transistors. The design has only a small number of gates, but this could be scaled up to a more useful size. Using FFET's in a logic array gives several advantages. First, it allows real-time programmability to the array to give high speed reconfiguration. It also allows the array to be configured nearly an unlimited number of times, unlike a FLASH FPGA. Finally, the Ferroelectric Programmable Logic Gate Array (FPLGA) can be implemented using a smaller number of transistors because of the inherent logic characteristics of an FFET. The device was only designed and modeled using Spice models of the circuit, including the FFET. The actual device was not produced. The design consists of a small array of NAND and NOR logic gates. Other gates could easily be produced. They are linked by FFET's that control the logic flow. Timing and logic tables have been produced showing the array can produce a variety of logic combinations at a real time usable speed. This device could be a prototype for a device that could be put into imbedded systems that need the high speed of hardware implementation of logic and the complexity to need to change the logic algorithm. Because of the non-volatile nature of the FFET, it would also be useful in situations that needed to program a logic array once and use it repeatedly after the power has been shut off.

Author

Field-Programmable Gate Arrays; Ferroelectricity; Logic Circuits; Field Effect Transistors; Design Analysis

20030064221 California Univ., Santa Barbara, CA

Integrated Microelectronics and Photonics Active Cooling Technology (IMPACT)

Bowers, John; Shakouri, A.; Majumdar, A.; Narayanamurti, V.; Croke, E.; Mar. 2003; 136 pp.; In English

Contract(s)/Grant(s): DAAD19-99-1-0158

Report No.(s): AD-A412656; ARO-P-40068.1-EL; No Copyright; Avail: CASI; A07, Hardcopy

The primary goal of the IMPACT effort is to demonstrate the advantages of heterostructure integrated thermionic (HIT) coolers and their integration with microelectronics and photonics. The majority of our research involves the development of this new technology through nanostructured materials design and growth; device design and fabrication; simulation and modeling; novel measurements of thermoelectric and thermionic behavior; and systems integration and packaging.

DTIC

Cooling; Fabrication; Microelectronics; Photonics; Integrated Circuits

20030064354 Fermi National Accelerator Lab., Batavia, IL, USA
Architecture of the BTeV Pixel Readout Chip
Christian, D. C.; Dec. 2002; 12 pp.; In English
Report No.(s): DE2003-805295; FERMILAB-CONF-02/319-E; No Copyright; Avail: Department of Energy Information Bridge

The most striking feature of BTeV, a dedicated b physics experiment which is expected to begin running in 2008 in the new CZero interaction region of the Fermilab Tevatron, is that the experiment will use data from a pixel vertex detector to reconstruct tracks and vertices for every beam crossing. The lowest level trigger will be an impact parameter trigger designed to identify events containing reconstructable decays of charm and bottom particles. An R&D program to develop a pixel readout chip optimized for the Tevatron was started at Fermilab in 1997, and is now nearing completion. The architecture of the BTeV pixel readout chip is described in this paper.
NTIS
Chips; Particle Accelerators; Pixels; Readout; Radiation Hardening

20030064885 Defence Science and Technology Organisation, Fishermans Bend, Australia
An Evaluation of the Eclypse ESP Hand-Held Standing Wave Reflectometer
Quinn, Jim; April 2003; 24 pp.; In English
Report No.(s): DSTO-TN-0490; DODA-AR-012-732; Copyright; Avail: Other Sources

The Eclypse ESP standing wave reflectometer was tested for its ability to locate open and short circuits on pairs of electrical wires. The robust and simple to use hand-held device was shown to operate successfully and quickly on coaxial cables, twisted pairs, shielded cables and pairs of wires within multi-wire looms. For aircraft wire management this offers an improved fault location capability prior to repairs on the flight line or during maintenance. The ESP could also find application in other defence platforms with complex electrical wiring.
Author
Reflectometers; Standing Waves; Fault Detection; Display Devices; Electric Wire; Electrical Impedance

20030064889 Jena Univ., Germany
Active Shielding in Measurements of DC Near Biomagnetic Fields
Nowak, H.; Haueisen, J.; Ziolkowski, M.; Resmer, F.; Schueler, J.; Oct. 25, 2001; 4 pp.; In English; Original contains color illustrations
Report No.(s): AD-A411660; No Copyright; Avail: CASI; A01, Hardcopy

Measurements of DC near biomagnetic fields are disturbed by low frequency noise, that are not reduced sufficiently by most of the magnetically shielded rooms or gradiometers. An effective SQUID based active shielding system has been developed and installed at the magnetically shielded rooms in the Biomagnetic Center of the University Jena to reduce external low frequency disturbances. A reduction of the magnetic noise of about 23 dB could be achieved at 50 mHz.
DTIC
Biomagnetism; Direct Current; Electromagnetic Shielding

20030065126 Electro Magnetic Applications, Inc., Newton, MA, USA
Implementation of Microwave Active Nulling
How, Hoton; Vittoria, Carmine; December 31, 2002; 76 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F49620-00-C-0016; Proj-FO8671-0000636-2304/BX
Report No.(s): AD-A413451; AFR-1; AFRL-SR-AR-TR-03-0143; No Copyright; Avail: CASI; A05, Hardcopy

We have fabricated a universal test equipment capable of measuring the phase and amplitude of the reflection wave from a coax-cable cavity resonator. Frequency-agile materials, such as ferroelectric and ferrite samples were included with the resonator so that the resonant frequency of the resonator can be tuned by applying either a bias electric voltage or a bias magnetic field Sensitive electric and magnetic tuning have been obtained, and the measurement results compared nicely with calculations. In order to enhance the sensitivity of electronic tuning resonance mechanisms have been incorporated with the reflector performance such as the structural resonance and the ferrimagnetic resonance.
DTIC
Microwaves; Null Zones; Electrical Measurement; Reflectors; Phase Shift; Millimeter Waves; Global Positioning System; Test Equipment

20030065252 Pennsylvania State Univ., University Park, PA
Electrical Contacts to A1GaN for UV Detectors
Mohney, Suzanne; Mar. 31, 2003; 30 pp.; In English
Contract(s)/Grant(s): F49620-99-1-0176
Report No.(s): AD-A413119; No Copyright; Avail: CASI; A03, Hardcopy

Along with the advancement of III-V nitride materials and devices has come the need for high performance electrical contacts to these semiconductors. This document contains the major findings of a study of contacts to AlGaN performed at The Pennsylvania State University during the period January, 1999-December, 2002 under AFOSR grant F49620-99-1-0176. The findings are discussed in four sections, which cover ohmic contacts to n-AlGaN, Schottky barrier contacts to n-AlGaN, ohmic contacts to p-type GaN, and ohmic contacts to p-type AlGaN. We then comment briefly on metallurgical considerations for these contacts and worthwhile avenues for future investigations.
DTIC
Electric Contacts; Aluminum Nitrides; Gallium Nitrides; Ultraviolet Detectors

20030065268 Massachusetts Inst. of Tech., Cambridge, MA
Optical Phase Control of Ultrashort Femtosecond Pulse
Ippen, Erich P.; Jun. 30, 1998; 5 pp.; In English
Contract(s)/Grant(s): F49620-98-1-0392; Proj-3484
Report No.(s): AD-A413214; AFRL-SR-AR-TR-03-0098; No Copyright; Avail: CASI; A01, Hardcopy

When optical pulses achieve durations as short as a few optical cycles, their propagation and nonlinear interaction properties will begin to depend on the phase of the optical waveform relative to its envelope. We have recently demonstrated the feasibility of controlling the relative optical phase of successive pulses from a laser and propose here to study the effect of that control on the pulse formation process itself as well as on other nonlinear optical processes. Phase stabilized Ti:sapphire and Cr:YAG lasers will be developed for experiments in two different wavelength regimes.
DTIC
Electromagnetic Pulses; Optical Control; Phase Control

20030065271 Florida International Univ., Miami, FL
Fabrication and Characterization Facility for Molecule Electronics
Tao, Nongjian; Mar. 31, 2002; 7 pp.; In English
Contract(s)/Grant(s): F49620-01-1-0265; Proj-3484
Report No.(s): AD-A413278; AFRL-SR-AR-TR-03-0107; No Copyright; Avail: CASI; A02, Hardcopy

The objectives of this project are to seek a better understanding of electron transport in single molecules and to develop a molecular electronic device that can communicate with the outside world in a more practical way than the existing methods. In order to reach the objectives, we have proposed to acquire and set up a thin film fabrication system and electronic characterization equipment.
DTIC
Fabrication; Molecular Electronics; Semiconductor Junctions; Characterization

20030065273 Purdue Univ., West Lafayette, IN, USA
Exploratory Development of SiC Bipolar Transistors and GaN Heterojunction Bipolar Transistors for High-Power Switching Applications
Cooper, James A., Jr; Mar. 31, 2003; 16 pp.; In English
Contract(s)/Grant(s): N00014-99-1-0938
Report No.(s): AD-A413135; No Copyright; Avail: CASI; A03, Hardcopy

Homojunction bipolar transistors (BJTs) have been designed, fabricated, and characterized in 4H-SiC Devices optimized for high current gain have betas as high as 55, a new record for SiC BJTs. Devices optimized for blocking voltage exhibit blocking voltages of 3,200 V, again a new record for SiC BJTs. For the high-gain devices, the critical parameter is the base doping, which must be high enough to prevent punch through, while low enough to achieve a high emitter injection efficiency. The optimum value in these devices is a doping of about 1xl0(17) cm(3) at a base thickness of 1 micron. Another critical parameter is the lateral spacing between the edge of the emitter and the implanted P+ region used to form the base contact.
DTIC
Bipolar Transistors; Heterojunctions; Gallium Nitrides; Silicon Carbides

20030065280

Microelectrodes with Three-Dimensional Structures for Improved Neural Interfacing

Metz, S.; Heuschkel, M. O.; Avila, B. V.; Holzer, R.; Bertrand, D.; Oct. 25, 2001; 5 pp.; In English

Report No.(s): AD-A412975; No Copyright; Avail: CASI; A01, Hardcopy

This paper describes the development of microelectrodes with integrated three-dimensional electrode structures. The integration of three-dimensional structures aims at an improvement of the electrode/tissue interface. Due to the increase in surface area the electrode impedance is reduced, while the density of microelectrodes per area remains the same as with flat electrodes. Two different types of electrodes have been developed: Flexible, implantable microelectrodes with pyramidal, protruding structures and tip-shaped electrode arrays on glass substrates. The protrusion heights of the electrode sites can easily be adjusted depending on the actual application. For the flexible structures we used a polyimide- based process to fabricate microelectrodes with sharp or flat pyramidal tips and with electrode arrangements on front and backside of the devices. The tip-shaped electrode arrays were fabricated from a glass substrate by isotropic wet chemical etching and subsequent metallization and passivation. Data from impedance measurements and acute brain slice recordings indicate a considerable improvement regarding electrode impedance and obtainable signal strength. Is - Three-dimensional, Electrode array, Microelectrodes, Polyimide, Class

DTIC

Electrodes; Polyimide Resins; Electrical Impedance

20030065284 Air Force Inst. of Tech., Wright-Patterson AFB, OH, USA

Total Dose Effects of Ionizing and Non-Ionizing Radiation on Piezoresistive Pressure Transducer Chips

Willmon, Samuel J.; Mar. 2003; 102 pp.; In English; Original contains color illustrations

Report No.(s): AD-A413108; AFIT/GNE/ENP/03-11; No Copyright; Avail: CASI; A06, Hardcopy

The effects of ionizing and non ionizing radiation on the resistivity of silicon based, piezoresistive bulk micro-machined chips from pressure transducers were examined. Standard current-voltage (I-V) measurements were taken in-situ and post-irradiation during isothermal annealing at room temperature. One group of chips was irradiated to a maximum total gamma dose of lMrad(Si) in the 11,000 Ci (60) Co gamma cell at Ohio State University. The second group of chips was irradiated at the Ohio State University Research Reactor facility to a maximum total neutron dose of 4 Mrad(Si) using beam port Hi. The resistivity was shown to decrease during gamma irradiation as a result of Compton current generation and increase during neutron irradiation as a result of displacement damage. During irradiation in the gamma cell, the chips exhibited a 0.45 plus or minus 0.19\% decrease in resistivity at saturation. During the neutron and gamma irradiation in the reactor, the chips exhibited a peak change in resistivity of 2.503 plus or minus 0.003\% at 2 Mrad(Si), 3. 055 plus or minus 0.002\% at 3 Mrad(Si), and 3.6921\% (with unknown uncertainty) at 4 Mrad(Si). Regardless of the total dose received, all chips demonstrated a permanent change in resistivity of 0.7697 plus or minus 0.0006\% at room temperature.

DTIC

Pressure Sensors; Ionizing Radiation

20030065287 Virginia Univ., Charlottesville, VA, USA

Simulation of Terahertz Frequency Sources. Polar-Optical Phonon Enhancement of Harmonic Generation in Schottky Diodes

Gelmont, Boris; Sep. 20, 2002; 4 pp.; In English

Contract(s)/Grant(s): DAAD19-00-1-0353

Report No.(s): AD-A413032; ARO-41102.1-EL; No Copyright; Avail: CASI; A01, Hardcopy

New algorithm has been developed for harmonic balance analysis A robust simulation tool that combined this novel modified harmonic-balance circuit analysis technique with a two-valley temperature dependent hydrodynamic transport model device simulator is developed We have demonstrated that polar-optical phonons dramatically affects the nonlinearity in capacitance of a material near its transverse polar optical vibration frequency When a high frequency input signal is applied to a frequency multiplier device polar-optical phonons can enhance the non-linearities inherent in this device, enabling higher amplitude harmonic generation of the signal to yield better output power and output efficiency of the device The incorporation of polar-optical phonon physics into the Schottky diode abrupt junction model was developed and applied in this work Simulation of a GaAs-based Schottky diode multipliers was performed to show the dramatic enhancement of output efficiency in the vicinity of the polar-phonon frequency. In our simulation we have utilized a novel modified harmonic-balance circuit analysis technique which allows for the rapid determination of the matched embedding circuit and an optimized multiplier design. However, to practically utilize these novel nonlinear effects related to polar optical vibration within terahertz region, new materials were required with the Schottky diode barrier height to be of the same order as in GaAs, but with a lower

transverse polar-phonon frequency. One of the candidates is Bi2S3, which has the transverse polar optical frequency on the order of 300GHz.
DTIC
Schottky Diodes; Design Analysis; Electric Networks; Transverse Oscillation

20030065288 Purdue Univ., West Lafayette, IN, USA
Investigation of Jet Vapor Deposited (JVD) Silicon Oxide/Nitride/Oxide (ONO) Films as Gate Dielectrics for SiC and GaN Devices
Cooper, James A., Jr; Mar. 31, 2003; 14 pp.; In English
Contract(s)/Grant(s): N00014-00-1-0831
Report No.(s): AD-A413131; No Copyright; Avail: CASI; A03, Hardcopy

Jet vapor deposited (JVD) silicon dioxide-nitride-dioxide (ONO) films are investigated as gate dielectrics for SiC MOS transistors and GaN high-electron-mobility transistors (HEMTs). The JVD process employs supersonic jets of a light carrier gas such as helium to transport depositing vapor from the source to the substrate. The high impact energies of the depositing species allow the use of room-temperature substrate, which contributes to improved film quality.
DTIC
Dielectrics; Electron Mobility; High Electron Mobility Transistors; Supersonic Jet Flow

20030065318 Montana State Univ., Bozeman, MT
ASSERT Proposal - FY 1997 Materials for Optical Memories, Signal Processing, and Frequency Standards
Aug. 2000; 7 pp.; In English
Contract(s)/Grant(s): F49620-97-1-0411; Proj-3484
Report No.(s): AD-A413208; AFRL-SR-AR-TR-03-0111; No Copyright; Avail: CASI; A02, Hardcopy

The achievements of previous graduate and undergraduate students and the recent technical accomplishments in our DOD-funded projects are presented to justify support for two graduate research assistants, for graduate student presentation of results at national scientific meetings, and for two undergraduate research students. This is a physics/optics research program to supplement DEPSCoRAFOSR Contract Numbers F49620-94-1-0465 for Persistent Spectral Hole Burning Materials for Time-and Frequency-Domain Optical Memories and Signal Processing' and F49620-96-1-0466 for 'Very-Narrow-Line Semiconductor Lasers and Optical Clocks Based on Spectral Hole Burning Frequency Standards.' Facilities for hole burning and coherent transient research are available in our laboratory at Montana State University, a we have sixteen years of experience in this area, studying a variety of rare-earth activated materials. Our work is carried(in collaboration with Scientific Materials Corporation -- an AFOSR SBIR contractor, with Roger Macfarlane at IBM Almaden Research Center, with groups at the University of Oxford - UK, and with other groups in the US and France. Roger Mcfarlane at IBM is collaborating directly in the work proposed here.
DTIC
Signal Processing; Frequency Standards; Optical Memory (Data Storage)

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*.

20030063095 New Mexico Univ., Albuquerque, NM, USA
Computational Methods for Jet Noise Simulation
Goodrich, John W., Technical Monitor; Hagstrom, Thomas; HBCUs/OMUs Research Conference Agenda and Abstracts; February 2003, pp. 28; In English; See also 20030063082; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The purpose of our project is to develop, analyze, and test novel numerical technologies central to the long term goal of direct simulations of subsonic jet noise. Our current focus is on two issues: accurate, near-field domain truncations and high-order, single-step discretizations of the governing equations. The Direct Numerical Simulation (DNS) of jet noise poses a number of extreme challenges to computational technique. In particular, the problem involves multiple temporal and spatial scales as well as flow instabilities and is posed on an unbounded spatial domain. Moreover, the basic phenomenon of interest, the radiation of acoustic waves to the far field, involves only a minuscule fraction of the total energy. The best current

simulations of jet noise are at low Reynolds number. It is likely that an increase of one to two orders of magnitude will be necessary to reach a regime where the separation between the energy-containing and dissipation scales is sufficient to make the radiated noise essentially independent of the Reynolds number. Such an increase in resolution cannot be obtained in the near future solely through increases in computing power. Therefore, new numerical methodologies of maximal efficiency and accuracy are required.
Author
Direct Numerical Simulation; Jet Aircraft Noise; Acoustic Simulation

20030063902 Research Inst. for Advanced Computer Science, Moffett Field, CA, USA
Multiresolution Wavelet Based Adaptive Numerical Dissipation Control for Shock-Turbulence Computations
Sjoegreen, B.; Yee, H. C.; January 2001; 44 pp.; In English; Original contains black and white illustrations
Report No.(s): RIACS-TR-01.01; No Copyright; Avail: CASI; A03, Hardcopy

The recently developed essentially fourth-order or higher low dissipative shock-capturing scheme of Yee, Sandham and Djomehri (1999) aimed at minimizing nu- merical dissipations for high speed compressible viscous flows containing shocks, shears and turbulence. To detect non smooth behavior and control the amount of numerical dissipation to be added, Yee et al. employed an artificial compression method (ACM) of Harten (1978) but utilize it in an entirely different context than Harten originally intended. The ACM sensor consists of two tuning parameters and is highly physical problem dependent. To minimize the tuning of parameters and physical problem dependence, new sensors with improved detection properties are proposed. The new sensors are derived from utilizing appropriate non-orthogonal wavelet basis functions and they can be used to completely switch to the extra numerical dissipation outside shock layers. The non-dissipative spatial base scheme of arbitrarily high order of accuracy can be maintained without compromising its stability at all parts of the domain where the solution is smooth. Two types of redundant non-orthogonal wavelet basis functions are considered. One is the B-spline wavelet (Mallat & Zhong 1992) used by Gerritsen and Olsson (1996) in an adaptive mesh refinement method, to determine regions where re nement should be done. The other is the modification of the multiresolution method of Harten (1995) by converting it to a new, redundant, non-orthogonal wavelet. The wavelet sensor is then obtained by computing the estimated Lipschitz exponent of a chosen physical quantity (or vector) to be sensed on a chosen wavelet basis function. Both wavelet sensors can be viewed as dual purpose adaptive methods leading to dynamic numerical dissipation control and improved grid adaptation indicators. Consequently, they are useful not only for shock-turbulence computations but also for computational aeroacoustics and numerical combustion. In addition, these sensors are scheme independent and can be stand alone options for numerical algorithm other than the Yee et al. scheme.
Author
Wavelet Analysis; Dissipation; Turbulence; Shock Layers; Numerical Analysis; Sensors

20030063973 Technische Hochschule, Berlin, Germany
Investigation of Flow in a Centrifugal Pump
Fischer, Karl; Mitteilungen des Hydraulischen Instituts der Technischen Hochschule; July 1946, No. 4, pp. 1-27; In English
Report No.(s): NACA-TM-1089; No Copyright; Avail: CASI; A03, Hardcopy

The investigation of the flow in a centrifugal pump indicated that the flow patterns in frictional fluid are fundamentally different from those in frictionless fluid. In particular, the dead air space adhering to the section side undoubtedly causes a reduction of the theoretically possible delivery head. The velocity distribution over a parallel circle is also subjected to a noticeable change as a result of the incomplete filling of the passages. The relative velocity on the pressure side of the vane, which for passages completely filled with active flow would differ little from zero even at comparatively lower than normal delivery volume, is increased, so that no rapid reverse flow occurs on the pressure side of the vane even for smaller delivery volume. It was established, further, that the flow ceases to be stationary for very small quantities of water. The inflow to the impeller can be regarded as radial for the operating range an question. The velocity triangles at the exit are subjected to a significant alteration in shape ae a result of the increased peripheral velocity, which may be of particular importance in the determination of the guide vane entrance angle.
Derived from text
Centrifugal Pumps; Flow Distribution; Velocity Distribution; Airspace

20030064220 National Advisory Committee for Aeronautics. Langley Aeronautical Lab., Langley Field, VA, USA
Nonstationary Gas Flow in Thin Pipes of Variable Cross Section
Guderley, G.; Zentrale fuer Wissenschaftliches Berichtswesen der Luftfahrtforschung des Generalluftzeugmeisters (ZWB); December 1948, 1744; 82 pp.; In English
Report No.(s): NACA-TM-1196; No Copyright; Avail: CASI; A05, Hardcopy

Characteristic methods for nonstationary flows have been published only for the special case of the isentropic flow up until the present, althought they are applicable in various places to more difficult questions too. This report derives the characteristic method for the flows which depend only on the position coordinates and time. At the same time the treatment of compression shocks is shown.
Author
Gas Flow; Pipe Flow; Velocity; Shock; Mathematical Models

20030064254 Sandia National Labs., Albuquerque, NM
Generalized Fourier Analyses of Semi-Discretizations of the Advection-Diffusion Equation
Christon, M. A.; Voth, T. E.; Martinez, M. J.; Nov. 2002; In English
Report No.(s): DE2003-805879; SAND2002-3866; No Copyright; Avail: National Technical Information Service (NTIS)
This report presents a detailed multi-methods comparison of the spatial errors associated with finite difference, finite element and finite volume semi- discretizations of the scalar advection-diffusion equation. The errors are re- ported in terms of non-dimensional phase and group speeds, discrete diffusivity, artificial diffusivity, and grid-induced anisotropy. It is demonstrated that Fourier analysis (aka von Neumann analysis) provides an automatic process for separating the spectral behavior of the discrete advective operator into its symmetric dissipative and skew-symmetric advective components. Further it is demonstrated that streamline upwind Petrov-Galerkin and its control- volume finite element analogue, streamline upwind control-volume, produce both an artificial diffusivity and an artificial phase speed in addition to the usual semi-discrete artifacts observed in the discrete phase speed, group speed and diffusivity. For each of the numerical methods considered, asymptotic truncation error and resolution estimates are presented for the limiting cases of pure advection and pure diffusion.
NTIS
Convection-Diffusion Equation; Phase Error

20030064266 Purdue Univ., West Lafayette, IN, USA
Experimental Investigation of Relative Permeability Upscaling from the Micro-Scale to the Macro-Scale. Semi-Annual Progress Report
Pyrak-Nolte, L. J.; Cheng, J. T.; Yu, P.; Giordano, N.; Mustata, M.; Apr. 2002; In English
Report No.(s): DE2003-807247; No Copyright; Avail: National Technical Information Service (NTIS)
The principal challenge of upscaling techniques for multi-phase fluid dynamics in porous media is to determine which properties on the micro-scale can be used to predict macroscopic flow and spatial distribution of phases at core- and field-scales. The most notable outcome of recent theories is the identification of interfacial areas per volume for multiple phases as a fundamental parameter that determines much of the multi-phase properties of the porous medium. A formal program of experimental research was begun to directly test upscaling theories in fluid flow through porous media by comparing measurements of relative permeability and capillary-saturation with measurements of interfacial area per volume. During this reporting period, we have shown experimentally that the optical coherence imaging system can acquire information on grain interfaces and void shape for a maximum depth of half a millimeter into sandstone. The measurement of interfacial area per volume (IAV), capillary pressure and saturation in two dimensional micro-models structures has shown the existence of a unique relationship among these hydraulic parameters for different pore geometry. The measurement of interfacial area per volume on a three-dimensional natural sample, i.e., sandstone, has shown the homogeneity of IAV with depth in a sample when the fluids are in equilibrium.
NTIS
Sandstones; Permeability; Fluid Flow

20030064398 Purdue Univ., West Lafayette, IN, USA
Experimental Investigation of Relative Permeability Upscaling from the Micro-Scale to the Macro-Scale
Yu, P.; Giordao, N.; Cheng, J. T.; Mustata, M.; Headley, W.; Mar. 2001; 48 pp.; In English
Report No.(s): DE2003-807246; No Copyright; Avail: Department of Energy Information Bridge
The principal challenge of upscaling techniques for multi-phase fluid dynamics in porous media is to determine which properties on the micro-scale can be used to predict macroscopic flow and spatial distribution of phases at core- and field-scales. The most notable outcome of recent theories is the identification of interfacial areas per volume for multiple phases as a fundamental parameter that determines much of the multi-phase properties of the porous medium. A formal program of experimental research was begun to directly test upscaling theories in fluid flow through porous media by comparing measurements of relative permeability and capillary-saturation with measurements of interfacial area per volume.

During this reporting period, we achieved the milestone of using Optical Coherence Imaging (OCI) to image to the back of the first layer of grains in a sandstone sample. This is the first time that OCI has been used to image through sandstone. Information on grain geometry was obtained as deep as 400 microns into the sample. This report also describes the work performed to achieve the milestone on the measurement of interfacial area per volume, capillary pressure and saturation in two dimensional micromodels structures that are statistically similar to real porous media. This report contains the first quantitative experimental measurements of interfacial area per volume in any system.
NTIS
Permeability; Sandstones

20030064405 Sandia National Labs., Albuquerque, NM
Bursting Frequency Predictions for Compressible Turbulent Boundary Layers
Liou, W. W.; Fang, Y.; Oct. 2002; 37 pp.; In English
Report No.(s): DE2003-805836; SAND2002-3303; No Copyright; Avail: Department of Energy Information Bridge

A computational method for the prediction of the bursting frequency associated with the coherent streamwise structures in high-speed compressible turbulent boundary layers is presented. The structures are described as wavelike disturbances of the turbulent mean flow. A direct resonance theory is used to determine the frequency of bursting. The resulting hydrodynamic linear stability equations are discretized by using a Chebyshev collocation method. A global numerical method capable of resolving the entire eigenvalue spectrum is used. Realistic turbulent mean velocity and temperature profiles are applied. For all of the compressible turbulent boundary layers calculated, the results show at least one frequency that satisfies the resonance condition. A second frequency can be identified for cases with high Reynolds numbers. An estimate is also made for the profile distribution of the temperature disturbance.
NTIS
Boundary Layers; Turbulent Flow; Chebyshev Approximation; Compressible Boundary Layer; High Reynolds Number; Turbulent Boundary Layer

20030064873 Engineering Research and Consulting, Inc., Edwards AFB, CA, USA
Interaction of Acoustic Waves with a Cryogenic Nitrogen Jet at Sub- and Supercritical Pressures
Chehroudi, B.; Talley, Doug; Apr. 23, 2001; 5 pp.; In English
Contract(s)/Grant(s): AF Proj-2308
Report No.(s): AD-A410897; AFRL-PR-ED-AB-2001-101; No Copyright; Avail: CASI; A01, Hardcopy

Combustion instability has always been one of the most complex phenomena in liquid rocket engines, and therefore difficult to fully control particularly in designing large output rockets. These difficulties stem from the emergence of oscillatory combustion with large pressure amplitudes. In one classification, high-amplitude, low-frequency (less than several hundred hertz) pressure variations (or chugging) due to combustion is understood to be coupled with the feed line and structural modes of oscillations. Chugging is responsive to system-type analysis. Another instability is characterized by high amplitudes and high frequencies (screaming), and can lead to local burnout of the combustion chamber walls and injector plates. This is caused by extreme heat-transfer rates brought about by high-frequency pressure and gas velocity fluctuations, see Harrje and Reardon.
DTIC
Combustion Stability; Cryogenics; Liquid Propellant Rocket Engines; Nitrogen; Sound Waves; Supercritical Pressures; Jet Flow

20030064898 National Advisory Committee for Aeronautics. Langley Aeronautical Lab., Langley Field, VA, USA
The Navier-Stokes Stress Principle for Viscous Fluids
Mohr, Ernst; Luftfahrtforschung; September 1942; Volume 18, No. 9, pp. 327-330; In English
Report No.(s): NACA-TM-1029; No Copyright; Avail: CASI; A03, Hardcopy

The Navier-Stokes stress principle is checked in the light of Maxwell's mechanism of friction and in connection herewith the possibility of another theorem is indicated. The Navier-Stokes stress principle is in general predicated upon the conception of the plastic body. Hence the process is a purely phenomenological one, which Newton himself followed with his special theorem for one-dimensional flows. It remained for Maxwell to discover the physical mechanism by which the shear inflow direction is developed: According to it, this shear is only 'fictitious' as it merely represents the substitute for a certain transport on macroscopic motion quantity, as conditioned by Brown's moiecular motion and the diffusion, respectively. It is clear that this mechanism is not bound to the special case of the one-dimensioilal flows, but holds for any flow as expression of the

diffusion, by which a fluid differs sharply from a plastic body. If it is remembered, on the other hand, that the cause of the stresses on the plastic body lies in a certain cohesion of the molecules, it appears by no means self evident that this difference in the mechanism of friction between fluid and plastic body should not prevail in the stress principle as well, although it certainly is desirable in any case, at least subsequently, to establish the general theorem in the sense of Maxwell. Actually, a different theorem is suggested which, in contrast to that by Navier-Stokes, has the form of an unsymmetrical matrix. Without anticipating a final decision several reasons are advanced by way of a special flow which seem to affirm this new theorem. To make it clear that the problem involved here still awaits its final solution, is the real purpose behind the present article. Author

Navier-Stokes Equation; Viscous Fluids; Friction; Stress Analysis

20030064901 NASA Langley Research Center, Hampton, VA, USA

Summary of EASM Turbulence Models in CFL3D With Validation Test Cases

Rumsey, Christopher L.; Gatski, Thomas B.; June 2003; 47 pp.; In English

Contract(s)/Grant(s): 762-20-11-06

Report No.(s): NASA/TM-2003-212431; L-18311; NAS 1.15:212431; No Copyright; Avail: CASI; A03, Hardcopy

This paper summarizes the Explicit Algebraic Stress Model in k-omega form (EASM-ko) and in k-epsilon form (EASM-ke) in the Reynolds-averaged Navier-Stokes code CFL3D. These models have been actively used over the last several years in CFL3D, and have undergone some minor modifications during that time. Details of the equations and method for coding the latest versions of the models are given, and numerous validation cases are presented. This paper serves as a validation archive for these models.

Author

K-Epsilon Turbulence Model; K-Omega Turbulence Model; Computational Fluid Dynamics; Turbulent Flow; Separated Flow; Program Verification (Computers); Coding

20030064933 National Advisory Committee for Aeronautics. Langley Aeronautical Lab., Langley Field, VA, USA

The Compressible Potential Flow Past Elliptic Symmetrical Cylinders at Zero Angle of Attack and with No Circulation

Hantzsche, W.; Wendt, H.; Luftfahrtforschung; October 1942; Volume 18, No. 9, pp. 311-316; In English

Report No.(s): NACA-TM-1030; No Copyright; Avail: CASI; A03, Hardcopy

For the tunnel corrections of compressible flows those profiles are of interest for which at least the second approximation of the Janzen-Rayleigh method can be applied in closed form. One such case is presented by certain elliptical symmetrical cylinders located in the center of a tunnel with fixed walls and whose maximum velocity, incompressible, is twice the velocity of flow. In the numerical solution the maximum velocity at the profile and the tunnel wall as well as the entry of sonic velocity is computed. The velocity distribution past the contour and in the minimum cross section at various Mach numbers is illustrated on a worked out-example.

Author

Compressible Flow; Elliptical Cylinders; Zero Angle Of Attack; Potential Flow

20030064966 NASA Langley Research Center, Hampton, VA, USA

Computational and Experimental Flow Field Analyses of Separate Flow Chevron Nozzles and Pylon Interaction

Massey, Steven J.; Thomas, Russell H.; AbdolHamid, Khaled S.; Elmiligui, Alaa A.; [2003]; 12 pp.; In English; 9th AIAA/CEAS Aeroacoustics Conference and Exhibition, 12-14 May 2003, Hilton Head, SC, USA; Original contains color illustrations

Report No.(s): AIAA Paper 2003-3212; Copyright; Avail: CASI; A03, Hardcopy

A computational and experimental flow field analyses of separate flow chevron nozzles is presented. The goal of this study is to identify important flow physics and modeling issues required to provide highly accurate flow field data which will later serve as input to the Jet3D acoustic prediction code. Four configurations are considered: a baseline round nozzle with and without a pylon, and a chevron core nozzle with and without a pylon. The flow is simulated by solving the asymptotically steady, compressible, Reynolds-averaged Navier-Stokes equations using an implicit, up-wind, flux-difference splitting finite volume scheme and standard two-equation kappa-epsilon turbulence model with a linear stress representation and the addition of a eddy viscosity dependence on total temperature gradient normalized by local turbulence length scale. The current CFD results are seen to be in excellent agreement with Jet Noise Lab data and show great improvement over previous computations

which did not compensate for enhanced mixing due to high temperature gradients.
Author
Flow Distribution; Pylons; Nozzle Design; Separated Flow; Computational Fluid Dynamics; Turbulence Models; Aeroacoustics

20030064985 NASA Langley Research Center, Hampton, VA, USA
Experimental and Computational Investigation of Multiple Injection Ports in a Convergent-Divergent Nozzle for Fluidic Thrust Vectoring
Waithe, Kenrick A.; Deere, Karen A.; [2003]; 14 pp.; In English; 21st AIAA Applied Aerodynamics Conference, 23-26 Jun. 20003, Orlando, FL, USA; Original contains color and black and white illustrations
Report No.(s): AIAA Paper 2003-3802; No Copyright; Avail: CASI; A03, Hardcopy

A computational and experimental study was conducted to investigate the effects of multiple injection ports in a two-dimensional, convergent-divergent nozzle, for fluidic thrust vectoring. The concept of multiple injection ports was conceived to enhance the thrust vectoring capability of a convergent-divergent nozzle over that of a single injection port without increasing the secondary mass flow rate requirements. The experimental study was conducted at static conditions in the Jet Exit Test Facility of the 16-Foot Transonic Tunnel Complex at NASA Langley Research Center. Internal nozzle performance was obtained at nozzle pressure ratios up to 10 with secondary nozzle pressure ratios up to 1 for five configurations. The computational study was conducted using the Reynolds Averaged Navier-Stokes computational fluid dynamics code PAB3D with two-equation turbulence closure and linear Reynolds stress modeling. Internal nozzle performance was predicted for nozzle pressure ratios up to 10 with a secondary nozzle pressure ratio of 0.7 for two configurations. Results from the experimental study indicate a benefit to multiple injection ports in a convergent-divergent nozzle. In general, increasing the number of injection ports from one to two increased the pitch thrust vectoring capability without any thrust performance penalties at nozzle pressure ratios less than 4 with high secondary pressure ratios. Results from the computational study are in excellent agreement with experimental results and validates PAB3D as a tool for predicting internal nozzle performance of a two dimensional, convergent-divergent nozzle with multiple injection ports.
Author
Computational Fluid Dynamics; Convergent-Divergent Nozzles; Thrust Vector Control; Transonic Wind Tunnels; Fluidics; Injection; Test Facilities

20030065091 NASA Langley Research Center, Hampton, VA, USA
Uncertainty Propagation for Turbulent, Compressible Flow in a Quasi-1D Nozzle Using Stochastic Methods
Zang, Thomas A.; Mathelin, Lionel; Hussaini, M. Yousuff; Bataille, Francoise; [2003]; 11 pp.; In English; 16th AIAA Computational Fluid Dynamics Conference, 23-26 Jun. 2003, Orlando, FL, USA; Original contains black and white illustrations
Report No.(s): AIAA Paper 2003-4240; Copyright; Avail: CASI; A03, Hardcopy

This paper describes a fully spectral, Polynomial Chaos method for the propagation of uncertainty in numerical simulations of compressible, turbulent flow, as well as a novel stochastic collocation algorithm for the same application. The stochastic collocation method is key to the efficient use of stochastic methods on problems with complex nonlinearities, such as those associated with the turbulence model equations in compressible flow and for CFD schemes requiring solution of a Riemann problem. Both methods are applied to compressible flow in a quasi-one-dimensional nozzle. The stochastic collocation method is roughly an order of magnitude faster than the fully Galerkin Polynomial Chaos method on the inviscid problem.
Author
Compressible Flow; Computational Fluid Dynamics; Stochastic Processes; Turbulent Flow; Nozzle Design; Nozzle Flow

20030065117 Case Inst. of Tech., Cleveland, OH, USA
Application of the Method of Coordinate Perturbation to Unsteady Duct Flow
Himmel, Seymour C.; September 1958; 154 pp.; In English
Report No.(s): NACA-TM-1439; No Copyright; Avail: CASI; A08, Hardcopy

The method of coordinate perturbation is applied to the unsteady flow of a compressible fluid in ducts of variable cross section. Solutions, in the form of perturbation series, are obtained for unsteady flows in ducts for which the logarithmic derivative of area variation with respect to the space coordinate is a function of the ‘smallness’ parameter of the perturbation series. This technique is applied to the problem of the interaction of a disturbance and a shock wave in a diffuser flow. It is

found that, for a special choice of the function describing the disturbance, the path of the shock wave can be expressed in closed form to first order. The method is then applied to the determination of the flow field behind a shock wave moving on a prescribed path in the x,t-plane. Perturbation series solutions for quite general paths are developed. The perturbation series solutions are compared with the more exact solutions obtained by the application of the method of characteristics. The approximate solutions are shown to be in reasonably accurate agreement with the solutions obtained by the method of characteristics.
Author
Perturbation; Coordinates; Unsteady Flow; Ducted Flow; Compressible Fluids; Perturbation Theory

20030065132 NASA Langley Research Center, Hampton, VA, USA
Failure of Anisotropic Unstructured Mesh Adaption Based on Multidimensional Residual Minimization
Wood, William A.; Kleb, William L.; [2003]; 9 pp.; In English; 16th Comuptational Fluid Dynamics Conference, 23-26 Jun. 2003, Orlando, FL, USA; Original contains black and white illustrations
Report No.(s): AIAA Paper 2003-3824; No Copyright; Avail: CASI; A02, Hardcopy

An automated anisotropic unstructured mesh adaptation strategy is proposed, implemented, and assessed for the discretization of viscous flows. The adaption criteria is based upon the minimization of the residual fluctuations of a multidimensional upwind viscous flow solver. For scalar advection, this adaption strategy has been shown to use fewer grid points than gradient based adaption, naturally aligning mesh edges with discontinuities and characteristic lines. The adaption utilizes a compact stencil and is local in scope, with four fundamental operations: point insertion, point deletion, edge swapping, and nodal displacement. Evaluation of the solution-adaptive strategy is performed for a two-dimensional blunt body laminar wind tunnel case at Mach 10. The results demonstrate that the strategy suffers from a lack of robustness, particularly with regard to alignment of the bow shock in the vicinity of the stagnation streamline. In general, constraining the adaption to such a degree as to maintain robustness results in negligible improvement to the solution. Because the present method fails to consistently or significantly improve the flow solution, it is rejected in favor of simple uniform mesh refinement.
Author
Anisotropy; Unstructured Grids (Mathematics); Optimization; Failure; Discretization (Mathematics); Viscous Flow

20030065134 Massachusetts Inst. of Tech., Cambridge, MA
Development of a Solid-State Microhydraulic Energy Harvesting Mechanism for Heel Strike Power Harvesting
Steyn, J. L.; Hagood, Nesbitt W.; Apr. 10, 2003; 153 pp.; In English
Contract(s)/Grant(s): DAAG55-98-1-0361
Report No.(s): AD-A413367; ARO-38980.1-CH; No Copyright; Avail: CASI; A08, Hardcopy

A Microhydraulic Transducer (MHT) device was developed with the goal of extracting energy from heel strike motion. The required power output is approximately 1W, with an associated power density of approximately 0.1-1W/kg. The MHT relies on the incorporation of discrete piezoelectric elements into a microfabricated device to produce compact, high stiffness actuation at high frequencies. These piezoelectric elements. in conjunction with a piezoelectric piston. enable the design of a stiff, efficient fluidic to electric energy conversion mechanism with high power density. Using this mechanism in combination with hydraulic amplification, piezoelectric hydraulically amplified valves were produced that made it possible to create pulsing fluid pressure on a piezoelectric piston, and hence extract electrical power. The device relies on the DRIE fabrication of high-strength silicon membranes to form pistons with membrane tethers. These pistons are the moving elements of the device. A final device was built and tested, with a maximum power output of 1 mW measured from the piezoelectric piston at a differential pressure of 450kPa. Good agreement with models was obtained and, although the device tested had a design limitation unaccounted for in the original modeling, future devices based on this concept should be able to reach the original design goals.
DTIC
Solid State; Piezoelectric Transducers; Energy Conversion; Hydraulics; Fluidics

20030065152 National Academy of Sciences - National Research Council, Washington, DC, USA
An Assessment of Naval Hydromechanics Science and Technology
January 2000; 74 pp.; In English
Report No.(s): AD-A413242; No Copyright; Avail: CASI; A04, Hardcopy

The Department of the Navy maintains a vigorous science and technology (S&T) research program in those areas that are critically important to ensuring U.S. naval superiority in the maritime environment. A number of these areas depend largely

on sustained Navy Department investments for their health, strength, and growth. One such area is naval hydromechanics, that is, the study of the hydrodynamic and hydroacoustic performance of Navy ships, submarines, underwater vehicles, and weapons. A fundamental understanding of naval hydromechanics provides direct benefits to naval warfighting capabilities through improvements in the speed, maneuverability, and stealth of naval platforms and weapons. This level of understanding requires the ability to predict complex phenomena, including surface and internal wave wakes, turbulent flows around ships and control surfaces, the performance of, sea-surface interactions, and associated. This ability, in turn, stems from the knowledge gained from traditional experiments in towing tanks, from at-sea evaluations, and, increasingly, from computational fluid dynamics.
DTIC
Underwater Acoustics; Hydromechanics; Hydrodynamics; Technology Assessment; Navy

20030065153 National Advisory Committee for Aeronautics. Langley Aeronautical Lab., Langley Field, VA, USA
Extreme Speeds and Thermodynamic States in Supersonic Flight
Oswatitsch, Klaus; Zeitschrift fuer Flugwissenschaften; April 1958; Volume 4, Issue 3/4, pp. 95-108; In English
Report No.(s): NACA-TM-1434; No Copyright; Avail: CASI; A03, Hardcopy

The increasing importance of high-speed flow leads to similar problems in various fields of research which are summarized in what follows. Typical of all cases is the conversion of high kinetic energy into extreme thermodynamic states with temperatures of several thousand degrees, frequently connected with dissociation and ionization of the gas involved. There is also a characteristic small sensitivity to the processes discussed in the case of gases of low molecular weight (light gases). The penetration of meteors into the atmosphere of the earth at astronomical speeds results in temperatures higher than those of the surface of the sun. Such temperatures may be produced in shock tubes, with light gases used as the driving gas. For supersonic fighters the problem of propulsion is less difficult to solve than the problem of large heating, on the surface and in the combustion chamber. Finally, for the space-travel rocket, astronomical speeds have to be reached which require the lightest possible gases as propellants. Here again, dissociation processes in the combustion chamber are of considerable importance.
Author
Aerothermodynamics; Supersonic Speed; High Temperature; Kinetic Energy; Energy Conversion; Supersonic Flight; Gas Dissociation; Gas Ionization

20030065167 Academy of Sciences (Russia), Russia
The Turbulent Boundary Layer on a Rough Curvilinear Surface
Droblenkov, V. F.; Izvestiia Akademii Nauk SSR, Otdelenie Teknicheskikh Nauk; September 1958, No. 8, pp. 17-21; In English
Report No.(s): NACA-TM-1440; No Copyright; Avail: CASI; A03, Hardcopy

A number of semiempirical approximate methods exist for determining the characteristics of the turbulent boundary layer on a curvilinear surface. At present, among these methods, the one proposed by L. G. Loitsianskii is given frequent practical application. This method is sufficiently effective and permits, in the case of wing profiles with technically smooth surfaces, calculating the basic characteristics of the boundary layer and the values of the overall drag with an accuracy which suffices for practical purposes. The idea of making use of the basic integral momentum equation ((d delta(sup xx))/dx) + ((V' delta(sup xx))/V) (2 + H) = (tau(sub 0))/(rho V(exp 2)) proves to be fruitful also for the solution of the problems in the determination of the characteristics of the turbulent boundary layer on a rough surface.
Derived from text
Turbulent Boundary Layer; Roughness; Turbulence Models; Contours

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*.

20030053069 ASRC Aerospace Corp., USA
Phabulous Photorendering
Randazzo, John; [2003]; 5 pp.; In English; ProEngineer Regional User Group, 7 May 2003, Orlando, FL, USA; Original contains black and white illustrations
Contract(s)/Grant(s): NAS10-03006
Report No.(s): KSC-2003-059; No Copyright; Avail: CASI; A01, Hardcopy

Contents include the following: Adding realistic colors. Your product in action. Tip for action shots. General scene suggestions. Decals and texture-lebeling your product. Tips for using decals and textures. Lighting suggestions. Opting for photorendering options. Taking the fuzzy out of the photorender. Graphic formats revealed. Recomendations for options.
CASI
Graphs (Charts); Textures; Color

20030053070 NASA Pasadena Office, CA, USA
Computed Tomography Imaging Spectrometer (CTIS) with 2D Reflective Grating for Ultraviolet to Long-Wave Infrared Detection Especially Useful for Surveying Transient Events
Wilson, Daniel W., Inventor; Maker, Paul D., Inventor; Muller, Richard E., Inventor; Mouroulis, Pantazis Z., Inventor; February 18, 2003; 17 pp.; In English
Patent Info.: Filed 4 Dec. 2000; US-Patient-6,522,403; US-Patent-Appl-SN-734242; NASA-Case-NPO-20836; No Copyright; Avail: CASI; A03, Hardcopy

The optical system of this invention is an unique type of imaging spectrometer, i.e. an instrument that can determine the spectra of all points in a two-dimensional scene. The general type of imaging spectrometer under which this invention falls has been termed a computed-tomography imaging spectrometer (CTIS). CTIS's have the ability to perform spectral imaging of scenes containing rapidly moving objects or evolving features, hereafter referred to as transient scenes. This invention, a reflective CTIS with an unique two-dimensional reflective grating, can operate in any wavelength band from the ultraviolet through long-wave infrared. Although this spectrometer is especially useful for events it is also for investigation of some slow moving phenomena as in the life sciences.
Official Gazette of the U.S. Patent and Trademark Office
Imaging Spectrometers; Tomography; Imaging Techniques; Patents

20030053078 NASA Goddard Space Flight Center, Greenbelt, MD, USA
NASA's Earth Observatory and Visible Earth: Imagery and Science on the Internet
King, Michael D.; Simmon, Robert B.; Herring, David D.; [2003]; 1 pp.; In English; ASPRS 2003 Annual Conference, 5-9 May 2003, Anchorage, AK, USA; Copyright; Avail: CASI; A01, Hardcopy

The purpose of NASA s Earth Observatory and Visible Earth Web sites is to provide freely-accessible locations on the Internet where the public can obtain new satellite imagery (at resolutions up to a given sensor's maximum) and scientific information about our home planet. Climatic and environmental change are the sites main foci. As such, they both contain ample data visualizations and time-series animations that demonstrate geophysical parameters of particular scientific interest, with emphasis on how and why they vary over time. An Image Composite Editor (ICE) tool will be added to the Earth Observatory in October 2002 that will allow visitors to conduct basic analyses of available image data. For example, users may produce scatter plots to correlate images; or they may probe images to find the precise unit values per pixel of a given data product; or they may build their own true-color and false-color images using multi- spectral data. In particular, the sites are designed to be useful to the science community, public media, educators, and students.
Author
Climate Change; Satellite Imagery; Websites; Foci

20030053079 NASA Goddard Space Flight Center, Greenbelt, MD, USA
LISA Optics Model: Early Results
Waluschka, Eugene; Scherr, Larry; [2003]; 1 pp.; In English; SPIE Conference, 3-8 Aug. 2003, San Diego, CA, USA; Copyright; Avail: Other Sources; Abstract Only

The Laser Interferometer Space Antenna (LISA) optics model is used to generate a synthetic data stream in the absence of gravitational waves. The simulation has the spacecraft in moving in their respective Keplerian orbits. The pointing of the spacecraft and station keeping about the proof masses is accomplished using a control scheme, which minimizes the disturbance on the proof masses in the sensitive direction. The resulting data stream gives an indication of the magnitude of instrumental noise due to pointing jitter and motions of the spacecraft with respect to the proof masses. Computational details are presented and the results discussed.
Author
Laser Interferometry; Data Flow Analysis; Gravitational Waves; Antennas

20030062216 Applied Photonics, Encinitas, CA, USA
An Improved Bio-Optical Method for Tumor Detection and Classification
Leatham, James G.; Oct. 2002; 15 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-00-1-0602
Report No.(s): AD-A411445; No Copyright; Avail: CASI; A03, Hardcopy

Optical approaches to breast cancer (BC) detection show promise over conventional methods because they have potential to work in the denser tissue of younger patients and because they do not use ionizing radiation which has been shown to induce cancer in some patients. Three technologies will be combined in this effort. (a) Optical probing, using controlled light at specific wavelengths, is becoming a respected approach to cancer tumor detection. A much-published RADAR-based method known as frequency-domain photon migration (FDPM) gives very high sensitivity. (b) 'Spectral fingerprint' analysis of fluorescence emission is the basis for cancer and precancer classification affecting surface cells. This has been shown for cervical and lung cancers. (c) Reading images, such as x-ray films, allows the tumor to stand out relative to the 'expected' complex image of the breast. An optical hardware system was envisioned and preliminary testing performed. Hardware was to be based on using technically similar systems used in unrelated industrial applications to make hardware development affordable. Specific systems were identified. Ultimately, collaborators could not be found to modify their systems, and system development proved to be prohibitively costly. Discussions with other researchers has provided a voice for this approach within the community, paving the way for valuable contributions to BC detection.
DTIC
Optical Equipment; Fluorescence; Photons; X Ray Imagery; Mammary Glands; Cancer

20030063108 Howard Univ., Washington, DC, USA
Experimental Verification of Electric Drive Technologies Based on Artificial Intelligence Tools
Rubaai, Ahmed; Kankam, David, Technical Monitor; HBCUs/OMUs Research Conference Agenda and Abstracts; February 2003, pp. 18; In English; See also 20030063082; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

A laboratory implementation of a fuzzy logic-tracking controller using a low cost Motorola MC68HC11E9 microprocessor is described in this report. The objective is to design the most optimal yet practical controller that can be implemented and marketed, and which gives respectable performance, even when the system loads, inertia and parameters are varying. A distinguishing feature of this work is the by-product goal of developing a marketable, simple, functional and low cost controller. Additionally, real-time nonlinearities are not ignored, and a mathematical model is not required. A number of components have been designed, built and tested individually, and in various combinations of hardware and software segments. These components have been integrated with a brushless motor to constitute the drive system. A microprocessor-based FLC is incorporated to provide robust speed and position control. Design objectives that are difficult to express mathematically can be easily incorporated in a fuzzy logic-based controller by linguistic information (in the form of fuzzy IF-THEN rules). The theory and design are tested in the laboratory using a hardware setup. Several test cases have been conducted to confirm the effectiveness of the proposed controller. The results indicate excellent tracking performance for both speed and position trajectories. For the purpose of comparison, a bang-bang controller has been tested. The fuzzy logic controller performs significantly better than the traditional bang-bang controller. The bang-bang controller has been shown to be relatively inaccurate and lacking in robustness. Description of the implementation hardware system is also given.
Author
Experimentation; Data Acquisition; Computer Programs; Controllers; Fuzzy Systems; Real Time Operation; Speed Control

20030064045 NASA Marshall Space Flight Center, Huntsville, AL, USA
Computed Tomography and Thermography Increases CMC Material and Process Development Efficiency and Testing Effectiveness
Effinger, Michael; Beshears, Ron; Hufnagle, David; Walker, James; Russell, Sam; Stowell, Bob; Myers, David; January 2003;

1 pp.; In English; 27th Annual Conference on Composites, Materials and Structures, 28-31 Jan. 2002, Cocoa Beach, FL, USA; Copyright; Avail: Other Sources; Abstract Only

Nondestructive characterization techniques have been used to steer development and testing of CMCs. Computed tomography is used to determine the volumetric integrity of the CMC plates and components. Thermography is used to determine the near surface integrity of the CMC plates and components. For process and material development, information such as density uniformity, part delamination, and dimensional tolerance conformity is generated. The information from the thermography and computed tomography is correlated and then specimen cutting maps are superimposed on the thermography images. This enables for tighter data and potential explanation of off nominal test data. Examples of nondestructive characterization utilization to make decisions in process and material development and testing are presented.

Author

Ceramic Matrix Composites; Tomography; Thermography; Nondestructive Tests

20030064057 Rice Univ., Houston, TX, USA

Design of a Gas-SWNT Interaction Test Module

Hauge, Robert H.; National Aeronautics and Space Administration (NASA)/American Society of Engineering Education (ASEE) Summer Faculty Fellowship Program - 2000; March 2003, pp. 5-0 - 5-3; In English; See also 20030064055

Contract(s)/Grant(s): NAG9-867; No Copyright; Avail: CASI; A01, Hardcopy

A gas-single walled carbon nanotube (SWNT) interaction test module was designed and constructed. The purpose of the module is to quantitatively measure the electrical response of SWNTs to a variety of gases. This is accomplished by monitoring the electrical response of a SWNT packed column to specific gases. The apparatus is similar to a gas chromatograph with the difference that the movement of gas is tracked by monitoring the electrical resistivity at the beginning and end of the column. The change in electrical resistivity as a function of the amount of gas injected, the time required to transit the column and their respective dependence on temperature will be documented.

Author

Carbon Nanotubes; Gas Injection

20030064245 Sandia National Labs., Albuquerque, NM

Intelligent Targeting for a Remotely Operated, Rapid Aiming Weapon Platform

Nelson, C. L.; Carlson, J. J.; Nov. 2002; 17 pp.; In English

Report No.(s): DE2003-805868; SAND2002-3733; No Copyright; Avail: Department of Energy Information Bridge

Sandia National Laboratories has been investigating the use of remotely operated weapon platforms in Department of Energy (DOE) facilities. These platforms offer significant force multiplication and enhancement by enabling near instantaneous response to attackers, increasing targeting accuracy, removing personnel from direct weapon fire, providing immunity to suppressive fire, and reducing security force size needed to effectively respond. Test results of the Telepresent Rapid Aiming Platform (TRAP) from Precision Remotes, Inc. have been exceptional and response from DOE sites and the U.S. Air Force is enthusiastic. Although this platform performs comparably to a trained marksman, the target acquisition speeds are up to three times longer. TRAP is currently enslaved to a remote operators joystick. Tracking moving targets with a joystick is difficult; it dependent upon target range, movement patterns, and operator skill. Even well-trained operators encounter difficulty tracking moving targets. Adding intelligent targeting capabilities on a weapon platform such as TRAP would significantly improve security force response in terms of effectiveness and numbers of responders. The initial goal of this project was to integrate intelligent targeting with TRAP. However, the unavailability of a TRAP for laboratory purposes drove the development of a new platform that simulates TRAP but has a greater operating range and is significantly faster to reposition.

NTIS

Targets; Retarding; Suppressors; Weapon Systems

20030064892 Army Communications-Electronics Command, Fort Belvoir, VA

FDTD Seismic Simulation of Moving Tracked Vehicle

Ketcharn, Stephen A.; Moran, Mark L.; Greenfield, Roy J.; Sep. 2000; 19 pp.; In English; Original contains color illustrations

Report No.(s): AD-A411877; No Copyright; Avail: CASI; A03, Hardcopy

This paper describes the utility of a large finite-difference time domain (FDTD) simulation of seismic wave propagation from a spatially and time varying source that generically represents a moving tracked vehicle. The focus is the computational approach and requirements for the long-duration simulation, the geologic model, the moving vehicle force algorithm, the

resulting particle velocity wave fields, and example applications of the data. The 8th order FDTD simulation consisted of parallel computations based upon a domain decomposition strategy. The computations were performed using a Sun workstation cluster at the U.S. Army Engineer Research and Development Center's Cold Regions Research and Engineering Laboratory (ERDC-CRREL). Our use of such a cluster was necessary because of the spatial extent of the model and the duration of the simulated event; the model dimension is roughly 210 m by 286 m by 80 m (deep) with 1.6-m node spacing, and the event duration is 24.6 s with time steps of 180 microseconds. The event duration reflects the time required for the vehicle to traverse the model surface at an average speed close to 45 km/h. Three-component particle-velocity wave-field histories over this duration were stored by the simulation for later processing. Models of this extent and duration are on the order of the expected range of coverage for battlefield systems such as Raptor or the Future Combat System sensor system. As a consequence, resulting simulation data can be used for system development in a manner similar to field data.
DTIC
Seismic Waves; Finite Difference Time Domain Method; Computerized Simulation; Tracked Vehicles; Sensors

20030065044 NASA Langley Research Center, Hampton, VA, USA
Characterization and Analysis of InGaAsSb Detectors
Abedin, M. Nurul; Refaat, Tamer F.; Joshi, Ravindra P.; Sulima, Oleg V.; Mauk, Michael; Singh, Upendra N.; [2003]; 11 pp.; In English; AeroSense 2003: Aerospace/Defense Sensing, Simulation, and Controls, 21-25 Apr. 2003, Orlando, FL, USA; Original contains black and white illustrations; Copyright; Avail: CASI; A03, Hardcopy

Profiling of atmospheric CO2 at 2 micron wavelength using the LIDAR technique, has recently gained interest. Although several detectors might be suitable for this application, an ideal device would have high gain, low noise and narrow spectral response peaking around the wavelength of interest. This increases the detector signal-to-noise ratio and minimizes the background signal, thereby increasing the device sensitivity and dynamic range. Detectors meeting the above idealized criteria are commercially unavailable for this particular wavelength. In this paper, the characterization and analysis of Sb-based detectors for 2 micron lidar applications are presented. The detectors were manufactured by AstroPower, Inc., with an InGaAsSb absorbing layer and AlGaAsSb passivating layer. The characterization experiments included spectral response, current versus voltage and noise measurements. The effect of the detectors bias voltage and temperature on its performance, have been investigated as well. The detectors peak responsivity is located at the 2 micron wavelength. Comparing three detector samples, an optimization of the spectral response around the 2 micron wavelength, through a narrower spectral period was observed. Increasing the detector bias voltage enhances the device gain at the narrow spectral range, while cooling the device reduces the cut-off wavelength and lowers its noise. Noise-equivalent-power analysis results in a value as low as 4 x 10(exp -12) W/Hz(exp 1/2) corresponding to D* of 1 x 10(exp 10) cmHz(exp 1/2)/W, at -1 V and 20 C. Discussions also include device operational physics and optimization guidelines, taking into account peculiarity of the Type II heterointerface and transport mechanisms under these conditions.
Author
Infrared Detectors; Indium Gallium Arsenides; Indium Antimonides; Carbon Dioxide Concentration

20030065135 NASA Marshall Space Flight Center, Huntsville, AL, USA
Charge Loss and Charge Sharing Measurements for Two Different Pixelated Cadmium-Zinc-Telluride Detectors
Gaskin, Jessica; Sharma, Dharma; Ramsey, Brian; Seller, Paul; [2003]; 1 pp.; In English; AAS High Energy Astrophysics Division Meeting, 23-26 Mar. 2003, Quebec, Canada; No Copyright; Avail: Other Sources; Abstract Only

As part of ongoing research at Marshall Space Flight Center, Cadmium-Zinc- Telluride (CdZnTe) pixilated detectors are being developed for use at the focal plane of the High Energy Replicated Optics (HERO) telescope. HERO requires a 64x64 pixel array with a spatial resolution of around 200 microns (with a 6m focal length) and high energy resolution (< 2\% at 60keV). We are currently testing smaller arrays as a necessary first step towards this goal. In this presentation, we compare charge sharing and charge loss measurements between two devices that differ both electronically and geometrically. The first device consists of a 1-mm-thick piece of CdZnTe that is sputtered with a 4x4 array of pixels with pixel pitch of 750 microns (inter-pixel gap is 100 microns). The signal is read out using discrete ultra-low-noise preamplifiers, one for each of the 16 pixels. The second detector consists of a 2-mm-thick piece of CdZnTe that is sputtered with a 16x16 array of pixels with a pixel pitch of 300 microns (inter-pixel gap is 50 microns). Instead of using discrete preamplifiers, the crystal is bonded to an ASIC that provides all of the front-end electronics to each of the 256 pixels. what degree the bias voltage (i.e. the electric field) and hence the drift and diffusion coefficients affect our measurements. Further, we compare the measured results with simulated results and discuss to
Author
Cadmium Tellurides; Zinc Tellurides; Electric Fields; Telescopes; Electric Potential; Pixels

20030065163 Northwestern Univ., Evanston, IL

Growth and Fabrication of Multi-Quantum Well Infrared Photodetectors

Razeghi, Manijeh; May 31, 2000; 63 pp.; In English

Contract(s)/Grant(s): F49620-97-1-0288; Proj-3484

Report No.(s): AD-A413372; AFRL-SR-AR-TR-03-0102; No Copyright; Avail: CASI; A04, Hardcopy

A majority of infrared sensors used for imaging arrays operating in the long-wavelength infrared region between lambda = 8-12 micrometers are based on HgCdTe. This material system is unable to satisfy all of the requirements that are imposed by modern applications. Structural difficulties due to poor uniformity, high defect densities, and weak bond strengths cause difficulties in manufacturing large infrared focal plane array cameras. As an alternative, quantum well infrared photodetectors (QWIPs) utilizing intersubband absorption between GaAs wells and AlGaAs barriers were perfected. These QWIPs possess better uniformity in comparison to HgCdTe detectors, and QWIP imaging arrays have recently become commercially available. However, the responsivity of GaAs/ AlGaAs QWIPs is still lower than HgCdTe detectors. In order to further improve the responsivity of QWIP detectors, the development of QWIPs with wells or barriers of OaInAsP instead of MOaAs has been developed.

DTIC

Quantum Wells; Infrared Detectors; Photometers

20030065192 North Carolina Univ., Chapel Hill, NC, USA

Superfluid Helium Droplet Spectroscopy Equipment Development

Miller, Roger E.; January 2003; 9 pp.; In English

Contract(s)/Grant(s): F49620-01-1-0221; Proj-3484

Report No.(s): AD-A413202; TR-5-36935; AFRL-SR-AR-TR-03-0103; No Copyright; Avail: CASI; A02, Hardcopy

The primary goal of this research has been the development of a new helium droplet spectrometer, based upon the use of a PPLN-OPO laser. Although the laser is commercially available, considerable development was required to make the system tunable. We have succeeded in this effort and the laser is now being used to carry out a range of studies related to our AFOSR funded research project dealing with the formation of highly reactive radical nano-solids. The high output power of this laser system, combined with its wide tunability, great enhance the capabilities we have in our laboratory. In parallel with the laser developments, we have built up a new helium droplet apparatus, which is also now fully functional.

DTIC

Spectrometers; Laser Spectroscopy; Liquid Helium

20030065255 Oregon State Univ., Corvallis, OR, USA

Volume Absorption Coefficients: Instruments, Characterization, Field Measurements and Data Analysis Protocols

Pegau, Scott; Zaneveld, J. Ronald; Mueller, James L.; Ocean Optics Protocols for Satellite Ocean Color Sensor Validation, Revision 4, Volume IV: Inherent Optical Properties: Instruments, Characterizations, Field Measurements and Data Analysis Protocols; May 2003, pp. 27-38; In English; See also 20030065253; No Copyright; Avail: CASI; A03, Hardcopy

Concepts and methods for measuring the absorption coefficient alpha(lambda) of seawater are briefly reviewed in Chapter 1 (Sect. 1.4) of this Volume. Chapter 4 of this Volume is devoted to laboratory spectrophotometric methods of measuring absorption of particles and dissolved materials in filtered water samples. The present chapter focuses on commercially available instruments that may be used from ships and moored platforms to practically measure alpha(lambda) in support of satellite validation activities. This first version of absorption protocols is particularly focused on instruments that fall under the reflective tube design concept briefly introduced in Sect. 1.4. However, the conceptual basis for determining absorption by measuring flux reflected from a diffuse target is also described later in this section. Expanded reviews of protocols using instruments based on other design concepts are deferred for possible consideration in future revisions to this volume.

Derived from text

Sea Water; Absorptivity; Measuring Instruments; Spectrophotometry

20030065277 Akela, Inc., Santa Barbara, CA

Through the Wall Imaging Radar

Hunt, Allan; March 2003; 65 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): F30602-00-C-0205; Proj-CWDP

Report No.(s): AD-A412971; AFRL-IF-RS-TR-2003-53; No Copyright; Avail: CASI; A04, Hardcopy

This effort was established to develop a dual mode stepped frequency radar and advanced image recognition processing.

The first mode would be used to image walls within a building. This imagery would allow a building to be remotely mapped. The second mode would be used to detect the presence of living people within the building. The task would then continue by working to integrate the imagery of the living people with the imagery of the building. A brassboard antenna array and radar electronics were integrated into a collapsing structure that weighs less than 20 pounds and is small enough to be carried by a single individual. The radar is capable of seeing through walls and forming images of the structure as well as detecting individuals at a range of 40 feet. The brassboard can be used to detect the motion of individuals through multiple interior walls using coherent scene subtraction. The images formed by the radar will improve tactical awareness in operational environments.

DTIC

Radar Maps; Detection; Antenna Arrays; Image Processing

20030065283 Northrop Grumman Corp., Redondo Beach, CA, USA

Modeling of Proton-Induced CCD Degradation in the Chandra X-Ray Observatory

Lo, D. H.; Srour, J. R.; February 7, 2003; 6 pp.; In English; IEEE Nuclear and Space Radiation Effects Conference, 21-25 Jul. 2003, Monterey, CA, USA

Contract(s)/Grant(s): NAS8-37710; No Copyright; Avail: CASI; A02, Hardcopy

Modeling results are presented for proton-induced degradation of charge-coupled devices (CCDs) used in the Advanced CCD Imaging Spectrometer instrument on the Chandra X-Ray Observatory. A methodology is described that provides insights regarding degradation mechanism and on-orbit performance for front-illuminated and back-illuminated CCDs Proton-induced changes in charge transfer inefficiency are modeled. The observed amount of on-orbit degradation can be accounted for using a proton spectrum at the CCD location that is reduced in magnitude by a factor of approx. 1E5 compared to the spectrum incident on the spacecraft.

Author

Models; Charge Coupled Devices; Imaging Spectrometers; X Ray Astrophysics Facility

20030065314 Missouri Univ., Saint Louis, MO, USA

Investigation of the Quantum 1/f Effect and of other Fluctuations in the Radiation-Hardening of Multiple-Satellite Systems

Handel, Peter H.; Feb. 14, 2003; 60 pp.; In English

Contract(s)/Grant(s): F49620-00-1-0306

Report No.(s): AD-A413206; AFRL-SR-AR-TR-03-0108; No Copyright; Avail: CASI; A04, Hardcopy

The author's quantum 1/f noise formulas were used for the first time here to calculate from first principles analytically, and to graph as a function of the absorbed dose, the radiation-induced 1/f noise increase injunction-type devices, such as junction-based photodetectors, BJTs, HBTs, mixers, etc. The same is done also for FET-type devices, such as FETs, or HFETs, yielding even a reduction of the equilibrium 1/f noise expected in high-mobility semiconductors for low radiation dose, and favoring them for radiation hardening. The same theory was adapted and used here for the first time to derive simple engineering formulas for the quantum 1/f effect in the radiation resistance of antennas from first principles. This allows for the optimization of the directivity of antenna arrays or of the response from multiple satellite systems in space. The same formulas were adapted and used here for the first time to derive analytical engineering formulas allowing for the quantum 1/f optimization of GaN/AlGaN HFETs, RTDs, biological and chemical resonant BAW and SAW quartz sensors, various silicon MEMS resonators, all types of spintronic devices, cavity resonators, nano-devices and bent ultra-thin semiconductor devices. This allows optimizing all these devices and systems for ultra-low 1/f noise and system phase noise, with staggering impact on major DOD instrumentation performance.

DTIC

Semiconductor Devices; Radiation Hardening; Resonators

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*.

20030064242 Sandia National Labs., Albuquerque, NM
Vertical Cavity Surface Emitting Lasers
Smith, A. V.; Allerman, A. A.; Fischer, A. J.; Esherick, P.; Nov. 2002; 19 pp.; In English
Report No.(s): DE2003-805860; SAND2002-3570; No Copyright; Avail: Department of Energy Information Bridge

The goal of this project was to increase the power of vertical cavity surface emitting lasers and to convert their wavelength into the blue/ultraviolet and the infrared for sensing applications. We have increased the power to the multi-watt level and have generated several milliwatts of blue light using optical pumping. Electrical pump has been less successful, but we have identified the problems and begun work to overcome them using a bottom emitting design.
NTIS
Light Emitting Diodes; Semiconductor Lasers

20030064397 Sarnoff Corp., Princeton, NJ
Continuously Tunable 3-5 Micrometers Single-Frequency Laser Source
Martinelli, Ramon U.; Feb. 8, 2003; 54 pp.; In English
Contract(s)/Grant(s): F49620-01-C-0003
Report No.(s): AD-A411611; AFRL-SR-AR-TR-03-0051; No Copyright; Avail: CASI; A04, Hardcopy

The goal of this project is to develop a 3-5 micrometer continuously tunable single-frequency laser source. Our approach uses an external cavity (EC) and various tuning elements in conjunction with a semiconductor optical amplifier (SOA). Optically pumped, amorphous-silicon ridge-waveguide lasers, grown via molecular-beam epitaxy, were developed that could function as curved-ridge-waveguide SOAs. The lasers operate at a temperature of 295 K, where they output 7 mW per facet. The wavelength is 3 micrometers. Comparison with a stripe laser in the same material suggests that a flaw in the ridge metal mask induces losses that increase the threshold pump power and similarly reduce the external efficiency. The lateral far-field for the ridge-waveguide lasers are multi-lobed, indicating that the lasers are not operating in the fundamental lateral mode. Sarnoff designed and constructed an EC that is compatible with the use the SOAs. The EC is 8 cm long with a footprint less than 1 sq ft. Sarnoff designed, fabricated and partially characterized the tuning etalon that selects one longitudinal cavity mode. It is an air-gap etalon using silicon-based mirrors and a 16.5 micrometers-thick polycarbonate spacer ring. The etalon free spectral range is 9 THz, which is the estimated SOA gain width.
DTIC
Tunable Lasers; Infrared Lasers

20030064399 City Coll. of the City Univ. of New York, NY
Fundamental Optical Criteria to Optimize Tunable Solid State Laser Crystals
Alfano, R. R.; Sharonov, M. Y.; Owen, S.; Wang, W. B.; Jan. 14, 2003; 10 pp.; In English
Contract(s)/Grant(s): DAAG55-98-1-0397
Report No.(s): AD-A411613; ARO-37569.1-PH; No Copyright; Avail: CASI; A02, Hardcopy

Impurity ion-doped dielectric crystals have extensive applications in lasers, photodetectors, nonlinear crystals, displays, and scintillators. The performance of these devices is intrinsically correlated with their ability to transfer energy from the photoexcited impurity ion into the surrounding host. We have experimentally shown the importance of exact energy resonance between phonon and local modes in the decay pathway route of the nonradiative relaxation processes. Resonance Raman scattering and up-converted hot luminescence measurements performed in Cr(4+):Ca2GeO4 have shown that there is only one phonon-local mode pair at 733/cm whose exact energy resonance provides the decay channel during the initial steps of the nonradiative relaxation of the photoexcited impurity ion. By understanding these nonradiative decay mechanisms, we have developed criteria for laser crystals with reduced nonradiative relaxation.
DTIC
Solid State Lasers; Optical Properties; Tunable Lasers

20030065115 Universal Energy Systems, Inc., Dayton, OH, USA

Thermal Management Research for Power Generation. Delivery Order 0002 -Volume 2: Closed-Loop Spray Cooling of High-Power Semiconductor Lasers

Lin, Lanchao; Dec. 2002; 65 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): F33615-98-D-2867; Proj-3145

Report No.(s): AD-A413471; UES-P183-03-601-VOL-2; AFRL-PR-WP-TR-2003-2052; No Copyright; Avail: CASI; A04, Hardcopy

A closed-loop spray cooling test setup is established for the cooling of high-power diode lasers. Eight miniature nozzles in a multinozzle plate are used to generated a spray array targeting at a 1 by 2 cm2 cooling surface. FC-87, FC-72, methanol and water are used as the working fluids. Thermal performance data for the multinozzle spray cooling in the confined and closed system are obtained at various operating temperatures, nozzle pressure drops (from 0.69 bar to 3.10 bar), and heat fluxes. It is demonstrated that the spray cooler can reach the critical heat fluxes up to 90 W/cm2 with fluorocarbon fluids and 490 W/cm2 with methanol. For water, the critical heat flux is higher than 500 W/cm2. It is found that air purposely introduced in the spray cooling system with FC-72 fluid has a significant influence on heat transfer characteristics of the spray over the cooling surface. A semiempirical correlation of CHF is presented using the present experimental data for the multinozzle spray cooling in the confined and closed system without air.

DTIC

Temperature Control; Feedback Control; Semiconductor Lasers

20030065131 Emory Univ., Atlanta, GA

Energy Transfer Kinetics and Dynamics of Relevance to Iodine Lasers

Heaven, Michael C.; Morokuma, Keiji; Kaledin, Alexey L.; August 25, 2001; 20 pp.; In English

Contract(s)/Grant(s): F49620-01-1-0070

Report No.(s): AD-A413428; AFRL-SR-AR-TR-03-0127; No Copyright; Avail: CASI; A03, Hardcopy

NCl(a) is the energy carrier in the all gas phase iodine laser (AGIL). Studies of NCl(a,X) kinetics are being performed using photolysis of ClN3 as the source of the radical. Photodissociation of ClN3 is being characterized using photoionization mass spectrometry and time-resolved-resoled IR emission spectroscopy. The fluorescence quantum yield for NCl(a) has been estimated, and the products Cl+N3 detected. Theoretical studies of NCl+NCl reactions are in progress. For NCl(a)+NCl(a) the potential energy surface intersections responsible for the energy pooling process NCl(a)+NCl(a) -->NCl(b)+NCl(X) have been located. These intersections lie just above the entrance channel, and are accessible to thermal collisions. It is confirmed that rapid self-removal of NCl(X) (k-8 x 10(exp -12)/cu cm/s) proceeds via the reaction NCl(X)+NCl(X) -->N2+2Cl. Potential energy surfaces for the reaction Cl+N3-->NCl+N2 have been calculated. A barrier 16.6 kcal/mol barrier was located on the triplet surface, which accounts for the preference for singlet products. Branching ratio calculations are in progress. The reactions H+X2-->HX+X (x=F, Cl) are of importance in HX chemical lasers. The uncertainties associated with the rate constants are too large for accurate computational modeling of laser systems. These constants are being re-measured using photolysis/LIF probe techniques.

DTIC

Energy Transfer; Iodine; Kinetics; Chemical Lasers

20030065206 Naval Postgraduate School, Monterey, CA

Active Mirror Alignment for Free Electron Lasers

Fiorani, Fulvia M.; Dec. 2002; 83 pp.; In English; Original contains color illustrations

Report No.(s): AD-A411373; No Copyright; Avail: CASI; A05, Hardcopy

This thesis investigates active mirror alignment systems of a free electron laser (FEL) for future integration as a ship self-defense weapon. An issue with this integration is the effect of low-frequency shipboard vibrations on the optical cavity mirrors. Alignment of the cavity mirrors is required for the proper operation of any type of laser. Mirror alignment is especially critical for an FEL because the electron beam and optical mode must substantially overlap. Laboratory FEL facilities, along with other laboratory high energy facilities that employ active mirror alignment systems, are investigated. In addition, a model theory for controlling the vibrations of a single-degree-of-freedom system is developed, and experiments with a simple mirror alignment system are described. Reduction of an impressed vibration amplitude by a factor of five is achieved, compared to a factor of fifteen that is achieved in major laboratory systems with sophisticated control systems. The purpose of these efforts is to understand the underlying physics of vibration control. The knowledge forms a basis for follow-on research towards the development of a prototype shipboard active mirror alignment system.

DTIC

Optical Properties; Free Electron Lasers; Self Alignment; Mirrors; Active Control

20030065275 Northrop Grumman Corp., San Antonio, TX, USA

Near-Infrared Ultrashort Pulse Laser Bioeffects Studies

Cain, Clarence P.; Noojin, Gary D.; Stolarski, David J.; Thomas, Robert J.; Rockwell, Benjamin A.; Feb. 2003; 262 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): F41924-97-D-9000; Proj-2312

Report No.(s): AD-A413066; AFRL-HE-BR-TR-2003-0029; No Copyright; Avail: CASI; A12, Hardcopy

Applications of ultrashort pulse laser systems have increased dramatically in the past several years. Retinal exposure to these laser pulses can produce visible lesions with pulse energies of less than 1 microjoule (microJ) per pulse. Our research has found a reduction in the energy required for retinal damage as pulse duration is decreased from the nanosecond (ns) to femtosecond (fs) regime. With this data, new laser safety standards are being proposed to reduce the dangers and uncertainties when working around these lasers.

DTIC

Pulsed Lasers; Safety; Eye (Anatomy)

20030065297 Air Force Inst. of Tech., Wright-Patterson AFB, OH, USA

Optical Characterization of Antimony-Based, Types-I and -II, Multiple Quantum-Well Semiconductor Structures for Mid-Infrared Laser Applications

Ferguson, Edward G.; Mar. 2003; 75 pp.; In English; Original contains color illustrations

Report No.(s): AD-A413085; AFIT/GAP/ENP/03-04; No Copyright; Avail: CASI; A04, Hardcopy

This experiment characterizes antimony-based, multiple quantum-well, types-I and -II, semiconductor samples designed for laser applications. The samples emit light in the 3-5-micron range to exploit an atmospheric transmission window, making them ideal for infrared (IR)-seeking missile countermeasures. Photoluminescence (PL) spectra were collected and yielded bandgap (E(sub g)) dependence-on-temperature relationships. The type-I sample was found to follow the Varshni equation, while the type-II samples showed a rise with temperature in a portion of the curve that should be linear according to the Varshni equation. The type-II samples followed the Varshni equation well at higher temperature. The PL study indicated that the type-I sample had better efficiency than the type-II samples, and that there is some change in efficiency with the waveguide nature of the sample. Carrier temperatures (T(sub c)) were derived from the PL study; all the samples for which Tc was derived operated in the optical phonon regime. The PL data were compared to the FEMB computer model and some correlation between the two in recombination energy was seen. A time-resolved photoluminescence (TRPL) experiment was conducted using the frequency upconversion technique. The experiment clearly found the upconverted signal, but there was a systematic error that prevented any further analysis of the data. (1 table, 27 figures, 30 refs.)

DTIC

Antimony; Semiconductor Devices; Waveguides; Optical Countermeasures; Infrared Lasers; Quantum Well Lasers; Surface To Air Missiles

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MECHANICAL ENGINEERING

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

20030053003 NASA Glenn Research Center, Cleveland, OH, USA

Efficiency of High-Speed Helical Gear Trains

Handschuh, Robert F.; Kilmain, Charles J.; April 2003; 16 pp.; In English; 59th Annual Forum and Technology Display, 6-8 May 2003, Phoenix, AZ, USA; Original contains color illustrations

Contract(s)/Grant(s): DA 1L1-62211-A-47A; WBS 22-708-28-02

Report No.(s): NASA/TM-2003-212222; NAS 1.15:21222; E-13841; ARL-TR-2968; Copyright; Avail: CASI; A03, Hardcopy

An experimental and analytical comparison of the efficiency of high-speed helical gear trains is presented. An analysis of the gearing losses was conducted and was used as a comparison to the measured losses. Test data from a helical gear train at varying speeds and loads (to 3730 KW (5000 hp) and 15000 RPM) was collected. A comparison of the results indicated that drive system rotational speed had the most detrimental effect to the efficiency of the gear system at light load and windage

losses approached or exceeded the gear meshing losses at high speed and load conditions.
Author
Gears; Transmissions (Machine Elements); Mechanical Drives; Power Efficiency; Performance Tests; Energy Dissipation

20030053341 NASA Glenn Research Center, Cleveland, OH, USA
Process for Testing Compaction of a Swaged Heater for an Anode Sub-Assembly of a Hollow Cathode Assembly
Patterson, Michael J., Inventor; Verhey, Timothy R. R., Inventor; Soulas, George C., Inventor; April 1, 2003; 17 pp.; In English; Original contains black and white illustrations
Patent Info.: Filed 19 Feb. 2002; US-Patent-6,539,818; US-Patent-Appl-SN-081001; US-Patent Appl-SN-754388; US-Patent-Appl-SN-503658; US-Patent-Appl-SN-152407; NASA-Case-LEW-16056-4; No Copyright; Avail: CASI; A03, Hardcopy

A process for testing compaction of a swaged heater for an anode sub-assembly of a Hollow Cathode Assembly (HCA), in which a test sample is cleaned, its mass measured before and after immersion in kerosene for 24 hours, and a compaction percentage calculated. A swaged heater is rejected if the compaction percentage exceeds 84\%, plus or minus 4\%.
Official Gazette of the U.S. Patent and Trademark Office
Anodes; Hollow Cathodes; Heaters; Subassemblies; Void Ratio

20030063986 National Advisory Committee for Aeronautics. Lewis Flight Propulsion Lab., Cleveland, OH, USA
Investigation of Turbine of Mark 25 Torpedo Power Plant with Five Nozzle Designs
Hoyt, Jack W.; Kottas, Harry; October 08, 1947; 50 pp.; In English; Original contains black and white illustrations
Report No.(s): NACA-RM-E7I03; No Copyright; Avail: CASI; A03, Hardcopy

Efficiency investigations were made on the two-stage turbine from a Mark 25 aerial torpedo to determine the performance of the unit with five different turbine nozzles. The output of the turbine blades was computed by analyzing the windage and mechanical-friction losses of the unit. A method was developed for measuring the change in turbine clearances with changed operating conditions. The turbine was found to be most efficient with a cast nozzle having a sharp-edged inlet to the nine nozzle ports.
Author
Torpedoes; Power Efficiency; Two Stage Turbines; Gas Turbines; Nozzle Design; Pressure Ratio

20030064061 Alabama Univ., Huntsville, AL, USA
Deformation and Flexibility Equations for Idealized ARIS Umbilicals, Under Planar End-Loading Conditions
Hampton, R. David; Quraishi, Naveed, Technical Monitor; National Aeronautics and Space Administration (NASA)/American Society of Engineering Education (ASEE) Summer Faculty Fellowship Program - 2000; March 2003, pp. 4-1-4-13; In English; See also 20030064055
Contract(s)/Grant(s): NAG9-867; No Copyright; Avail: CASI; A03, Hardcopy

The International Space Station (ISS) relies on the Active Rack Isolation System (ARIS) as the central component of an integrated, station-wide strategy to isolate microgravity space-science experiments. ARIS uses electromechanical actuators to isolate an International Standard Payload Rack (ISPR) from disturbances due to the motion of the ISS. Disturbances to microgravity experiments on ARIS-isolated racks are primarily transmitted via the ARTS power and vacuum umbilicals. Recent experimental tests indicate that these umbilicals resonate at frequencies outside the ARIS controller's bandwidth, at levels of potential concern for certain microgravity experiments. Reduction in the umbilical resonant frequencies could help to address this issue. This report develops equations for the in-plane deflections and flexibilities of an idealized umbilical (thin, flexible, cantilever beam) under end-point, in-plane loading (inclined-force and moment). The effect of gravity is neglected due to the on-orbit application. The analysis assumes an initially straight, cantilevered umbilical with uniform cross-section, which undergoes large deflections with no plastic deformation, such that the umbilical terminus remains in a single quadrant and the umbilical slope changes monotonically. The analysis is applicable to the ARIS power and vacuum umbilicals, under the indicated assumptions.
Author
Deformation; Flexibility; Umbilical Connectors; Resonance; Microgravity; Equations

20030064111 Illinois Univ., Chicago, IL, USA

Computerized Design, Generation, Simulation of Meshing and Contact, and Stress Analysis of Formate Cut Spiral Bevel Gear Drives

Handschuh, Robert F., Technical Monitor; Litvin, Faydor L.; Fuentes, Alfonso; Mullins, Baxter R.; Woods, Ron; June 2003; 62 pp.; In English; Original contains black and white illustrations

Contract(s)/Grant(s): NAG3-2450; WBS 22-708-28-02; DA Proj. 1L1-62211-A-47-A

Report No.(s): NASA/CR-2003-212336; E-13931; NAS 1.26:212336; ARL-CR-525; Copyright; Avail: Other Sources

A new approach for design, generation, computerized simulation of meshing and contact, and stress analysis of formate cut spiral bevel gear drives is reported. The approach proposed is based on application of four procedures that permit in sequence to provide a longitudinally directed bearing contact, a predesigned parabolic function of transmission errors, a limit to the shift of bearing contact caused by errors of alignment, and to automatically generate the finite element models for application of a general purpose finite element analysis computer program. A new computer program has been developed that provides optimized machine-tool settings for finishing of spiral bevel gears utilizing the Formate grinding process with minimized transmission errors. The new computer program is based on the four procedures mentioned above. The developed theory is illustrated with several examples of design and computations.

Author

Spiral Bevel Gears; Transmissions (Machine Elements); Computer Aided Design; Computerized Simulation; Computer Programs; Stress Analysis; Finite Element Method

20030064140 NASA Glenn Research Center, Cleveland, OH, USA

Spiral Bevel Pinion Crack Detection in a Helicopter Gearbox

Decker, Harry J.; Lewicki, David G.; June 2003; 16 pp.; In English; 59th Annual Forum and Technology Display, 6-8 May 2003, Phoenix, AZ, USA; Original contains color and black and white illustrations

Contract(s)/Grant(s): DA Proj. 1L1-61102-AF20

Report No.(s): NASA/TM-2003-212327; ARL-TR-2958; NAS 1.15:212327; E-13922; No Copyright; Avail: CASI; A03, Hardcopy

The vibration resulting from a cracked spiral bevel pinion was recorded and analyzed using existing Health and Usage Monitoring System (HUMS) techniques. A tooth on the input pinion to a Bell OH-58 main rotor gearbox was notched and run for an extended period at severe over-torque condition to facilitate a tooth fracture. Thirteen vibration-based diagnostic metrics were calculated throughout the run. After 101.41 hours of run time, some of the metrics indicated damage. At that point a visual inspection did not reveal any damage. The pinion was then run for another 12 minutes until a proximity probe indicated that a tooth had fractured. This paper discusses the damage detection effectiveness of the different metrics and a comparison of effects of the different accelerometer locations.

Author

Vibration; Spiral Bevel Gears; Fracturing; Cracks; Accelerometers

20030064213 Aerodynamische Versuchsanstalt, Goettingen, Germany

Investigations on Experimental Impellers for Axial Blowers

Encke, W.; ZWB, M94, Nr. 3135; April 1947, pp. 1-28; In English

Report No.(s): NACA-TM-1123; No Copyright; Avail: CASI; A03, Hardcopy

A selection of measurements obtained on experimental impellers for axial blowers will be reported. In addition to characteristic curves plotted for low and for high peripheral velocities, proportions and blade sections for six different blower models and remarks on the design of blowers will be presented.

Author

Impellers; Blowers

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QUALITY ASSURANCE AND RELIABILITY

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

20030063976 NASA Glenn Research Center, Cleveland, OH, USA
Neural-Net Based Optical NDE Method for Structural Health Monitoring
Decker, Arthur J.; Weiland, Kenneth E.; June 2003; 17 pp.; In English; 2003 International Society for Optical Engineering Annual Meeting: Sensitivity and Calibration of Non-Destructive Evaluation Method that Uses Neural-Net Processing of Characteristic Fringe Patterns, 3-8 Aug. 2003, San Diego, CA, USA; Original contains black and white illustrations
Contract(s)/Grant(s): WBS 323-78-00
Report No.(s): NASA/TM-2003-212492; E-14041; NAS 1.15:212492; No Copyright; Avail: CASI; A03, Hardcopy

This paper answers some performance and calibration questions about a non-destructive-evaluation (NDE) procedure that uses artificial neural networks to detect structural damage or other changes from sub-sampled characteristic patterns. The method shows increasing sensitivity as the number of sub-samples increases from 108 to 6912. The sensitivity of this robust NDE method is not affected by noisy excitations of the first vibration mode. A calibration procedure is proposed and demonstrated where the output of a trained net can be correlated with the outputs of the point sensors used for vibration testing. The calibration procedure is based on controlled changes of fastener torques. A heterodyne interferometer is used as a displacement sensor for a demonstration of the challenges to be handled in using standard point sensors for calibration.
Author
Neural Nets; Nondestructive Tests; Calibrating; Systems Health Monitoring

20030064273 California Univ., Lawrence Berkeley National Lab., Berkeley, CA, USA
Labs21 Environmental Performance Criteria: Toward 'LEED(Trade Mark) for Labs'
Mathew, P.; Sorter, D.; Linter, W.; Wirdzek, P.; 2002; In English
Report No.(s): DE2003-807425; LBNL-51650; No Copyright; Avail: National Technical Information Service (NTIS)

Laboratory facilities present a unique challenge for energy efficient and sustainable design, with their inherent complexity of systems, health and safety requirements, long-term flexibility and adaptability needs, energy use intensity, and environmental impacts. The typical laboratory is about three to five times as energy intensive as a typical office building and costs about three times as much per unit area.
NTIS
Research Facilities; Adaptation; Costs

20030064417 California Inst. of Tech., Pasadena, CA, USA
In-Situ Investigation of Advanced Structural Coatings and Composites
Ustundag, Ersan; June 2003; 18 pp.; In English; Original contains color and black and white illustrations
Contract(s)/Grant(s): NAG3-2686; WU 708-87-23
Report No.(s): NASA/CR-2003-212303; E-13875; NAS 1.26:212303; No Copyright; Avail: CASI; A03, Hardcopy

The premise of this project is a comprehensive study that involves the in-situ characterization of advanced coatings and composites by employing both neutron and x-ray diffraction techniques in a complementary manner. The diffraction data would then be interpreted and used in developing or validating advanced micromechanics models with life prediction capability. In the period covered by this report, basic work was conducted to establish the experimental conditions for various specimens and techniques. In addition, equipment was developed that will allow the in-situ studies under a range of conditions (stress, temperature, atmosphere, etc.).
Author
Composite Materials; Composite Structures; Protective Coatings; Neutron Diffraction; X Ray Diffraction; In Situ Measurement

20030064449 Lawrence Livermore National Lab., Livermore, CA
Optical Filters to Exclude Non-Doppler-Shifted Light in Fast Velocimetry
Goosman, D.; Avara, F.; Wade, J.; Rivera, A.; Aug. 22, 2000; 14 pp.; In English
Report No.(s): DE2003-15002892; UCRL-JC-145646-REV-1; No Copyright; Avail: Department of Energy Information Bridge

We frequently measure velocity-time histories of dynamic experiments. In some, the Doppler-shifted light is often weak

compared to non-shifted light reflected from stationary surfaces and imperfections in components. With our Fabry-Perot (FP) based systems which handle multiple frequencies, data is lost where the fringes coincide; if we had used an intensity-measuring VISAR system, it would probably fail. We designed a facility for doing experiments under such conditions by selectively eliminating most of the non-shifted light. Our first filter excluded non-shifted light by a factor of 300 when manually tuned, and by 150 when run in an auto-tuning mode. It used a single 50 mm diameter FP as the filter with a spacing of 1.65 mm and reflectivities of 77\%, and filters five channels prior to use in one of our 5-beam velocimeters. One use of the filter system was to embed optical fibers in long sections of explosives to make continuous detonation velocity-time histories. We have carried out many such tests with this filter, and two without. A special single-beam filter was constructed with a 40\% efficiency for shifted light that rejected non-shifted light by 4 million times, with a bandpass of a few GHz.
NTIS
Optical Filters; Doppler Effect; Velocity Measurement; Light Beams

20030064451 Lawrence Livermore National Lab., Livermore, CA
Optical Filters to Exclude Non-Doppler-Shifted Light in Fast Velocimetry
Goosman, D.; Avara, F.; Wade, J.; Rivera, A.; Jun. 19, 2002; In English
Report No.(s): DE2003-15002893; UCRL-JC-145646; No Copyright; Avail: National Technical Information Service (NTIS)

We have used optical velocimetry for 25 years at LLNL to measure velocity-time histories of many dynamic experiments. In certain ones, the shifted light was often quite weak compared to non-shifted light returning from surfaces and imperfections in glass components. In an intensity-measuring VISAR system, this would mean failure, and even with Fabry-Perot (FP) based systems which handle multiple frequencies, data is lost where the finges coincide. We designed, constructed and successfully used an experimental facility for doing experiments under such conditions by selectively eliminating most of the non-shifted light. Instead of making experimental records which were mostly non-shifted light prior to the use of the filter, we now obtain records where almost all of the light is shifted. The first system had a maximum efficiency of 25\% for the desired light, but another version is under construction with a maximum efficiency of over 50\%. The first version excluded the non-shifted light by a factor of 300 when manually tuned, and by 150 when run in a Window- based auto-tuning mode. Our first version used a 50 mm diameter FP as the filter with a spacing of 1.65 mm and reflectivities of 77\%. It was constructed for use in one of our 5-beam velocimeters. Rather than using five separate filters, we multiplexed all five records so that the desired light would reflect from the filter FPI and image onto separate fibers. These five output fibers then fed our standard tau-table with 5 cameras as described in our report for the 1996 HSPC in Santa Fe, USA. One use of the filter system involved embedding optical fibers in long sections of explosives to make continuous detonation velocity-time histories. To date we have recently carried out 6 tests with this new facility, and two prior ones without. Explosive safety required that four shutters be used to assure that no significant light could illuminate the explosive fiom the end of the embedded fiber when personnel were close. An arrangement allowing the same system to use one filter FPI for 10 optical fibers can be made.
NTIS
Optical Filters; Velocity Measurement; Light Beams; Optical Fibers

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STRUCTURAL MECHANICS

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

20030053073 Army Research Lab., Hampton, VA, USA
Modeling the Interactions Between Multiple Crack Closure Mechanisms at Threshold
Newman, John A.; Riddell, William T.; Piascik, Robert S.; May 2003; 19 pp.; In English
Contract(s)/Grant(s): 706-62-31-51
Report No.(s): NASA/TM-2003-212402; L-18279; NAS 1.15:212402; ARL-TR-2959; No Copyright; Avail: CASI; A03, Hardcopy

A fatigue crack closure model is developed that includes interactions between the three closure mechanisms most likely to occur at threshold; plasticity, roughness, and oxide. This model, herein referred to as the CROP model (for Closure, Roughness, Oxide, and Plasticity), also includes the effects of out-of plane cracking and multi-axial loading. These features make the CROP closure model uniquely suited for, but not limited to, threshold applications. Rough cracks are idealized here as two-dimensional sawtooths, whose geometry induces mixed-mode crack- tip stresses. Continuum mechanics and crack-tip

dislocation concepts are combined to relate crack face displacements to crack-tip loads. Geometric criteria are used to determine closure loads from crack-face displacements. Finite element results, used to verify model predictions, provide critical information about the locations where crack closure occurs.
Author
Models; Crack Tips; Fatigue (Materials); Finite Element Method; Crack Closure

20030063096 Texas Univ., San Antonio, TX, USA
Structural Reliability Using Probability Density Estimation Methods Within NESSUS
Chamis, Chrisos C., Technical Monitor; Godines, Cody Ric; HBCUs/OMUs Research Conference Agenda and Abstracts; February 2003, pp. 30; In English; See also 20030063082; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

A reliability analysis studies a mathematical model of a physical system taking into account uncertainties of design variables and common results are estimations of a response density, which also implies estimations of its parameters. Some common density parameters include the mean value, the standard deviation, and specific percentile(s) of the response, which are measures of central tendency, variation, and probability regions, respectively. Reliability analyses are important since the results can lead to different designs by calculating the probability of observing safe responses in each of the proposed designs. All of this is done at the expense of added computational time as compared to a single deterministic analysis which will result in one value of the response out of many that make up the density of the response. Sampling methods, such as monte carlo (MC) and latin hypercube sampling (LHS), can be used to perform reliability analyses and can compute nonlinear response density parameters even if the response is dependent on many random variables. Hence, both methods are very robust; however, they are computationally expensive to use in the estimation of the response density parameters. Both methods are 2 of 13 stochastic methods that are contained within the Numerical Evaluation of Stochastic Structures Under Stress (NESSUS) program. NESSUS is a probabilistic finite element analysis (FEA) program that was developed through funding from NASA Glenn Research Center (GRC). It has the additional capability of being linked to other analysis programs; therefore, probabilistic fluid dynamics, fracture mechanics, and heat transfer are only a few of what is possible with this software. The LHS method is the newest addition to the stochastic methods within NESSUS. Part of this work was to enhance NESSUS with the LHS method. The new LHS module is complete, has been successfully integrated with NESSUS, and been used to study four different test cases that have been proposed by the Society of Automotive Engineers (SAE). The test cases compare different probabilistic methods within NESSUS because it is important that a user can have confidence that estimates of stochastic parameters of a response will be within an acceptable error limit. For each response, the mean, standard deviation, and 0.99 percentile, are repeatedly estimated which allows confidence statements to be made for each parameter estimated, and for each method. Thus, the ability of several stochastic methods to efficiently and accurately estimate density parameters is compared using four valid test cases. While all of the reliability methods used performed quite well, for the new LHS module within NESSUS it was found that it had a lower estimation error than MC when they were used to estimate the mean, standard deviation, and 0.99 percentile of the four different stochastic responses. Also, LHS required a smaller amount of calculations to obtain low error answers with a high amount of confidence than MC. It can therefore be stated that NESSUS is an important reliability tool that has a variety of sound probabilistic methods a user can employ and the newest LHS module is a valuable new enhancement of the program.
Author
Probability Theory; Stochastic Processes; Structural Reliability; Structural Strain; Mathematical Models; Stress Distribution

20030063910 Clarkson Univ., Potsdam, NY, USA
Test-Free Fracture Toughness
Minnetyan, Levon; Chamis, Christos C., Technical Monitor; June 2003; 79 pp.; In English
Contract(s)/Grant(s): NAG3-2394; WBS 708-48-11
Report No.(s): NASA/CR-2003-212352; E-13940; NAS 1.26:212352; No Copyright; Avail: CASI; A05, Hardcopy

Computational simulation results can give the prediction of damage growth and progression and fracture toughness of composite structures. The experimental data from literature provide environmental effects on the fracture behavior of metallic or fiber composite structures. However, the traditional experimental methods to analyze the influence of the imposed conditions are expensive and time consuming. This research used the CODSTRAN code to model the temperature effects, scaling effects and the loading effects of fiber/braided composite specimens with and without fiber-optic sensors on the damage initiation and energy release rates. The load-displacement relationship and fracture toughness assessment approach is compared with the test results from literature and it is verified that the computational simulation, with the use of established material modeling and finite element modules, adequately tracks the changes of fracture toughness and subsequent fracture

propagation for any fiber/braided composite structure due to the change of fiber orientations, presence of large diameter optical fibers, and any loading conditions.
Author
Fracture Strength; Computerized Simulation; Fiber Composites; Mechanical Properties; Computer Programs

20030063987 National Advisory Committee for Aeronautics. Lewis Flight Propulsion Lab., Cleveland, OH, USA
Determination of Stress-Rupture Parameters for Four Heat-Resisting Alloys
Lidman, William G.; August 25, 1947; 18 pp.; In English
Report No.(s): NACA-RM-E7G18a; No Copyright; Avail: CASI; A03, Hardcopy

Stress-rupture data for four heat-resisting alloys are analyzed according to equations of the theory of rate processes. A method for determining the four parameters of structure and composition is demonstrated and the four parameters are determined for each of the alloys: forged S816, cast S816, cast S590, and cast Vitallium. It is concluded that parameters can be determined for an alloy provided sufficient reliable experimental data are available.
Author
Heat Resistant Alloys; Stress Analysis; Cracking (Fracturing); High Temperature Environments; Destructive Tests; Differential Equations; Mathematical Models

20030064089 European Space Agency. European Space Research and Technology Center, ESTEC, Noordwijk, Netherlands
Investigation of the Behavior of Thin-Walled Panels with Cutouts
Podorozhny, A. A.; September 1946; 45 pp.; In English
Report No.(s): NACA-TM-1094; No Copyright; Avail: CASI; A03, Hardcopy

The present paper deals with the computation and methods of reinforcement of stiffened panels with cutouts under bending loads such as are applied to the sides of a fuselage. A comparison is maade between the computed and test results. Results are presented of tests on panels with cutouts under tensile and compressive loads.
Author
Fuselages; Panels; Thin Walls; Compression Loads; Mechanical Properties; Openings

20030064239 Virginia Transportation Research Council, Charlottesville, VA
Investigation of Transfer Length, Development Length, Flexural Strength, and Prestress Losses in Lightweight Prestressed Concrete Girders
Cousins, T. E.; Nassar, A.; Apr. 2003; 58 pp.; In English
Report No.(s): PB2003-104529; VTRC-03-CR20; Copyright; Avail: National Technical Information Service (NTIS)

Encouraged by the performance of high performance normal weight composite girders, the Virginia Department of Transportation has sought to exploit the use of high performance lightweight composite concrete (HPLWC) girders to achieve economies brought about by the reduction of dead loads in bridges. Transfer length measurements (conducted on two AASHTO Type IV HPLWC prestressed girders) indicated an average transfer length of 17 inches, well below the AASHTO and ACI requirements. Two HPLWC AASHTO Type II girders and a 48 x 8 inch normal weight 4000-psi concrete deck were fabricated. The girders were cast of concretes with a compressive strength of 6380 psi and a unit weight of 114 pcf. Full scale testing of the girders was conducted to evaluate development length and flexural strength in HPLWC composite girders. Embedment lengths of five, six, and eight feet were evaluated. Tests indicated a development length of about 72 inches, marginally below the ACI and ASSHTO requirements. All tested girders exceeded their theoretical flexural capacity by 24\% to 30\%. A third composite Type II girder was cast of high performance normal weight concrete and topped with a 48 x 8 inch normal weight 4000-psi concrete deck. This girder was intended as a control specimen. Prestress losses in the HPLWC AASHTO Type IV girders monitored over a nine-month period were found to be less than those calculated using the ACI and PCI models.
NTIS
Girders; Bridges (Structures)

20030064289 Academy of Sciences (USSR), USSR
Stability of Cylindrical and Conical Shells of Circular Cross Section, with Simultaneous Action of Axial Compression and External Normal Pressure
Mushtari, K. M.; Sachenkov, A. V.; Prikladnaia Matematika i Mekhanika; April 1958; Volume 18, No. 6; 16 pp.; In English
Report No.(s): NACA-TM-1433; No Copyright; Avail: CASI; A03, Hardcopy

We consider in this report the determination of the upper limit of critical loads in the case of simultaneous action of a compressive force, uniformly distributed over plane cross sections, and of isotropic external normal pressure on cylindrical or conical shells of circular cross section. As a starting point we use the differential equations for neutral equilibrium of conical shells which have been used for the solution of the problem of stability of conical shells under torsion and under axial compression; upon solution of the problem it is possible to satisfy all boundary conditions, in contrast to the report where no attention is paid to the fulfillment of the boundary conditions, and to the report where only part of the boundary conditions are satisfied by solution of the problem according to Galerkin's method. Approximate formulas are used for the determination of the critical external normal pressure with simultaneous action of longituninal compression. Let us note that the formulas suggested in reference 5 are not well founded and may lead, in a number of cases, to a substantial mistake in the magnitude of the critical load.
Author
Cylindrical Shells; Conical Shells; Cross Sections; Stability; Critical Loading; Compression Loads

20030064950 NASA Langley Research Center, Hampton, VA, USA
Nonlinear Shell Modeling of Thin Membranes with Emphasis on Structural Wrinkling
Tessler, Alexander; Sleight, David W.; Wang, John T.; [2003]; 11 pp.; In English; 44th AIAA/ASME/ASCE/AHS/ASC Structure, Structural Dynamics, 7-10 Apr. 2003, Norfolk, VA, USA
Report No.(s): AIAA Paper 2003-1931; No Copyright; Avail: CASI; A03, Hardcopy

Thin solar sail membranes of very large span are being envisioned for near-term space missions. One major design issue that is inherent to these very flexible structures is the formation of wrinkling patterns. Structural wrinkles may deteriorate a solar sail's performance and, in certain cases, structural integrity. In this paper, a geometrically nonlinear, updated Lagrangian shell formulation is employed using the ABAQUS finite element code to simulate the formation of wrinkled deformations in thin-film membranes. The restrictive assumptions of true membranes, i.e. Tension Field theory (TF), are not invoked. Two effective modeling strategies are introduced to facilitate convergent solutions of wrinkled equilibrium states. Several numerical studies are carried out, and the results are compared with recent experimental data. Good agreement is observed between the numerical simulations and experimental data.
Author
Membrane Structures; Solar Sails; Wrinkling; Models; Nonlinearity

20030065223 National Advisory Committee for Aeronautics, Washington, DC, USA
The Elasto-Plastic Stability of Plates
Ilyushin, A. A.; December 1947; 32 pp.; In English; Original contains black and white illustrations
Report No.(s): NACA-TM-1188; No Copyright; Avail: CASI; A03, Hardcopy

This article explains results developed from the following research: 'The Stability of Plates and Shells beyond the Elastic Limit.' A significant improvement is found in the derivation of the relations between the stress factors and the strains resulting from the instability of plates and shells. In a strict analysis, the problem reduces to the solution of two simultaneous nonlinear partial differential equations of the fourth order in the deflection and stress function, and in the approximate analysis to a single linear equation of the Bryan type. Solutions are given for the special cases of a rectangular plate buckling into a cylindrical form, and of an arbitrarily shaped plate under uniform compression. These solutions indicate that the accuracy obtained by the approximate method is satisfactory.
Author
Elastoplasticity; Stress-Strain Relationships; Shells (Structural Forms); Stability; Elastic Plates; Plastic Plates

20030065265 Air Force Inst. of Tech., Wright-Patterson AFB, OH, USA
Stress Analysis of Silicon Carbide Microelectromechanical Systems Using Raman Spectroscopy
Ness, Stanley J.; Mar. 2003; 118 pp.; In English; Original contains color illustrations
Report No.(s): AD-A413482; AFIT/GMS/ENP/03-01; No Copyright; Avail: CASI; A06, Hardcopy

During the fabrication of Micro-Electro-Mechanical Systems (MEMS), residual stress is often induced in the thin films that are deposited to create these systems. These stresses can cause the device to fail due to buckling, curling, or fracture. Government and industry are looking for ways to characterize the stress during the deposition of thin films in order to reduce or eliminate device failure. Micro-Raman spectroscopy has been successfully used to analyze poly-silicon MEMS devices made with the Multi-User MEMS Process (MUMPS trade name). Micro-Raman spectroscopy was selected because it is nondestructive, fast and has the potential for in situ stress monitoring. This research attempts to validate the use of Raman

spectroscopy to analyze the stress in MEMS made of silicon carbide (SiC) using the Multi-User Silicon Carbide surface micromachining (MUSiCsm) process. Surface interferometry of fixed-fixed beam arrays and comb drive resonance test are employed to determine stress and compare it to the Raman values. Research also includes baseline spectra of 6H, 4H, and 15R poly-types of bulk SiC. Raman spectra of 1- to 2-micrometers thick 3C-SiC thin films deposited on silicon, silicon nitride, and silicon oxide substrates are presented as an attempt to establish a baseline spectra for 3C-SiC, the poly-type of SiC found in MEMS made with the MUSiCsm process.
DTIC
Stress Analysis; Raman Spectroscopy; Silicon Carbides; Microelectromechanical Systems

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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*.

20030063979 Massachusetts Inst. of Tech., Cambridge, MA, USA
Carbonate Platform Development and Stromatolite Morphogenesis: Constraints on Environmental and Biological Evolution
Grotzinger, John P.; [2003]; 2 pp.; In English
Contract(s)/Grant(s): NAG5-9445
Report No.(s): MIT-6890618; No Copyright; Avail: Other Sources; Abstract Only

Work has been completed on the digital mapping of a terminal Proterozoic reef complex in Namibia. This complex formed an isolated carbonate platform developed downdip on a carbonate ramp of the Nama Group. The stratigraphic evolution of the platform was digitally reconstructed from an extensive dataset that was compiled by using digital surveying technologies. The platform comprises three accommodation cycles in which each subsequent cycle experienced progressively greater influence of a long-term accommodation increase. Aggradation and progradation during the first cycle resulted in a flat, uniform, sheet-like platform. The coarsening and shallowing-upward sequence representing the first cycle is dominated by columnar stromatolitic thrombolites and massive dolostones with interbedded mudstone-grainstone at the base of the sequence grading into cross-bedded dolostones. The second cycle features aggradation, formation of a distinct margin containing thrombolite mounds and domes, and the development of a bucket geometry. Columnar stromatolitic thrombolites dominate the platform interior. The final stage of platform development shows a deepening trend with initial aggradation and formation of well-bedded, thin deposits in the interior and mound development at the margins. While the interior drowned, the platform margin kept up with rising sea level and a complex pinnacle reef formed containing fused and coalesced thrombolite mounds flanked by bioclastic grainstones (containing Cloudina and Namacalathus fossils) and collapse breccias. A set of isolated large thrombolite mounds flanked by shales indicate the final stage of the carbonate platform. During a progressive increase in accommodation, a flat-topped isolated carbonate platform becomes aerially less extensive by either backstepping or formation of smaller pinnacles or a combination of both. The overall geometric evolution of the studied platform from flat-topped to bucket with elevated margins is recorded in many Proterozoic and Phanerozoic isolated carbonate platforms with similar dimensions. The terminal Proterozoic, microbial-dominated, isolated carbonate platform of this study clearly illustrates that the answer to accommodation changes was already familiar among carbonate platforms before the dawn of metazoan-dominated platforms.
Derived from text
Biological Evolution; Namibia; Microorganisms; Carbonates; Breccia

20030064020 California Univ., Los Angeles, CA, USA
A Search for Soot from Global Wildfires in Central Pacific Cretaceous-Tertiary Boundary and Other Extinction and Impact Horizon Sediments
Wolbach, Wendy S.; Widicus, Susanna; Kyte, Frank T.; Astrobiology; January 2003; Volume 3, No. 1, pp. 91-97; In English
Contract(s)/Grant(s): NAG5-9411; ACS-PRF-33115-B2; Copyright; Avail: Other Sources

Hypotheses of global wildfires following the Cretaceous-Tertiary (KT) boundary impact are supported by high concentrations of elemental carbon (3.6 mg cm-3) and soot (1.8 mg cm-2) in DSDP Site 465, which was located several thousand kilometers from potential continental sources at 65 Ma. Soot is not preserved at four other central Pacific KT localities, but this is attributed to loss during oxic diagenesis. We find no evidence for wildfires related to major impacts in

the late Eocene or to Ir anomalies and extinctions in the late Cenomanian.
Author
Cretaceous-Tertiary Boundary; Forest Fires; Soot; Hypervelocity Impact; Carbon

20030064091 Alfred-Wegener-Inst. for Polar and Marine Research, Bremerhaven, Germany
The Late Pliocene Eltanin Impact: Documentation From Sediment Core Analyses
Gersonde, R.; Kyte, F.; Flores, J. A.; Becquey, S.; [2002]; 1 pp.; In English; AGU Fall Meeting
Contract(s)/Grant(s): NAG5-9441
Report No.(s): OS22C-0285; Copyright; Avail: Other Sources; Abstract Only

The expeditions ANT-XII/4 (1995) and ANT-XVIII/5a (2001) of the RV POLARSTERN collected extensive bathymetric and seismic data sets as well as sediment cores from an area in the Bellingshausen Sea (eastern Pacific Southern Ocean) that allow the first comprehensive geoscientific documentation of an asteroid impact into a deep ocean (approx. 5 km) basin, named the Eltanin impact. Impact deposits have now been recovered from a total of more than 20 sediment cores collected in an area covering about 80,000 km2. Combined biomagnetostratigraphic dating places the impact event into the earliest Matuyama Chron, a period of enhanced climate variability. Sediment texture analyses and studies of sediment composition including grain size and microfossil distribution reveal the pattern of impact- related sediment disturbance and the sedimentary processes immediately following the impact event. The pattern is complicated by the San Martin Seamounts (approx. 57.5 S, 91 W), a large topographic elevation that rises up to 3000 m above the surrounding abyssal plain in the area affected by the Eltanin impact. The impact ripped up sediments as old as Eocene and probably Paleocene that have been redeposited in a chaotic assemblage. This is followed by a sequence sedimented from a turbulent flow at the sea floor, overprinted by fall-out of airborne meteoritic ejecta that settled trough the water column. Grain size distribution reveals the timing and interaction of the different sedimentary processes. The gathered estimate of ejecta mass deposited over the studied area, composed of shock-melted asteroidal material and unmelted meteorites including fragments up to 2.5 cm in diameter, point to an Eltanin asteroid larger than the 1 km in diameter size originally suggested as a minimum based on the ANT-XII/4 results. This places the energy released by the impact at the threshold of those considered to cause environmental disturbance at a global scale and it makes the impact a likely transport mechanism explaining the presence of extinct Cenozoic microfossils in the transantarctic Sirius Unit. Although a crater structure representing Eltanin ground zero has not been discovered, the distribution pattern of sediment disturbance and ejecta deposits now allows to better determine the central target area north of the San Martin Seamounts.
Author
Craters; Hypervelocity Impact; Sediments; Asteroids; Expeditions

20030064115 California Univ., Los Angeles, CA, USA
Composition of Impact Melt Debris from the Eltanin Impact Strewn Field, Bellingshausen Sea
Kyte, Frank T.; Deep-Sea Research II; January 2002; ISSN 0967-0645; Volume 49, pp. 1029-1047; In English
Contract(s)/Grant(s): NAG5-9411; NSF EAR-9418303; Copyright; Avail: Other Sources

The impact of the km-sized Eltanin asteroid into the Bellingshausen Sea produced mm- to cm-sized vesicular impact melt-rock particles found in sediment cores across a large area of the ocean floor. These particles are composed mainly of olivine and glass with minor chromite and traces of NiFe-sulfides. Some particles have inclusions of unmelted mineral and rock fragments from the precursor asteroid. Although all samples of melt rock examined have experienced significant alteration since their deposition in the late Pliocene, a significant portion of these particles have interiors that remain pristine and can be used to estimate the bulk composition of the impact melt. The bulk composition of the melt-rock particles is similar to the composition of basaltic meteorites such as howardites or mesosiderite silicates, with a contribution from seawater salts and a siderophile-rich component. There is no evidence that the Eltanin impact melt contains a significant terrestrial silicate component that might have been incorporated by mixing of the projectile with oceanic crust. If terrestrial silicates were incorporated into the melt, then their contribution must be much less than 10 wt%. Since excess K, Na, and CI are not present in seawater proportions, uptake of these elements into the melt must have been greatest for K and least for CI, producing a K/CI ratio about 4 times that in seawater. After correcting for the seawater component, the bulk composition of the Eltanin impact melt provides the best estimate of the bulk composition of the Eltanin asteroid. Excess Fe in the impact melt, relative to that in howardites, must be from a significant metal phase in the parent asteroid. Although the estimated Fe:Ni:Ir ratios (8:1:4 x 10(exp -5)) are similar to those in mesosiderite metal nodules (10:1:6 x 10(exp -5), excess Co and Au by factors of about 2 and 10 times, respectively, imply a metal component distinct from that in typical mesosiderites. An alternative interpretation, that siderophiles have been highly fractionated from a mesosiderite source, would require loss of about 90\% of the original metal from the impact melt and the sediments, and is unsupported by any observational data. More likely, the

excess Fe in the melt rocks is 'representative of the amount of metal in the impacting asteroid, which is estimated to be 4+/- 1 wt%.
Author
Impact Melts; Meteorites; Asteroids; Petrology; Meteoritic Composition; Iron Meteorites; Chemical Elements

20030064288 Bureau of Reclamation, Denver, CO
Canyon Ferry Reservoir Resource Management Plan/Environmental Assessment. Executive Summary and Finding of No Significant Impact
Feb. 2003; 50 pp.; In English
Report No.(s): PB2003-104165; No Copyright; Avail: CASI; A03, Hardcopy

The Bureau of Reclamation (Reclamation) prepared this combined Resource Management Plan/Environmental Assessment (RMP/EA) to establish a 10-year management framework for conserving, protecting, enhancing, developing, and using the physical and biological resources at Canyon Ferry Reservoir and its surrounding lands (study areas) located in south-central Montana. The RMP/EA does not address water operations or power generation. Preparation and implementation of an RMP is a Federal action, and the National Environmental Policy Act (NEPA) requires Federal agencies to consider the potential effect(s) of a Federal action on the environment before it can be implemented. In compliance with NEPA, the EA portions of this document describe three proposed alternatives, including a No Action Alternative; existing resources in the study area; and the potential effects of three alternative resource management plans (alternatives) on these resources.
NTIS
Environment Management; Resources Management; Reservoirs

20030064392 Purdue Univ., West Lafayette, IN, USA
Experimental Investigation of Relative Permeability Upscaling from the Micro-Scale to the Macro-Scale
Pyrak-Nolte, L. J.; Yu, P.; Cheng, J.; Giordano, N.; Dec. 2000; In English
Report No.(s): DE2003-807245; No Copyright; Avail: National Technical Information Service (NTIS)

The principal challenge of upscaling techniques for multi-phase fluid dynamics in porous media is to determine which properties on the micro-scale can be used to predict macroscopic flow and spatial distribution of phases at core- and field-scales. The most notable outcome of recent theories is the identification of interfacial areas per volume for multiple phases as a fundamental parameter that determines much of the multi-phase properties of the porous medium. A formal program of experimental research was begun to directly test upscaling theories in fluid flow through porous media by comparing measurements of relative permeability and capillary-saturation with measurements of interfacial area per volume. During this reporting period, work was performed to initial test the laboratory equipment that will be used for testing the upscaling theories and to provide initial data sets. The holographic laser imaging technique (Optical Coherence Imaging) underwent initial testing and provided initial results (on imaging through turbid media, three- dimensional laser ranging and imaging sandstone), which lead to modifications to the system. Initial testing of the relative permeability system for the laboratory micro-models was performed and provided initial results on drainage & imbibition experiments. Initial testing of the Wood's metal injection system and permeability measurement system was performed on sandstone cores and modification to the system were made.
NTIS
Permeability; Drainage; Laser Applications; Holography

20030064418 Lawrence Livermore National Lab., Livermore, CA
LDRD ER: Recreating Planetary Cores in the Laboratory
Collins, G.; Feb. 07, 2003; In English
Report No.(s): DE2003-15003387; UCRL-ID-151388; No Copyright; Avail: National Technical Information Service (NTIS)

An accurate equation of state (EOS) for planetary constituents at extreme conditions is the key to any credible model of planets or low mass stars. However, very few materials have their high pressure (>few Mbar) EOS experimentally validated, and even then, only on the principal Hugoniot. For planetary and stellar interiors, compression occurs from gravitational force so that material states follow a line of isentmpic compression (ignoring phase separation) to ultra-high densities. An example of the hydrogen phase space composing Jupiter and one particular Brown Dwarf.
NTIS
Brown Dwarf Stars; Planetary Cores; Equations Of State; Geophysics

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EARTH RESOURCES AND REMOTE SENSING

Includes remote sensing of earth features, phenomena and resources by aircraft, balloon, rocket, and spacecraft; analysis of remote sensing data and imagery; development of remote sensing products; photogrammetry; and aerial photography. For related instrumentation see *35 Instrumentation and Photography*.

20030063903 NASA Ames Research Center, Moffett Field, CA, USA

Modeling and Visualizing Uncertainty in Continuous Variables Predicted using Remotely Sensed Data

Dungan, Jennifer L.; Kao, David L.; Pang, Alex; May 15, 2003; 2 pp.; In English; International Geoscience and Remote Sensing Symposium, 21-25 Jul. 2003, Toulouse, France

Contract(s)/Grant(s): RTOP 749-30-10; No Copyright; Avail: CASI; A01, Hardcopy

The use of remotely sensed images to map continuous biophysical variables, such as those related to terrestrial vegetation amount, sea surface temperature, and many other targets of NASA s Earth Observing System (EOS), includes variable, parametric, positional, spatial support and structural sources of uncertainty. A complete description of uncertainty will lead to a probability distribution at each location, allowing the exploration of the spatial dimension of uncertainty, that is, where the field is not well quantified. To achieve this purpose, convenient visualization tools are required. We have produced such a tool, called PDFVis, that facilitates the display of probability density functions (PDFs) on a per-grid-cell basis. The density estimate from Monte-Carlo generated realizations is interactively displayed as well as parametric and non-parametric summaries of the PDF field (such as mean, median, quartiles, standard deviation, number of modes, and locations of modes). Shaded surface renderings of PDFs along a transect can also be projected onto a plane. This tool will become more useful as richer descriptions of spatial uncertainty become available.

Author

Remote Sensing; Probability Density Functions; Earth Observing System (Eos); Probability Theory

20030064042 NASA Marshall Space Flight Center, Huntsville, AL, USA

Land Use and Land Cover Change, Urban Heat Island Phenomenon, and Health Implications: A Remote Sensing Approach

Lo, C. P.; Quattrochi, Dale A.; [2003]; 3 pp.; In English; Copyright; Avail: Other Sources; Abstract Only

Land use and land cover maps of Atlanta Metropolitan Area in Georgia were produced from Landsat MSS and TM images for 1973,1979,1983,1987,1992, and 1997, spanning a period of 25 years. Dramatic changes in land use and land cover have occurred with loss of forest and cropland to urban use. In particular, low-density urban use, which includes largely residential use, has increased by over 119\% between 1973 and 1997. These land use and land cover changes have drastically altered the land surface characteristics. An analysis of Landsat images revealed an increase in surface temperature and a decline in NDVI from 1973 to 1997. These changes have forced the development of a significant urban heat island effect and an increase in ground level ozone production to such an extent, that Atlanta has violated EPA's ozone level standard in recent years. The urban heat island initiated precipitation events that were identified between 1996 and 2000 tended to occur near high-density urban areas but outside the I-285 loop that traverses around the Central Business District, i.e. not in the inner city area, but some in close proximity to the highways. The health implications were investigated by comparing the spatial patterns of volatile organic compounds (VOC) and nitrogen oxides (NOx) emissions, the two ingredients that form ozone by reacting with sunlight, with those of rates of cardiovascular and chronic lower respiratory diseases. A clear core-periphery pattern was revealed for both VOC and NOx emissions, but the spatial pattern was more random in the cases of rates of cardiovascular and chronic lower respiratory diseases. Clearly, factors other than ozone pollution were involved in explaining the rates of these diseases. Further research is therefore needed to understand the health geography and its relationship to land use and land cover change as well as urban heat island effect. This paper illustrates the usefulness of a remote sensing approach for this purpose.

Author

Atlanta (Ga); Heat Islands; Land Use; Remote Sensing; Surface Temperature

20030064881 Colorado Univ., Boulder, CO, USA

Regional Impacts of Woodland Expansion on Nitrogen Oxide Emissions from Texas Savannahs: Combining Field, Modeling and Remote Sensing Approaches

Asner, Gregory P., Principal Investigator; [2003]; 6 pp.; In English

Contract(s)/Grant(s): NGT5-30348; No Copyright; Avail: CASI; A02, Hardcopy

Woody encroachment has contributed to documented changes world-wide and locally in the southwestern U.S.

Specifically, in North Texas rangelands encroaching mesquite (Prosopis glandulosa var. glandulosa) a known N-fixing species has caused changes in aboveground biomass. While measurements of aboveground plant production are relatively common, measures of soil N availability are scarce and vary widely. N trace gas emissions (nitric and nitrous oxide) flom soils reflect patterns in current N cycling rates and availability as they are stimulated by inputs of organic and inorganic N. Quantification of N oxide emissions from savanna soils may depend upon the spatial distribution of woody plant canopies, and specifically upon the changes in N availability and cycling and subsequent N trace gas production as influenced by the shift from herbaceous to woody vegetation type. The main goal of this research was to determine whether remotely sensible parameters of vegetation structure and soil type could be used to quantify biogeochemical changes in N at local, landscape and regional scales. To accomplish this goal, field-based measurements of N trace gases were carried out between 2000-2001, encompassing the acquisition of imaging spectrometer data from the NASA Airborne Visible and Infrared Imaging Spectrometer (AVIRIS) on September 29, 2001. Both biotic (vegetation type and soil organic N) and abiotic (soil type, soil pH, temperature, soil moisture, and soil inorganic N) controls were analyzed for their contributions to observed spatial and temporal variation in soil N gas fluxes. These plot level studies were used to develop relationships between spatially extensive, field-based measurements of N oxide fluxes and remotely sensible aboveground vegetation and soil properties, and to evaluate the short-term controls over N oxide emissions through intensive field wetting experiments. The relationship between N oxide emissions, remotely-sensed parameters (vegetation cover, and soil type), and physical controls (soil moisture, and temperature) permitted the regional scale quantification of soil N oxides emissions. Landscape scale analysis linking N oxide emissions with cover change revealed an alleviation from N limitation following mesquite invasion. This study demonstrated the advantage of using N trace gases as a measure of ecosystem N availability combined with remote sensing to characterize the spatial heterogeneity in ecosystem parameters at a scale commensurate with field-based measurements of these properties. Woody vegetation encroachment provided an opportunity to capitalize on detection of the remotely-sensible parameter of woody cover as it relates to belowground biogeochemical processes that determine N trace gas production. The first spatially-explicit estimates of NO flux were calculated based on Prosopis fractional cover derived from high resolution remote sensing estimates of fractional woody cover (< 4 m) for a 120 sq km region of North Texas. An assessment of both N stocks and fluxes from the study revealed an alleviation of N limitation at this site experiencing recent woody encroachment. Many arid and semi-arid regions of the world are experiencing woody invasions, often of N-fixing species. The issue of woody encroachment is in the center of an ecological and political debate. Improving the links between biogeochemical processes and remote sensing of ecosystem properties will improve our understanding of biogeochemical processes at the regional scale, thus providing a means to address issues of land-use and land-cover change.
Author
Grasslands; Trees (Plants); Nitrogen Oxides; Soils; Remote Sensing; Environment Models; Texas; Biogeochemistry

20030065256 Oregon State Univ., Corvallis, OR, USA
Volume Scattering Function and Backscattering Coefficients: Instruments, Characterization, Field Measurements and Data Analysis Protocols
Zaneveld, J. Ronald; Pegau, Scott; Mueller, James L.; Ocean Optics Protocols for Satellite Ocean Color Sensor Validation, Revision 4, Volume IV: Inherent Optical Properties: Instruments, Characterizations, Field Measurements and Data Analysis Protocols; May 2003, pp. 65-76; In English; See also 20030065253; No Copyright; Avail: CASI; A03, Hardcopy

This chapter gives the equations which govern the measurement of Volume Scattering Function (VSF) and the calibration of VSF sensors. It discusses weighting functions, the use of a reflecting plaque in calibration, and determining backscattering coefficients.
CASI
Scattering Functions; Backscattering; Scattering Coefficients; Light Scattering

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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*.

20030064233 Environmental Resources Management, Inc., Annapolis, MD, USA, MetaMetrics, Inc., Washington, DC, USA
Environmental Review of the Allen Family Foods/CHx Engineering Cogeneration Project
Walters, G.; Mountain, D.; Goldstein, D.; Hall, P.; Nov. 2002; 84 pp.; In English
Report No.(s): PB2003-104570; No Copyright; Avail: CASI; A05, Hardcopy

In July 2000, Allen Food (Allen Food), one of Delmarva's largest poultry companies, proposed to construct a 4 MW power plant at its Hurlock, Maryland processing facility that would rely upon poultry litter as its primary fuel. Allen undertook the project in concert with CHx Engineering, a Michigan-based engineering firm that specializes in the design construction and operation of solid waste gasification systems. The Department of Natural Resources (DNR) Power Plant Research Program (PPRP), coordinating with other State agencies, performed an environmental review of the Allen/CHx project as part of the licensing process administered by the Maryland Public Service Commission (PSC). PPRP reviewed the project to evaluate the potential impacts to environmental and cultural resources from the proposed facility, pursuant to Section 3-304 of the Natural Resources Article of the Annotated Code of Maryland. PPRP used the analyses of potential impacts as the basis for establishing recommended license conditions for construction and operation of the proposed facility.
NTIS
Cogeneration; Solid Wastes; Gasification; Electric Generators; Waste Utilization

20030064263 Argonne National Lab., IL
Hybrid Electric Vehicle Technology Assessment: Methodology, Analytical Issues, and Interim Results
Plotkin, S.; Santini, D.; Vyas, A.; Anderson, J.; Wang, M.; Oct. 2001; 150 pp.; In English
Report No.(s): DE2003-807353; ANL/ESD/02-2; No Copyright; Avail: Department of Energy Information Bridge
This report presents the interim results of the Argonne National Laboratory (ANL) Hybrid Electric Vehicle Technology Assessment (HEVTA). Hybrid electric vehicles, or HEVs, are vehicles with drivetrains that combine an electric drive (including electric motor and some form of electricity storage) with a refuelable power plant (e.g., an internal combustion engine). A full technology assessment (TA) examines the effects on society of introducing a new technology or expanding the use of an existing technology, including a full range of costs and benefits. This assessment focuses particularly on the energy impacts and costs of HEVs. The focus is on the individual vehicle.
NTIS
Technology Utilization; Electric Motor Vehicles

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ENVIRONMENT POLLUTION

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

20030063994 Environmental Quality Management, Inc., Cincinnati, OH, USA
Clean Air Act Emission Testing of the T-38C Aircraft Engines
Gerstle, Tom; Sep. 2002; 250 pp.; In English
Contract(s)/Grant(s): F41624-95-D-9012
Report No.(s): AD-A411925; IERA-RS-BR-SR-2003-0001; No Copyright; Avail: CASI; A11, Hardcopy
The Report is the product of an emissions testing program designed to document, characterize, and evaluate emissions from the T-38C aircraft engines modifications. The purpose of the emissions testing program was to develop emission factors for the tested engines under representative load conditions. Testing was performed by Environmental Quality Management, Inc. (EQM). Testing was conducted for criteria and hazardous air pollutants.
DTIC
Emission; Air Pollution; Aircraft Engines

20030064215 Resources for the Future, Inc., Washington, DC, USA
Electricity Restructuring, Environmental Policy and Emissions: Insights from a Modeling Analysis
Palmer, K.; Burtraw, D.; Bharvirkar, R.; Paul, A.; November 2002; 92 pp.; In English
Report No.(s): PB2003-104571; No Copyright; Avail: CASI; A05, Hardcopy
Electricity restructuring could result in substantial changes in the mix of generation technologies employed to produce electricity in the efficiency of power plant operations and in the price and quantity of electricity traded in the marketplace. This study uses REF's Haiku electricity market model to analyze how the introduction of retail competition in electricity markets to the roughly 25 states that have yet to adopt it is likely to affect emissions of NO-x and carbon from electricity generators. We also analyze the ancillary effects of carbon reduction policies in the electricity sector on NO-x emissions.
NTIS
Electricity; Electric Generators; Carbon; Environment Management; Greenhouse Effect

20030064259 National Oceanic and Atmospheric Administration, Silver Spring, MD, USA, Oak Ridge Associated Universities, Inc., TN, USA

Issues Affecting Dispersion Near Highways: Light Winds, Intra-Urban Dispersion, Vehicle Wakes, and the Roadway-2 Dispersion Model

Hosker, R. P.; Rao, K. S.; Gunter, R. L.; Nappo, C. J.; Meyers, T. P.; Feb. 2003; In English

Report No.(s): PB2003-103367; NOAA/TM/OAR/ARL-247; No Copyright; Avail: National Technical Information Service (NTIS)

The research described in this report is a collaboration between the National Oceanic and Atmospheric Administration's (NOAA) Atmospheric Turbulence and Diffusion Division (ATDD) and the Federal Highway Administration (FHWA). The FHWA must perform assessments of the likely impacts of traffic-related air pollutants near highways. Urban highways are a particular concern, and introduce a range of complications, particularly uncertainties about the wind and turbulence information needed to drive the air quality models. This research covered several tasks. The first was a thorough study of light wind data, stratified by wind speed category and time of day, using observations from a number of research-grade meteorological networks in different locations around the U.S. The instruments in these networks could resolve winds down to about 0.5 m/s. Data from the humid and vegetation-covered southeastern U.S., the arid northwest, and a coastal environment were those considered in the most detail.

NTIS

Highways; Wakes; Air Pollution; Wind (Meteorology); Environment Models; Atmospheric Turbulence

20030064484 Eastern Research Group, Inc., Morrisville, NC

Urban Air Toxics Monitoring Program (UATMP), 1999/2000

Mar. 2001; 532 pp.; In English

Report No.(s): PB2003-105489; EPA/454/R-02/009; No Copyright; Avail: CASI; A23, Hardcopy

This report presents the results and conclusions from the ambient air monitoring conducted as part of the 1999/2000 Urban Air Toxics Monitoring Program (UATMP)a program designed to characterize the magnitude and composition of potentially toxic air pollution in, or near, urban locations. The 1999/2000 UATMP included 15 monitoring stations that collected 24-hour air samples, typically on a 6- or 12-day schedule. Six sites analyzed ambient air samples for concentrations of 59 volatile organic compounds (VOC) and 16 carbonyl compounds. Ten sites also analyzed for 80 speciated nonmethane organic compounds (SNMOC). One site analyzed for the VOC, carbonyl compounds, and 92 semivolatile compounds (SVOC). Overall, nearly 28,000 ambient air concentrations were measured during the 1999/2000 UATMP. The summary presented in this report uses various graphical, numerical, and statistical analyses to put the vast amount of ambient air monitoring data collected into perspective. Not surprisingly, the ambient air concentrations measured during the program varied significantly from city to city and from season to season. This report describes and interprets these spatial and temporal variations separately for halogenated hydrocarbons, hydrocarbons, polars, and carbonyls.

NTIS

Air Pollution; Air Quality; Environmental Monitoring; Toxicity; Cities

20030065184 Colorado Univ., Boulder, CO

Real-Time Measurements of Reactive Chlorine and Carbon Dioxide in Rocket Plumes

Toohey, Darin W.; April 23, 2003; 27 pp.; In English

Contract(s)/Grant(s): F49620-99-1-0131; Proj-2303

Report No.(s): AD-A413330; AFRL-SR-AR-TR-03-0169; No Copyright; Avail: CASI; A03, Hardcopy

The objectives of this work were to measure reactive chlorine (Cl, ClO, and Cl2O2) and carbon dioxide (CO2) and to examine the mechanisms of ozone loss in the plumes of various rockets as part of an ongoing investigation of the impacts of rocket emissions on stratospheric ozone. This work has demonstrated that ozone losses in rocket plumes proceed at rates that can be explained by standard ozone loss chemistry involving the ClO radical - chemistry that is analogous to that occurring in the winter polar vortices. This work has also helped to identify an error in a key kinetic parameter. In combination with fast response measurements of Cl and ClO in the plume of STS-106, we have shown that calculations based on the revised rate constant for ClO+ClO, along with consideration of non-linear effects, can explain ozone loss rates within the uncertainties of the measurements.

DTIC

Environment Effects; Carbon Dioxide; Rocket Exhaust; Chlorine

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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*.

20030052732 NASA Goddard Space Flight Center, Greenbelt, MD, USA
A New Fitting Procedure for the Blended He I 1083 nm Multiplet
Jones, H. P.; Malanushenko, O. V.; [2003]; 1 pp.; In English; SHINE 2003 Workshop, 6-11 Jul. 2003, HI, USA; No Copyright; Avail: Other Sources; Abstract Only

The He I 1083 nm multiplet is a powerful tool for observing the outer solar atmosphere but is difficult to analyze because the lines are weak, highly variable, and spectrally blended, both internally and with other neighboring solar and telluric lines. After separation from nearby spectral features, two components of the He I multiplet are resolved. Fitting these lines with two unconstrained Gaussian profiles always gives a ratio of major to minor component of less than half the value which would be expected for optically thin lines. One possibility for explaining the discrepancy between the weakness of the lines and the ratio of the spectral components is to assume that the line formation regions are concentrated in laterally unresolved, optically thick structures with small filling factor. However, we present here a least-squares fitting technique using cubic splines with fixed breakpoints with the constraint that the blend is the sum of three identically shaped profiles shifted in wavelength according to the atomic structure of the blend and weighted by the corresponding statistics weights, in agreement with optically thin line formation. The basis functions for the fitting procedure have no built-in spectral symmetry or shape. The resulting underlying profiles tend to be asymmetric with excess absorption to the blue, consistent with formation by 'hot' and 'cool' spatial elements within the observed volume, with the hotter regions having differential motion toward the observer. The results agree well with NASA/XSO Spectromagnetograph observations in quiet sun and coronal holes. Partial funding of this research was provided through the NASA Sun-Earth Connection SR&T program.
Author
Helium Isotopes; Solar Spectra; Solar Terrestrial Interactions; Coronal Holes

20030052734 NASA Kennedy Space Center, Cocoa Beach, FL, USA
Single Station System and Method of Locating Lightning Strikes
Medelius, Pedro J., Inventor; Starr, Stanley O., Inventor; April 22, 2003; 18 pp.; In English
Patent Info.: Filed 10 Jul. 2001; US-Patent-6,552,521; US-Patent-Appl-SN-906014; US-Patent-Appl-SN-217601; NASA-Case-KSC-12035-1; No Copyright; Avail: CASI; A03, Hardcopy

An embodiment of the present invention uses a single detection system to approximate a location of lightning strikes. This system is triggered by a broadband RF detector and measures a time until the arrival of a leading edge of the thunder acoustic pulse. This time difference is used to determine a slant range R from the detector to the closest approach of the lightning. The azimuth and elevation are determined by an array of acoustic sensors. The leading edge of the thunder waveform is cross-correlated between the various acoustic sensors in the array to determine the difference in time of arrival, AT. A set of AT S is used to determine the direction of arrival, AZ and EL. The three estimated variables (R, AZ, EL) are used to locate a probable point of the lightning strike.
Author
Detection; Elevation; Lightning; Position (Location); Signal Detectors; Sound Waves

20030063914 NASA Marshall Space Flight Center, Huntsville, AL, USA
Ion Velocity Distributions Within LLBL and Their Possible Implication to Multiple Reconnections
Vaisberg, O. L.; Avanov, L. A.; Moore, T. E.; Smirnov, V. N.; [2003]; 1 pp.; In English; No Copyright; Avail: Other Sources; Abstract Only

We analyze two LLBL crossings made by Interball Tail satellite under southward or variable magnetosheath magnetic field: one crossing on the flank of the magnetosphere, and another one closer to the subsolar point. Three different types of ion velocity distributions within LLBL are observed: (a) D-shaped distributions, (b) ion velocity distributions consisting of two counter-streaming components of magnetosheath-ty and (c) distributions with three components one of which has nearly zero parallel velocity and two counter-streaming components. Only the (a) type fits to the single magnetic flux tube formed by reconnection between magnetospheric and magnetosheath magnetic fields. We argue that two counter-streaming magnetosheath-like ion components observed by Interball within LLBL cannot be explained by the reflection of the ions from the magnetic mirror deeper within magnetosphere. Types (b) and (c) ion velocity distributions would form within spiral magnetic flux tube consisting of a mixture of alternating segments originating from the magnetosheath and from

magnetospheric plasma. The shapes of ion velocity distributions and their evolution with decreasing number density in LLBL indicate that a significant part of LLBL is located on magnetic field lines of long spiral flux tube islands at the magnetopause, as has been proposed and found to occur in magnetopause simulations. We consider these observations as evidence for multiple reconnection X-ray lines between magnetosheath and magnetospheric flux tubes.
Author
Velocity Distribution; Ion Distribution; Magnetic Field Reconnection; Magnetosheath; Ions; Magnetic Flux

20030063957 NASA Marshall Space Flight Center, Huntsville, AL, USA
Observations at Low Latitudes of Magnetic Merging Signatures Within a Flux Transfer Event During a Northward IMF
Chandler, M. O.; Avanov, L. A.; [2003]; 1 pp.; In English; No Copyright; Avail: Other Sources; Abstract Only

Flux transfer events (FTE) have been postulated to result from transient magnetic merging. If so, the ion distributions within an event should exhibit features known to result from merging. Observations of a FTE by instruments on the Polar spacecraft revealed classical merging signatures that included: 1) D-shaped, accelerated, magnetosheath ion distributions, 2) a well defined de Hoffman-Teller frame, 3) local stress balance, and 4) a P-N magnetic field signature. This FTE was observed near the magnetic equator at approx. 13 MLT under conditions of a moderately northward interplanetary magnetic field (IMF) (clock angle of less than 10 deg). The nature of the ion distributions and the consistency of the measured cutoff speed with that calculated from the measured local magnetic field and the derived de Hoffman-Teller speed show the ion injection to be local. Coupled with the northward IMF these results lead to the conclusion that component merging in the low latitude region was responsible for the FTE.
Author
Flux Transfer Events; Magnetic Signatures; Magnetic Field Reconnection; Ion Distribution; Interplanetary Magnetic Fields; Earth Magnetosphere

20030063967 Brown Univ., Providence, RI, USA
Planetary Geophysics and Tectonics
Parmentier, E. Marc; [2002]; 6 pp.; In English
Contract(s)/Grant(s): NAG5-3659; No Copyright; Avail: CASI; A02, Hardcopy

We have carried out several studies that explore explanations for the role of chemical density variations in Moon s evolution. Meaningful models for the evolution of the Moon must explain a number of important magmatic characteristics. Volcanic activity subsequent to the formation of its anorthositic crust was dominated by the eruption of mare basalt. 1) The main phase of mare volcanism began approx. 500 Myr after the crystallization of the anorthositic crust and continued for approx. l Gyr. 2) The picitic glasses, considered to be representative of mare basalt least affected by low pressure, near-surface fractionation, were generated by melting, at 400-600 km depth, of a source containing components that, on the basis of the magma ocean hypothesis, should have crystallized at much shallower depth during fractionation of the anorthositic crust. 3) Mare basalts occur primarily in one region of the Moon. Recent topographic data demonstrate that the earlier idea that mare basalt flooded areas of low elevation is not correct. Large areas of very low elevation do not contain mare basalt. The hemispheric asymmetry of mare basalt distribution on the lunar surface must be explained in some other way. 4) A region of the surface roughly correlating with that containing mare basalts also is thought to contain high subsurface concentrations of KREEP which was excavated during the formation of large impact basins. This so-called Procellarum KREEP Terrane (PKT) is responsible for the Imbrium basin-centered thorium anomaly mapped by Lunar Prospector.
Derived from text
Tectonics; Geophysics; Lunar Evolution; Planetary Evolution; Volcanology; Structural Basins

20030064021 NASA Marshall Space Flight Center, Huntsville, AL, USA
Proton Aurora Dynamics in Response to the IMF and Solar Wind Variations
Chang, S.-W.; Mende, S. B.; Frey, H. U.; Gallagher, D. L.; Lepping, R. P.; Geophysical Research Letters; 2002; ISSN 0094-8276; Volume 29, No. 12, pp. 26-1 - 26-4; In English
Contract(s)/Grant(s): NCC8-200
Report No.(s): AGU-2002GL015019; Copyright; Avail: Other Sources

On May 23, 2000, proton auroras observed by IMAGE FUV on the dayside were very dynamic. Auroral pattern at the cusp footpoint is well correlated with IMF and solar wind parameters. A proton aurora brightened at high latitude poleward from the dayside oval after solar wind ion temperature increased while solar wind density and bulk speed were steady. It then

vanished after IMF turned southward. Under this IMF condition, auroral activity occurred only in the dayside oval. As IMF B(sub z), reverted to northward, cusp proton aurora reappeared at high latitude. The location of the cusp proton aurora changes with the IMF B(sub y), polarity, consistent with previous reports. These results suggest an upstream source for the observed high-latitude cusp proton aurora. One possible explanation is that bow shock energetic ions are transported into the cusp via the high-latitude magnetic merging process to induce optical emissions in the ionosphere.
Author
Auroras; Interplanetary Magnetic Fields; Protons; Solar Wind; Image Satellite; Geophysics; Wind Variations; Earth Magnetosphere

20030064043 California Univ., Los Angeles, CA, USA
Iridium Concentrations and Abundances of Meteoritic Ejecta from the Eltanin Impact in Sediment Cores from Polarstern Expedition ANT XII/4
Kyte, Frank T.; Deep-Sea Research Part II; 2002; ISSN 0967-0645; Volume 49, pp. 1049-1061; In English
Contract(s)/Grant(s): NAG5-9441; NSF EAR-94-18303; Copyright; Avail: Other Sources

The abundances of meteoritic ejecta from the Eltanin asteroid impact have been examined in several sediment cores recovered by the FS Polarstern during expedition ANT XII/4 using elemental concentrations of iridium and weights of coarse ejecta debris. Three cores with well-preserved impact deposits, PS204-1, PS2708-1, and PS2709-1, each contain Ir and ejecta fluences similar to those found in USNS Eltanin core E13-4. Small Ir anomalies and traces of ejecta were found in cores PS2706-1 and PS2710-1, but since these cores lack well-defined deposits, these are considered to be reworked and not representative of the fallout. No evidence of ejecta was found in cores PS2802-1 and PS2705-1. These results confirm earlier speculation that the Eltanin impact resulted in deposits of ejecta with up to 1 gram/sq centimeter of depris over a wide area of the ocean floor. However, there are sill large uncertainties over the actual regional or global extent of this unique sediment deposit.
Author
Ocean Bottom; Sediments; Ejecta; Asteroids; Iridium; Meteorites

20030064054 Nauchno-Proizvodstvennoe Obedinenie Prikladnoi Mekhaniki, Krasnoyarsk, Russia
Hall Effect Thruster Interactions Data From the Russian Express-A2 and Express-A3 Satellites, Part 12, Express/T-160 Project Express A2 and A3 Sensors Operations Procedures Document
Dunning, John, Technical Monitor; Sitnikova, N.; Volkov, D.; Maximov, I.; Petrusevich, V.; Allen, D.; June 2003; 20 pp.; In English
Contract(s)/Grant(s): NAS3-99151; NAS3-99204; WBS 22-800-91-01
Report No.(s): NASA/CR-2003-212005/PT12; E-13691-12/PT12; NAS 1.26:212005/PT12; Copyright; Avail: Other Sources

This 12-part report documents the data obtained from various sensor measurements taken aboard the Russian Express-A2 and Express-A3 spacecraft in Geosynchronous Earth Orbit (GEO). These GEO communications satellites, which were designed and built by NPO Prikladnoy Mekhaniki (NPO PM) of Zheleznogorsk, Russia, utilize Hall thruster propulsion systems for north-south and east-west stationkeeping and as of June 2002, were still operating at 80 deg. E. and 11 deg. W respectively. Express-A2 was launched on March 12, 2000, while Express-A3 was launched on June 24, 2000. The diagnostic equipment from which these data were taken includes electric field strength sensors, ion current and energy sensors, and pressure sensors. The diagnostics and the Hall thruster propulsion systems are described in detail along with lists of tabular data from those diagnostics and propulsion system and other satellite systems. Space Power, Inc., now part of Pratt & Whitney's Chemical Systems Division, under contract NAS3 99151 to the NASA Glenn Research Center, obtained these data over several periods from March 12, 2000, through September 30, 2001. Each of the 12 individual reports describe, in detail, the propulsion systems as well as the diagnostic sensors utilized. Finally, parts 11 and 12 include the requirements to which NPO PM prepared and delivered these data.
Author (revised)
Hall Effect; Thrustors; Data Acquisition; Communication Satellites; Propulsion System Performance; Ion Currents; Electric Field Strength

20030064285 Akademiya Nauk SSSR, Tomsk, Russia
Atmospheric and Ocean Optics. Atmospheric Physics, VIII Joint International Symposium, 25-29 June 2001, Held in Irkutsk, Russian Federation
Dec. 9, 2002; 273 pp.; In English
Contract(s)/Grant(s): F61775-01-W-F051
Report No.(s): AD-A411894; No Copyright; Avail: CASI; A12, Hardcopy

This is an interdisciplinary conference. Topics include: Molecular Spectroscopy and Atmospheric Radiative Process; Optical Propagation in the Atmosphere and Ocean; Optical Investigation of the Atmosphere and Ocean; Physical Phenomena in the Thermosphere and Lonosphere; Structure and Dynamics of the Middle Atmosphere; and Dynamics of the Atmosphere and Climate of the Asian Region.
DTIC
Atmospheric Optics; Oceans; Atmospheric Physics; Chemical Analysis

20030064355 California Univ., Lawrence Berkeley National Lab., Berkeley, CA, USA
Semianalytical Solutions of Radioactive or Reactive Transport in Variably-Fractured Layered Media: 1. Solutes
Moridis, G. J.; Oct. 2001; 68 pp.; In English
Report No.(s): DE2003-805441; LBNL-45871; No Copyright; Avail: Department of Energy Information Bridge
In this paper, semianalytical solutions are developed for the problem of transport of radioactive or reactive solute tracers through a layered system of heterogeneous fractured media with misaligned fractures. The tracer transport equations in the non- flowing matrix account for (a) diffusion, (b) surface diffusion, (c) mass transfer between the mobile and immobile water fractions, (d) linear kinetic or equilibrium physical, chemical, or combined solute sorption or colloid filtration, and (e) radioactive decay or first-order chemical reactions. The tracer-transport equations in the fractures account for the same processes, in addition to advection and hydrodynamic dispersion. Any number of radioactive decay daughter products (or products of a linear, first-order reaction chain) can be tracked. The solutions, which are analytical in the Laplace space, are numerically inverted to provide the solution in time and can accommodate any number of fractured and/or porous layers. The solutions are verified using analytical solutions for limiting cases of solute and colloid transport through fractured and porous media.
NTIS
Reservoirs; Fractures (Materials); Radioactive Isotopes; Numerical Analysis

20030065260 Arizona State Univ., Tempe, AZ
Fundamental Theoretical and Numerical Issues of Turbulence in the Middle Atmosphere
Nicolaenko, Basil; Mahalov, Alex; January 21, 2002; 49 pp.; In English
Contract(s)/Grant(s): F49620-99-1-0300
Report No.(s): AD-A413349; AFRL-SR-AR-TR-03-0144; No Copyright; Avail: CASI; A03, Hardcopy
This project falls within the realm of the USAF Airborne Laser (ABL) program. One of the challenges of the ABL program is the development of laser-beam propagation codes. Such codes must account for beam propagation through an extended turbulent medium of the bulk of the troposphere and stratosphere. From the operational perspective, accurate modeling of the refractive index structure function for long nearly horizontal path under high scintillation conditions characteristic of the atmosphere is important. Direct numerical simulations have been performed to study the dynamics of an inhomogeneous stratified shear flow modeling an atmospheric jet in the tropopause in the ABL context. The basic state is characterized by a jet at the tropopause in which the density stratification is vertically non-uniform. Small to moderate background stratifications are selected, and simulations are conducted for a range of Reynolds numbers. Quasi-equilibrium turbulent flow-fields are obtained by long-time integration of governing equations. The structure of the mean flow and turbulence fields are calculated and interpreted using relevant length scales. The jet core is found to support sustained mechanical (active) turbulence, outside of which lay a region of patchy turbulence and non-linear gravity wave activity characterized by spatially decaying velocity fluctuations and strong temperature fluctuations.
DTIC
Airborne Lasers; Middle Atmosphere; Numerical Analysis; Atmospheric Turbulence; Wind (Meteorology); Military Technology

20030065274 Colorado Univ., Boulder, CO, USA
Collaborative Research: Lagrangian Modeling of Dispersion in the Planetary Boundary Layer
Weil, Jeffrey C.; Apr. 3, 2003; 17 pp.; In English
Contract(s)/Grant(s): DAAG55-97-1-0259
Report No.(s): AD-A413180; ARO-35215.1-EV; No Copyright; Avail: CASI; A03, Hardcopy
The objective of this study was to improve scientists' understanding of dispersion in the planetary boundary layer, particularly the convective boundary layer (CBL), using Lagrangian 'particle' models coupled with large-eddy simulation (LES) fields. A one-particle model for the mean concentration field was enhanced by a theoretically improved treatment of the

LES subgrid-scale (SGS) velocities. The new model agreed with laboratory and field data and surface layer similarity theory. Investigations of stability effects on CBL dispersion showed that the dispersion rate decreased with a decreasing stability index -z(i)/L, which was attributed to the greater wind shear and the smaller turbulence scales in the surface layer. Using a two-particle model, the authors investigated relative dispersion in the CBL and found that it behaved in a quasi-homogeneous manner for all source heights except those near the surface; the latter was due to the vertical inhomogeneity in the dissipation rate. A study of concentration fluctuations revealed the large (factor of ^ 10) variability caused by velocity field fluctuations; the predicted concentration variability matched the trends in field observations from CBL sources. (11 figures, 36 refs.)
DTIC
Dispersing; Turbulent Boundary Layer; Earth Atmosphere

20030065278 Texas Univ., Austin, TX, USA
Determining 'Ground Truth' in the New Jersey STRATAFORM Natural Laboratory
Austin, James A., Jr.; Fulthorpe, Craig S.; Olson, Hilary; Apr. 8, 2003; 4 pp.; In English
Contract(s)/Grant(s): N00014-99-1-0005
Report No.(s): AD-A413080; No Copyright; Avail: CASI; A01, Hardcopy

UTIG is integrating 'nested' seismic data off New Jersey with subsurface samples, as they become available. This STRATAFORM goal is elusive, because 'ground-truthing' of seismic sequence boundaries and intervening facies by sampling at relevant depths is incomplete Objectives remain: (1) to study sea-level changes over the past ^35 Ma, and (2) to determine the effects of depositional and erosional processes on the preserved sediment record, from the seafloor to subbottom depths of ^l00 m. A comprehensive characterization of the uppermost middle-outer New Jersey shelf is underway, building upon multibeam backscatter/bathymetric seafloor images and 2D/3D ultra-high resolution geophysical control. Results from ODP Leg l74A (1997) are published (see http: www-odp.tamu.edu/publications/). Since UTIG collected 3D Huntec data on the New Jersey shelf (1989), the primary continuing activity has been ground-truthing surficial images. Short piston cores were acquired after the 1989 survey; short vibra-cores were collected in association with a second 3D survey in 1993; long coring is now being pursued as part of Geoclutter.
DTIC
Seismology; Ground Truth

47
METEOROLOGY AND CLIMATOLOGY

Includes weather observation forecasting and modification.

20030053055 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Numerical Simulation of the Large-Scale North American Monsoon Water Sources
Bosilovich, Michael G.; Sud, Yogesh C.; Schubert, Siegfried D.; Walker, Gregory K.; [2002]; 27 pp.; In English; Original contains color illustrations; No Copyright; Avail: CASI; A03, Hardcopy

A general circulation model (GCM) that includes water vapor tracer (WVT) diagnostics is used to delineate the dominant sources of water vapor for precipitation during the North American monsoon. A 15-year model simulation carried out with one-degree horizontal resolution and time varying sea surface temperature is able to produce reasonable large-scale features of the monsoon precipitation. Within the core of the Mexican monsoon, continental sources provide much of the water for precipitation. Away from the Mexican monsoon (eastern Mexico and Texas), continental sources generally decrease with monsoon onset. Tropical Atlantic Ocean sources of water gain influence in the southern Great Plains states where the total precipitation decreases during the monsoon onset. Pacific ocean sources do contribute to the monsoon, but tend to be weaker after onset. Evaluating the development of the monsoons, soil water and surface evaporation prior to monsoon onset do not correlate with the eventual monsoon intensity. However, the most intense monsoons do use more local sources of water than the least intense monsoons, but only after the onset. This suggests that precipitation recycling is an important factor in monsoon intensity.
Author
Numerical Analysis; Water Circulation; Water Vapor; Monsoons; Evaporation; Atmospheric General Circulation Models

20030053074 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Simulated Radar Characteristics of LBA Convective Systems: Easterly and Westerly Regimes

Lang, Stephen E.; Tao, Wei-Kuo; Simpson, Joanne; [2003]; 1 pp.; In English; 31st International Conference on Radar Meteorology, 6-12 Aug. 2003, Seattle, WA, USA; No Copyright; Avail: CASI; A01, Hardcopy

The 3D Goddard Cumulus Ensemble (GCE) model was used to simulate convection that occurred during the TRMM LBA field experiment in Brazil. Convection in this region can be categorized into two different regimes. Low-level easterly flow results in moderate to high CAPE and a drier environment. Convection is more intense like that seen over continents. Low-level westerly flow results in low CAPE and a moist environment. Convection is weaker and more widespread characteristic of oceanic or monsoon-like systems. The GCE model has been used to study both regimes n order to provide cloud datasets that are representative of both environments in support of TRMM rainfall and heating algorithm development. Two different cases are analyzed: Jan 26, 1999, an eastely regime case, and Feb 23, 1999, a westerly regime case. The Jan 26 case is an organized squall line, while the Feb 23 case is less organized with only transient lines. Radar signatures, including CFADs, from the two simulated cases are compared to each other and with observations. The microphysical processes simulated in the model are also compared between the two cases.

Author

Atmospheric Models; Cumulus Clouds; Trmm Satellite; Three Dimensional Models; Computerized Simulation; Radar Imagery

20030053076 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Real-time, Quasi-Global, Multi-Satellite Precipitation Analysis Using TRMM and other Satellite Observations

Adler, Robert F.; Huffman, George; Curtis, Scott; Bolvin, David; Nelkin, Eric; [2003]; 1 pp.; In English; GPM Workshop, 21-29 Jun. 2003, Netherlands; Copyright; Avail: Other Sources; Abstract Only

A TRMM-based 3-hr analyses that use TRMM observations to calibrate polar-orbit microwave observations from SSM/I (and other satellites) and geosynchronous IR observations and merges the various calibrated observations into a final, 3-hr resolution map is described. This TRMM standard product will be available for the entire TRMM period (January 1998-present) in 2003 as part of Version 6 of the TRMM products. A real-time version of this merged product is being produced and is available at 0.25' latitude-longitude resolution over the latitude range from 50 N-500S. Examples will be shown, including its use in monitoring flood conditions and in relating weather-scale patterns to climate-scale patterns. Plans to incorporate the TRMM data and 3-hourly analysis into the Global Precipitation Climatology Project (GPCP) products are outlined. The outcome in the near future should be an improved global analysis and climatology on monthly scales for the 23 year period and finer time scale analyses for more recent periods, including 3-hourly analyses over the globe. These technique developments are potential prototypes for analyses with the Global Precipitation Measurement (GPM) mission.

Author

Climatology; Precipitation (Meteorology); Real Time Operation; Weather

20030053077 NASA Goddard Space Flight Center, Greenbelt, MD, USA

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

Braun, Scott A.; Montgomery, Michael T.; Pu, Zhao-Xia; [2003]; 5 pp.; In English; Tenth Conference on Mesoscale Processes, 23-27 Jun. 2003, Portland, OR, USA; Original contains color and black and white illustrations; Copyright; Avail: CASI; A01, Hardcopy

This study examines a high-resolution simulation of Hurricane Bonnie. Results from the simulation will be compared to the conceptual model of Heymsfield et al. (2001) to determine the extent to which this conceptual model explains vertical motions and precipitation growth in the eyewall.

Derived from text

Hurricanes; Motion Simulation; Vertical Motion

20030053174 NASA Goddard Space Flight Center, Greenbelt, MD, USA

MODIS Cloud Products Derived from Terra and Aqua During CRYSTAL-FACE

King, Michael D.; Platnick, S.; Riedi, J. C.; Ackerman, S. A.; Menzel, W. P.; [2003]; 1 pp.; In English; EGS-AGU-EUG Joint Assembly, 7-11 Apr. 2003, Nice, France; Copyright; Avail: Other Sources; Abstract Only

The Moderate Resolution Imaging Spectroradiometer (MODIS), developed as part of the Earth Observing System (EOS) and launched on Terra in December 1999 and Aqua in May 2002, is designed to meet the scientific needs for satellite remote sensing of clouds, aerosols, water vapor, and land and ocean surface properties. During the CRYSTAL-FACE experiment,

numerous aircraft coordinated both in situ and remote sensing observations with the Terra and Aqua spacecraft. In this paper we will emphasize the optical, microphysical, and physical properties of both liquid water and ice clouds obtained from an analysis of the satellite observations over Florida and the Gulf of Mexico during July 2002. We will present the frequency distribution of liquid water and ice cloud microphysical properties throughout the region, separating the results over land and ocean. Probability distributions of effective radius and cloud optical thickness will also be shown.
Author
Imaging Spectrometers; Spectroradiometers; Terra Spacecraft; Remote Sensing; Earth Observations (From Space); Clouds (Meteorology)

20030063974 ENSCO, Inc., Cocoa Beach, FL, USA, DYNACS Engineering Co., Inc., USA
A New Objective Technique for Verifying Mesoscale Numerical Weather Prediction Models
Case, Jonathan L.; Manobianco, John; Lane, John E.; Immer, Christopher D.; June 2003; 42 pp.; In English
Contract(s)/Grant(s): NAS10-01052
Report No.(s): NASA/CR-2003-211187; NAS 1.26:211187; Rept-03-001; Copyright; Avail: CASI; A03, Hardcopy

This report presents a new objective technique to verify predictions of the sea-breeze phenomenon over east-central Florida by the Regional Atmospheric Modeling System (RAMS) mesoscale numerical weather prediction (NWP) model. The Contour Error Map (CEM) technique identifies sea-breeze transition times in objectively-analyzed grids of observed and forecast wind, verifies the forecast sea-breeze transition times against the observed times, and computes the mean post-sea breeze wind direction and speed to compare the observed and forecast winds behind the sea-breeze front. The CEM technique is superior to traditional objective verification techniques and previously-used subjective verification methodologies because: It is automated, requiring little manual intervention, It accounts for both spatial and temporal scales and variations, It accurately identifies and verifies the sea-breeze transition times, and It provides verification contour maps and simple statistical parameters for easy interpretation. The CEM uses a parallel lowpass boxcar filter and a high-order bandpass filter to identify the sea-breeze transition times in the observed and model grid points. Once the transition times are identified, CEM fits a Gaussian histogram function to the actual histogram of transition time differences between the model and observations. The fitted parameters of the Gaussian function subsequently explain the timing bias and variance of the timing differences across the valid comparison domain. Once the transition times are all identified at each grid point, the CEM computes the mean wind direction and speed during the remainder of the day for all times and grid points after the sea-breeze transition time. The CEM technique performed quite well when compared to independent meteorological assessments of the sea-breeze transition times and results from a previously published subjective evaluation. The algorithm correctly identified a forecast or observed sea-breeze occurrence or absence 93\% of the time during the two- month evaluation period from July and August 2000. Nearly all failures in CEM were the result of complex precipitation features (observed or forecast) that contaminated the wind field, resulting in a false identification of a sea-breeze transition. A qualitative comparison between the CEM timing errors and the subjectively determined observed and forecast transition times indicate that the algorithm performed very well overall. Most discrepancies between the CEM results and the subjective analysis were again caused by observed or forecast areas of precipitation that led to complex wind patterns. The CEM also failed on a day when the observed sea- breeze transition affected only a very small portion of the verification domain. Based on the results of CEM, the RAMS tended to predict the onset and movement of the sea-breeze transition too early and/or quickly. The domain-wide timing biases provided by CEM indicated an early bias on 30 out of 37 days when both an observed and forecast sea breeze occurred over the same portions of the analysis domain. These results are consistent with previous subjective verifications of the RAMS sea breeze predictions. A comparison of the mean post-sea breeze winds indicate that RAMS has a positive wind-speed bias for .all days, which is also consistent with the early bias in the sea-breeze transition time since the higher wind speeds resulted in a faster inland penetration of the sea breeze compared to reality.
Author
Numerical Weather Forecasting; Atmospheric Models; Mesometeorology; Relief Maps; Temporal Distribution

20030064049 National Oceanographic Data Center, Silver Spring, MD, USA
Earth System Monitor, Volume 13, No. 4
Torstenson, R., Editor; June 2003; ISSN 1068-2678; 16 pp.; In English; Original contains color and black and white illustrations; Copyright; Avail: Other Sources

Two articles are presented in this newsletter. The first addresses the benefits of an oceanographic database of the Arctic Seas to the study of the Arctic climatic system. The second addresses the NESDIS Operational Significant Event Image metadata system that produces compelling near real-time views of phenomena occurring all over the planet. These images are

used on the NOAA homepage to increase awareness of these phenomena and NOAA's role in observing them.
CASI
Arctic Ocean; Arctic Regions; Data Bases; Imagery; Meteorological Charts

20030064053 Massachusetts Inst. of Tech., MA, USA
Large-scale Stratospheric Transport Processes
Plumb, R. Alan; July 15, 2003; 2 pp.; In English
Contract(s)/Grant(s): NAG5-11285; No Copyright; Avail: CASI; A01, Hardcopy

The PI has undertaken a theoretical analysis of the existence and nature of compact tracer-tracer relationships of the kind observed in the stratosphere, augmented with three-dimensional model simulations of stratospheric tracers (the latter being an extension of modeling work the group did during the SOLVE experiment). This work achieves a rigorous theoretical basis for the existence and shape of these relationships, as well as a quantitative theory of their width and evolution, in terms of the joint tracer-tracer PDF distribution. A paper on this work is almost complete and will soon be submitted to Rev. Geophys. We have analyzed lower stratospheric water in simulations with an isentropic-coordinate version of the MATCH transport model which we recently helped to develop. The three-dimensional structure of lower stratospheric water, in particular, attracted our attention: dry air is, below about 400K potential temperature, localized in the regions of the west Pacific and equatorial South America. We have been analyzing air trajectories to determine how air passes through the tropopause cold trap. This work is now being completed, and a paper will be submitted to Geophys. Res. Lett. before the end of summer. We are continuing to perform experiments with the 'MATCH' CTM, in both sigma- and entropy-coordinate forms. We earlier found (in collaboration with Dr Natalie Mahowald, and as part of an NSF-funded project) that switching to isentropic coordinates made a substantial improvement to the simulation of the age of stratospheric air. We are now running experiments with near-tropopause sources in both versions of the model, to see if and to what extent the simulation of stratosphere-troposphere transport is dependent on the model coordinate. Personnel Research is supervised by the PI, Prof. Alan Plumb. Mr William Heres conducts the tracer modeling work and performs other modeling tasks. Two graduate students, Ms Irene Lee and Mr Michael Ring, have been participating in the research.
Author
Atmospheric Models; Stratosphere; Three Dimensional Models; Gas Transport

20030064169 Geological Survey, Reston, VA
Trace-Element Deposition in the Cariaco Basin, Venezuela Shelf, under Sulfate-Reducing Conditions-a History of the Local Hydrography and Global Climate, 20 ka to the Present
Piper, D. Z.; Dean, W. E.; 2002; In English
Report No.(s): PB2003-103777; USGS-PP-1670; No Copyright; Avail: National Technical Information Service (NTIS)

A sediment core from the Cariaco Basin on the Venezuelan continental shelf, which recovered sediment that has been dated back to 20 ka (thousand years ago), was examined for its major-element-oxide and trace-element composition. Cadmium (Cd), chromium (Cr), copper (Cu), molybdenum (Mo), nickel (Ni), vanadium (V), and zinc (Zn) can be partitioned between a siliciclastic, terrigenous-derived fraction and two seawater-derived fractions. The two marine fractions are (1) a biogenic fraction represented by nutrient trace elements taken up mostly in the photic zone by phytoplankton, and (2) a hydrogenous fraction that has been derived from bottom water via adsorption and precipitation reactions. This suite of trace elements contrasts with a second suite of trace elements-barium (Ba), cobalt (Co), gallium (Ga), lithium (Li), the rare-earth elements, thorium (Th), yttrium (Y), and several of the major-element oxides-that has had solely a terrigenous source. The partitioning scheme, coupled with bulk sediment accumulation rates measured by others, allows us to determine the accumulation rate of trace elements in each of the three sediment fractions and of the fractions themselves.
NTIS
Trace Elements; Venezuela; South America; Alkaline Earth Oxides; Sediments; Structural Basins; Metal Oxides; Climate Change

20030064261 Sandia National Labs., Albuquerque, NM
Massively Parallel Global Climate Model for Paleoclimate Applications
Boslough, M. B. E.; Jun. 2002; In English
Report No.(s): DE2003-805884; SAND2002-1925; No Copyright; Avail: National Technical Information Service (NTIS)

GENESIS Version 2.0 is a general circulation model developed at the National Center for Atmospheric Research (NCAR) and is the principal code that is used by paleoclimatologists to model climate at various times throughout Earth's history. The

primary result of this LDRD project has been the development of a distributed-memory parallel version of GENESIS, leading to a significant performance enhancement on commodity-based, large-scale computing platforms like the CPlant. The shared-memory directives of the original version were replaced by MPI calls in the new version of GENESIS. This was accomplished by means of parallel decomposition over latitude strip domains. The code achieved a parallel speedup of four times that of the shared-memory parallel version at R15 resolution. T106 resolution runs 20 times faster than the NCAR serial version on 20 nodes of the CPlant. As part of the project, GENESIS was used to model the climatic effects of an orbiting debris ring due to a large planetary impact event.
NTIS
Massively Parallel Processors; Climate Models; Atmospheric General Circulation Models; Climatology

20030064334 Meteorological Satellite Center, Kiyose, Japan
Monthly Report of the Meteorological Satellite Center: April 2003
April 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 April 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

20030064445 Lawrence Livermore National Lab., Livermore, CA, USA
Evaluation of Cloud Parameterizations in a High Resolution Atmospheric General Circulation Model using ARM Data
Govindasamy, B.; Duffy, P.; Apr. 12, 2002; In English
Report No.(s): DE2003-15003273; UCRL-ID-148091; No Copyright; Avail: National Technical Information Service (NTIS)

Typical state of the art atmospheric general circulation models used in climate change studies have horizontal resolution of approximately 300 km. As computing power increases, many climate modeling groups are working toward enhancing the resolution of global models. An important issue that arises when resolution of a model is changed is whether cloud and convective parameterizations, which were developed for use at coarser resolutions, will need to be reformulated or re-tuned. We propose to investigate this issue and specifically cloud statistics using ARM data. The data streams produced by highly instrumented sections of Cloud and Radiation Testbeds (CART) of ARM program will provide a significant aid in the evaluation of cloud and convection parameterization in high-resolution models.
NTIS
Parameterization; Atmospheric General Circulation Models; Clouds (Meteorology); Climatology

20030064907 Forest Service, Portland, OR
Assessing Values of Air Quality and Visibility at Risk from Wildland Fires
Ferguson, S. A.; McKay, S. J.; Nagel, D. E.; Piepho, T.; Rorig, M. L.; Apr. 2003; In English
Report No.(s): PB2003-105491; FSRP-PNW-550; No Copyright; Avail: National Technical Information Service (NTIS)

To assess values of air quality and visibility at risk from wildland fire in the USA, we generated a 40-year database that includes twice-daily values of wind, mixing height, and a ventilation index that is the product of wind speed and mixing height. The database provides the first nationally consistent map of surface wind and ventilation index. In addition, it is the longest climate record of mixing height in the country. We built the database into an interactive ventilation climate information system that allows users to assess risk based on frequency patterns of poor, marginal, fair, and good ventilation conditions.
NTIS
Air Quality; Visibility; Fires; Mixing Height; Climatology

20030064962 NASA Marshall Space Flight Center, Huntsville, AL, USA
Atmospheric Models for Engineering Applications
Johnson, Dale L.; Roberts, Barry C.; Vaughan, William W.; Justus, C. G.; [2002]; 6 pp.; In English; 41st AIAA Aerospace Sciences Meeting and Exhibit, 6-9 Jan. 2003, Reno, NV, USA
Report No.(s): AIAA Paper 2003-0894; Copyright; Avail: CASI; A02, Hardcopy

This paper will review the historical development of reference and standard atmosphere models and their applications. The evolution of the U.S. Standard Atmosphere will be addressed, along with the Range Reference Atmospheres and, in particular, the NASA Global Reference Atmospheric Model (GRAM). The extensive scope and content of the GRAM will be addressed since it represents the most extensive and complete 'Reference' atmosphere model in use today. Its origin was for engineering applications and that remains today as its principal use.
Author
Atmospheric Models; Reference Atmospheres; Standardization

20030064974 Meteorological Satellite Center, Kiyose, Japan
Monthly Report of the Meteorological Satellite Center: March 2003
March 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 March 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

20030065201 Air Force Inst. of Tech., Wright-Patterson AFB, OH
Forecasting Excessive Rainfall and Low-Cloud Bases East of the Northern Andes and Mesoscale Convective Complex Movement in Central South America
Gasbarro, Marc R.; Mar. 2003; 165 pp.; In English; Original contains color illustrations
Report No.(s): AD-A412908; AFIT/GM/ENP/03-03; No Copyright; Avail: CASI; A08, Hardcopy

This research produces better forecast tools for SOUTHCOM's 25th Operational Weather Squadron (OWS) over multiple areas of operation in South America. Heavy rainfall and low-cloud base events along the northeastern Andes foothills are examined, as well as, mesoscale convective complexes (MCCs) in Central South America (CSA). Low clouds, fog, and flooding rains hamper daily Department of Defense (DoD) counter-drug operations in Northwestern South America (NWSA). In addition, fierce MCCs interfere with joint-military exercises in CSA.
DTIC
Weather Forecasting; Weather; Rain

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*.

20030064283 Texas A&M Univ., College Station, TX, USA
Stability and Change in Gulf of Mexico Chemosynthetic Communities. Volume 1: Executive Summary
MacDonald, I. R.; Jul. 2002; 50 pp.; In English
Report No.(s): PB2003-100388; No Copyright; Avail: CASI; A03, Hardcopy

A multidisciplinary team of marine scientists has completed a program entitled Stability and Change in Gulf of Mexico Chemosynthetic Communities. The program was carried out under contract with the Department of Interior, Minerals Management Service, with technical supervision of the Gulf of Mexico Outer Continental Shelf Regional Office, New Orleans, Louisiana. The fundamental concern of the program was the effect that development of offshore energy reserves might have upon dense assemblages of deep-sea organisms, particularly chemosynthetic tubeworms, mussels, and clams, as well as fish and crustaceans, that live in association with them. Hydrocarbons from commercial oil and gas reserves escape into the sea bottom at natural seeps found commonly across the Gulf of Mexicos northern continental slope. Chemosynthetic animals utilize chemical energy from hydrocarbons to maintain colonies that have unusually high biomass compared with the sea bottom elsewhere. Chemosynthetic communities at hydrocarbon seeps were discovered in 1984 and have been previously

investigated in studies funded by MMS. However, more knowledge was needed about the life history and ecology of chemosynthetic communities in the Gulf of Mexico. The program has produced a substantial body of findings, which include numerous peer-reviewed publications and student theses in addition to the results detailed in the final report. Given the pace of publication, it is likely that this productivity will continue for some time to come. The program obtained results from an extensive program of field collections and laboratory analyses.
NTIS
Gulf Of Mexico; Ecology; Biomass

20030065253 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Ocean Optics Protocols for Satellite Ocean Color Sensor Validation, Volume 4, Inherent Optical Properties: Instruments, Characterizations, Field Measurements and Data Analysis Protocols
Mueller, J. L., Editor; Fargion, Giuletta S., Editor; McClain, Charles R., Editor; Pegau, Scott; Zaneveld, J. Ronald V.; Mitchell, B. Gregg; Kahru, Mati; Wieland, John; Stramska, Malgorzat; May 2003; 86 pp.; In English; See also 20030065254 - 20030065258
Report No.(s): NASA/TM-2003-211621/VOL4/REV4; Rept-2003-01674-0/VOL4/REV4; NAS 1.15:211621/VOL4/REV4; No Copyright; Avail: CASI; A05, Hardcopy

This document stipulates protocols for measuring bio-optical and radiometric data for the Sensor Intercomparison 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 (Mueller and Fargion 2002, Volumes 1 and 2) is entirely superseded by the six volumes of Revision 4 listed above.
Author
Oceanography; Radiometers; Optical Measuring Instruments; Water Color; Sensors; Biogeochemistry

20030065258 Oregon State Univ., Corvallis, OR, USA
Inherent Optical Property Measurement Concepts: Physical Principles and Instruments
Pegau, Scott; Zaneveld, J. Ronald V.; Mueller, James L.; Ocean Optics Protocols for Satellite Ocean Color Sensor Validation, Revision 4, Volume IV: Inherent Optical Properties: Instruments, Characterizations, Field Measurements and Data Analysis Protocols; May 2003, pp. 1-14; In English; See also 20030065253; No Copyright; Avail: CASI; A03, Hardcopy

In this chapter we extend the IOP definitions and relationships of Vol. I, Ch. 2 to develop the theoretical and mathematical bases for practical instrument concepts and methods for measuring IOP in seawater. Instruments will be described to measure, in situ at depth z, the beam attenuation coefficient c(z,lambda), the volume absorption coefficient a(z,lambda) and the volume scattering function (VSF) Beta(z,lambda,psi) at one or more scattering angles psi. Spectrophotometric laboratory methods are also described in detail for determining absorption coefficients from filtered, discrete water samples. Methods of data analysis are described to determine, from combinations of these measurements, the volume scattering coefficient b(z, lambda) and backscattering coefficient b(sub b)(z, lambda). We do not consider instrument concepts or methods for measuring either fluorescence, or Raman scattering, in Vol. IV. Even though the Raman and fluorescence cross-sections of water, suspended particles and dissolved materials are also IOP of seawater, only elastic scattering processes are considered in this volume. In the remainder of Vol. IV, we will ordinarily omit the explicit notation identifying IOP variables as functions of depth z in the water column.
Author
Optical Properties; Radiative Transfer; Sea Water; Optical Measuring Instruments

51
LIFE SCIENCES (GENERAL)

Includes general research topics related to plant and animal biology (non-human); ecology; microbiology; and also the origin, development, structure, and maintenance of animals and plants in space and related environmental conditions. For specific topics in life sciences see *categories 52 through 55*.

20030052739 NASA Ames Research Center, Moffett Field, CA, USA
Recovery After Prolonged Bed-Rest Deconditioning
Greenleaf, John E.; Quach, David T.; January 2003; 85 pp.; In English
Contract(s)/Grant(s): UPN 111-10-20
Report No.(s): NASA/TM-2002-211860; NAS 1.15:211860; A-0207736; No Copyright; Avail: CASI; A05, Hardcopy

Recovery data were analyzed from normal healthy test subjects maintained in the horizontal or head-down body position in well-controlled bed rest (BR) studies in which adherence to the well-designed protocol was monitored. Because recovery data were almost always of secondary importance to the data collected during the BR period, there was little consistency in the recovery experimental designs regarding control factors (e.g., diet or exercise), duration, or timing of data collection. Thus, only about half of the BR studies that provided appropriate data were analyzed here. These recovery data were sorted into two groups: those from BR protocols of less than 37 days, and those from protocols greater than 36 days. There was great disparity in the unchanged responses at the end of BR in these two groups. Likewise with the variables that required more than 40 days for recovery; for example, some immune variables required more than 180 days. Knowledge of the recovery process after BR in healthy people should assist rehabilitation workers in differentiating 'healthy' BR recovery responses from those of the infirmity of sick or injured patients; this should result in more appropriate and efficient health care.
Author
Bed Rest; Human Factors Engineering; Deconditioning; Physiological Responses; Human Beings

20030063929 NASA Ames Research Center, Moffett Field, CA, USA
Panspermia: Atmospheric Spacecraft Breakup Survival
Szewczyk, Nathaniel J.; Mancinelli, Rocco L.; McLamb, William; Reed, David; Conley, Catharine A.; May 30, 2003; 2 pp.; In English; Copyright; Avail: CASI; A01, Hardcopy

Life on Earth may be derived from a universal ancestor whose origin several theories attempt to explain. Life's origin might have occurred on another planet with an organism surviving escape from that planet, spacetravel, atmospheric entry, and impact on Earth where it successfully reproduced. For contemplators of interplanetary transfer of life, we herein make the first report of survival following spacecraft breakup. C. elegans strains N2 and CC1 were grown on two media inside anodized aluminum canisters onboard STS-107. Stowed inside a middeck locker within Pyrell foam, canisters were subject to ambient cabin atmosphere (Nitrogen/Oxygen mix, 25.9\% Oxygen at 101.4 +/- 2.8 kPa). During reentry, Columbia broke up in the mesosphere (approximately 62 km at M 18), exposing animals to potentially lethal events including shear forces, explosive decompression, shockwave(s), freezing, heat, and environmental toxicity. Animals tolerate anoxia, withstand cosmic radiation, and withstand brief exposure to 100,000 x G. Four adjacently stowed canisters were recovered at independent, evenly spaced, locations along an 8 km line. Adjacent stowage did not strongly correlate with adjacent recovery. A forward stowed fifth canister was recovered 19.3 km tangentially Southeast, while a sixth's fate is unknown. Canisters were recovered within the period animals can survive without food. Canister walls were intact indicating shockwaves and explosive decompression should not have harmed animals. Based upon past flight hardware survival, spacecraft breakup around the canisters likely dissipated some initial destructive forces much as meteor breakup protects meteoroid fragments. As meteoroid fragments do, canisters independently experienced non-identical entry forces. Canisters had variable loss of anodization and external pitting of the aluminum in different locations. The nature and randomness of damage suggests canisters independently freefell through a cloud of debris wherein canisters, debris, or both were heated and/or traveling rapidly. Scorched nylon Velcro, strapping polystyrene culture dishes together, and scorched Teflon, bumpers lining canister sides, evidenced interior heating. Temperature was logged autonomously every thirty minutes, inside three canisters. Temperatures were consistent with cabin ambient before breakup (22 C), about twice recovery site ambient approximately twenty minutes after breakup (26 C vs. 12 C, 23 C vs. ll C, 28 C vs. 14 C), and consistent with ambient thereafter. ABS plastic logger housing was slightly melted at canister contact points. Polystyrene has the lowest melting point of the hardware used, remarkably only one dish suffered heat damage. These observations confirm canisters experienced non-identical heating and indicate heat transfer to dishes and animals was inefficient, as consistent with incomplete heat transfer to the core of entering meteorites. Demonstrating an animal can survive brief loss of support systems and atmospheric spacecraft breakup, live animals were recovered from all canisters except the Southeasterly one containing the damaged dish. Higher canister temperatures likely killed the animals, but

post-impact, pre-recovery canister freezing provides an alternative explanation. One canister contained interspersed dishes of dead and live animals, one contained one dish with live animals, and one contained one dish without live animals. The dish differing from the balance was at an end in both. These data suggest organism location both within the spacecraft and within individual debris is important to survival. Survival of entry was not limited to a single identical organism. Live animals were on every dish in a canister containing both strains. Survival was not dependent on media type. Recultured animals, from both media, displayed normal growth rates, normal brood sizes, and no heritable mutant phenotypes. Animals on test media were reproductive while animals on control media were dauer, presptively from in-flight food exhaustion. Survival and ability to reproduce were not dependent on animals being presumptively reproductive or arrested prior to entry. This supports arguments to meticulously sterilize planetary probes destined for entry disposal. However, entry event survival is not sufficient for an organism to continue to survive and reproduce after entry into an unfamiliar habitat. Animals on just over half the recovered dishes were killed by an airborne post-impact, pre-recovery contaminating mold upon reculturing. C. elegans is extremely unlikely to survive an unsupported interplanetary trip. Yet, strains survive twenty years in liquid nitrogen making it tempting to speculate organisms containing developed neural, muscular, and reproductive systems could be spread inside something such as a protective, frozen meteoroid core.

Author

Worms; Atmospheric Entry; Survival; Spacecraft Breakup

20030065069 Saint John Hospital and Medical Center, USA

Establishment of a Pharmacy and Therapeutics Committee for Space Station Freedom

Martin, William; Proceedings of Space Station Freedom Clinical Experts Seminar; April 1991, pp. 25-27; In English; See also 20030065052; No Copyright; Avail: CASI; A01, Hardcopy

The idea was to start to establish what the weights and volumes would be and start to determine some quantities. In the past few years, I've changed my mind as to what I've looked at as the formulary. So, the question that was to describe the system for updating the pharmacy and central supply formulary during the Space Station Freedom life cycle which is approximately 30 years. At this point in the development of the formulary, it is paramount baseline this and establish something called the pharmacy and therapeutics committee. All university institutions have a medical executive committee (in this case, it would be NASA) and then they have a pharmaceutics and therapeutics committee. This is a committee that is multi-disciplinary and typically has a pharmacist, a nurse, respiratory therapist, someone from lab, but it is dominated by physicians and their specialties. Although these people have votes, there are only four votes that are multi-disciplinary that have input, but there are typically 12 or 14 physicians on this committee and they each have a specialty so that when certain drugs come up, they can provide their input. And then is a formulary committee. Since P&T committees get busy with all types of issues, protocols, etc. they establish a formulary group. This first group, the formulary working group does the lion's share of the job. This is a draft. The decision should be based on the following issues: Therapeutic efficacy. Safe Use. Ease of Administration. Packaging Issues (Weight & Volume Constraints).

Derived from text

Life Sciences; Pharmacology; Physicians

20030065070 Naval Submarine Medical Research Lab., Groton, CT, USA

Lessons from Navy Medicine

Stetson, Douglas; Proceedings of the Space Station Freedom Clinical Experts Seminar; April 1991, pp. 37-39; In English; See also 20030065052; No Copyright; Avail: CASI; A01, Hardcopy

The paper discusses operational medicine in Navy submarines. Submarines are a truly isolated form of transportation and give you an opportunity to provide all kinds of support and care to the crew. The Navy fleet in 1989 evacuated 67 persons from submarines. Of those 67, about one-third were related to abdominal pain. Perhaps one-half of those were related to a surgical diagnosis which would ultimately turn out to be appendicitis and, in the interim, had medical treatment. The next largest group of problems was trauma of the extremities i.e., a hand, a finger, a forearm that got banged up somehow or another. The next largest category, interestingly, was psychological. A lot of people were depressed or anxious, or suicidal or something and the crew didn't want to deal with it. I guess the crew didn't vote a lot; the Captain did. The next group was dental which didn't have a great deal of discussion, but that was the next category including fractured teeth and other things which were not potentially serious. There was some trauma to the abdomen: someone who fell, somebody who had damage to his spleen which turned out to be a renal contusion which did not require much care, someone who had kidney stones, a couple of other people who had chest pain diagnosed as myocardial infarction and who survived. So these kind of cases are out there in the 18-55 year old and are important.

Author (revised)

Submarines; Medical Services; Sicknesses; Diagnosis

20030065071 LDS Hospital, Salt Lake, UT, USA

Comments on Special Medical Issues

Thomas, Frank; Campbell, Mark; Broadwell, Kim; Wu, Alan; Stiernberg, Charles M.; Rock, John; Donner, Howard; Proceedings of Space Station Freedom Clinical Experts Seminar; April 1991, pp. 93-107; In English; See also 20030065052; No Copyright; Avail: CASI; A03, Hardcopy

Much debate on the X-rays individual feelings that probably is perceived as a standard of care, and there is much debate on whether it is necessary for the space station. We did agree that except for chest X-rays, it is doubtful that any information obtained will result in any additional therapeutical modalities. Most diagnoses could be made without the use of X-ray, and we are totally leaning that way with therapeutical modalities that would be initiated. We didn't think it was necessary for the space station, but it is probably going to be needed for the Lunar-Mars Mission, so it's a development that will occur at one time. Whether it's required for this particular mission is another story, but it probably will be required for these missions. Author

X Rays; Diagnosis; Life Sciences

20030065157 NASA Ames Research Center, Moffett Field, CA, USA

Plant Response to Microwaves at 2.45 GHz

Skiles, J. W.; [2003]; 1 pp.; In English; 54th International Astronautical Congress, 29 Sep. - 3 Oct. 2003, Bremen, Germany; No Copyright; Avail: Other Sources; Abstract Only

One method of beaming to Earth energy captured by Space Solar Power (SSP) satellites is by using microwaves. Since microwaves are non-ionizing and of low energy they probably will have little or no direct effect (either long- or short-term) on terrestrial biota. This contention must to be proved however, before the public will accept a continuous beam of microwaves being sent to the ground near populated areas or onto agricultural lands. To begin to address this question, an experiment has been done that exposed an important agronomic plant speaes (alfalfa, Medicago sativa L.) to a continuous microwave beam at 2.45 GHz and from between 0.5 to 1.2 milli-watts per square centimeter. The hypothesis was that plants exposed to microwaves will be no different from those control plants that were not exposed to microwaves. The microwaves were broadcast over a tray of mature, growing plants in the laboratory. The control plants were subjected to the same environmental conditions (light, temperature, soil and nutrients) minus the microwave exposure. Both populations of plants were watered as needed. As may be seen, the experiment was designed so that the only variable to which the test plants were subjected was microwave exposure. Precise, non-destructive measurements were taken of leaf chlorophyll concentration over the period of the experiment. Also measured were gross plant variables such as stem length, internodal distance, and, at the end of the experiment, above-ground biomass, both fresh and dry weights. Soil temperatures on bare soil and under the plant canopy were also measured. After seven weeks of exposure to microwaves there was no sigruficant difference between control and test plant populations. A number of other plant/ microwave exposure studies will be discussed in this presentation. However, this experiment is one of the few published examples of organisms being exposed to continuos microwave illumination at one of the proposed SSP microwave frequencies and intensities.

Author

Microwaves; Alfalfa; Soils

20030065257 Scripps Institution of Oceanography, San Diego, CA, USA

Determination of Spectral Absorption Coefficients of Particles, Dissolved Material and Phytoplankton for Discrete Water Samples

Mitchell, B. Greg; Kahru, Mati; Wieland, John; Stramska, Malgorzata; Ocean Optics Protocols for Satellite Ocean Color Sensor Validation, Revision 4, Volume IV: Inherent Optical Properties: Instruments, Characterizations, Field Measurements and Data Analysis Protocols; May 2003, pp. 39-64; In English; See also 20030065253; No Copyright; Avail: CASI; A03, Hardcopy

This chapter defines protocols for the operational determinations of absorption coefficients for particulate and soluble matter in water samples. Methods are specified for separating particulate and soluble material by filtration, partitioning total particulate absorption into contributions by phytoplankton and de-pigmented particles (detritus), and corrections for pathlength amplification due to semi-diffuse transmittance of the filters. Recommendations are made based on widely accepted methods and processing procedures. NASA-sponsored workshops have confirmed various aspects of previously reported methods.

Derived from text

Absorption Spectra; Coefficients; Particulates; Dissolved Organic Matter; Phytoplankton; Water Sampling

52
AEROSPACE MEDICINE

Includes the biological and physiological effects of atmospheric and space flight (weightlessness, space radiation, acceleration, and altitude stress) on the human being; and the prevention of adverse effects on those environments. For psychological and behavioral effects of aerospace environments, see *53 Behavioral Sciences*. For the effects of space on animals and plants see *51 Life Sciences*.

20030063917 NASA Johnson Space Center, Houston, TX, USA

Description of 103 Cases of Hypobaric Sickness from NASA-sponsored Research

Conkin, Johnny; Klein, Jill S.; Acock, Keena E.; July 2003; 120 pp.; In English

Report No.(s): NASA/TM-2003-212052; NAS 1.15:212052; No Copyright; Avail: CASI; A06, Hardcopy

One hundred and three cases of hypobaric decompression sickness (DCS) are documented, with 6 classified as Type II DCS. The presence and grade of venous gas emboli (VGE) are part of the case descriptions. Cases were diagnosed from 731 exposures in 5 different altitude chambers from 4 different laboratories between the years 1982 and 1999. Research was funded by NASA to develop operational prebreathe (PB) procedures that would permit safe extravehicular activity from the Space Shuttle and International Space Station using an extravehicular mobility unit (spacesuit) operated at 4.3 psia. Both vehicles operate at 14.7 psia with an 'air' atmosphere, so a PB procedure is required to reduce nitrogen partial pressure in the tissues to an acceptable level prior to depressurization to 4.3 psia. Thirty-two additional descriptions of symptoms that were not diagnosed as DCS together with VGE information are also included. The information for each case resides in logbooks from 32 different tests. Additional information is stored in the NASA Decompression Sickness Database and the Prebreathe Reduction Protocol Database, both maintained by the Environmental Physiology Laboratory at the Johnson Space Center. Both sources were reviewed to provide the narratives that follow.

Author

Decompression Sickness; Extravehicular Activity; Extravehicular Mobility Units; Space Suits; Aeroembolism

20030064059 Miami Univ., Coral Gables, FL, USA

Development of Poincare Software to Predict Arrythmias

Maaliki, Samer; National Aeronautics and Space Administration (NASA)/American Society of Engineering Education (ASEE) Summer Faculty Fellowship Program - 2000; March 2003, pp. 20-1 - 20-14; In English; See also 20030064055; Original contains black and white illustrations

Contract(s)/Grant(s): NAG9-867; No Copyright; Avail: CASI; A03, Hardcopy

The most distressing types of heart malfunction occur because of an abnormal rhythm of the heart. Cardiac arrythmias can be caused by abnormal rhythmicity of the pacemaker, electrolyte disturbances, blockage of the transmission of the electric impulse through the heart, and other abnormalities. There is strong evidence that space flight is associated with decreased cardiac electrical stability that may pose a life threatening risk to astronauts. For example, during the Skylab missions, a crewmember had a five beat run of ventricular tachycardia during lower body negative pressure. Also, analysis of nine 24-hour Holter monitor recordings obtained during long term spaceflight on Mir revealed one 14-beat run of ventricular tachycardia. A Mir cosmonaut was replaced in 1986 because of cardiac dysrhythmias. Most recently, in July of 1997, a Mir commander was unable to participate in the Spektr module repair due to complaints of an irregular heart rhythm. Despite these examples, possible mechanisms of arrhythmias and countermeasure strategies have barely been addressed. The Poincare method has been proposed as a technique that might potentially predict life-threatening arrhythmias before they occur. According to this method, each RR interval obtained from an EKG recording is plotted sequentially vs. the previous RR interval. Several studies using the method have demonstrated a strong correlation between the shape of the Poincare plot and ventricular arrhythmia. Our purpose was to develop an automated software program that detects the R peaks from an EKG recording while simultaneously displaying the Poincare plot and other related parameters.

Author

Arrhythmia; Astronauts; Predictions; Computer Programs

20030064062 Kentucky Univ., Lexington, KY, USA

Using Tri-Axial Accelerometers to Assess the Dynamic Control of Head Posture During Gait

Lawrence, John H., III; National Aeronautics and Space Administration (NASA)/American Society of Engineering Education (ASEE) Summer Faculty Fellowship Program - 2000; March 2003, pp. 9-1 - 9-8; In English; See also 20030064055

Contract(s)/Grant(s): NAG9-867; No Copyright; Avail: CASI; A02, Hardcopy

Long duration spaceflight is known to cause a variety of biomedical stressors to the astronaut. One of the more functionally destabilizing effects of spaceflight involves microgravity-induced changes in vestibular or balance control.

Balance control requires the integration of the vestibular, visual, and proprioceptive systems. In the microgravity environment, the normal gravity vector present on Earth no longer serves as a reference for the balance control system. Therefore, adaptive changes occur to the vestibular system to affect control of body orientation with altered, or non-present, gravity and/or proprioceptive inputs. Upon return to a gravity environment, the vestibular system must re-incorporate the gravity vector and gravity-induced proprioceptive inputs into the balance control regime. The result is often a period of postural instability, which may also be associated with space motion sickness (oscillopsia, nausea, and vertigo). Previous studies by the JSC Neuroscience group have found that returning astronauts often employ alterations in gait mechanics to maintain postural control during gait. It is believed that these gait alterations are meant to decrease the transfer of heel strike shock energy to the head, thus limiting the contradictory head and eye movements that lead to gait instability and motion sickness symptoms. We analyzed pre- and post-spaceflight tri-axial accelerometer data from the NASA/MIR long duration spaceflight missions to assess the heel to head transfer of heel strike shock energy during locomotion. Up to seven gait sessions (three preflight, four postflight) of head and shank (lower leg) accelerometer data was previously collected from six astronauts who engaged in space flights of four to six months duration. In our analysis, the heel to head transmission of shock energy was compared using peak vertical acceleration (a), peak jerk (j) ratio, and relative kinetic energy (a). A host of generalized movement variables was produced in an effort to isolate those that best highlighted vestibular adaptation due to spaceflight. Data suggest that astronauts used either head or body centered control to reduce the effects of heel strike shock on head position during normal walking at self-selected speeds. Moreover, the form of that control appears to fall under one of two categories: homeostatic or adaptive. Homeostatic control refers to tight constraint (small error) over the value of a given variable before and after spaceflight with little or no adaptive changes. Adaptive control refers to lesser constraint over a given movement variable with clear adaptation to earth gravity upon return from spaceflight. Heel strike shock absorption (ratio of heel to head peak acceleration) best-discriminated head and body centered control strategies. Further, peak jerk data was useful for illustrating pre- and postflight differences in segmental (shank versus head) movement energy. Results from kinetic energy analysis show high consistency between subjects and across test dates. Whether this result highlights a control strategy or is an artifact of approximating body segments using anthropometric tables is, at this point, unclear.
Author
Gait; Walking; Head Movement; Posture; Microgravity; Proprioception; Acceleration Stresses (Physiology); Body Kinematics; Adaptive Control; Astronauts

20030064064 Fordham Univ., New York, NY, USA
Human Peripheral Blood Mononuclear Cells Cultured in Normal and Hyperglycemic Media in Simulated Microgravity Using NASA Bioreactors
Lawless, DeSales; National Aeronautics and Space Administration (NASA)/American Society of Engineering Education (ASEE) Summer Faculty Fellowship Program - 2000; March 2003, pp. 8-1 - 8-16; In English; See also 20030064055
Contract(s)/Grant(s): NAG9-867; No Copyright; Avail: CASI; A03, Hardcopy

We sought answers to several questions this summer at NASA Johnson Space Center. Initial studies involved the in vitro culture of human peripheral blood mononuclear in cells in different conditioned culture media. Several human cancer clones were similarly studied to determine responses to aberrant glycosylation by the argon laser. The cells were grown at unit gravity in flasks and in simulated microgravity using NASA bioreactors. The cells in each instance were analyzed by flow cytometry. Cell cycle analysis was acquired by staining nuclear DNA with propidium iodide. Responses to the laser stimulation was measured by observing autofluorescence emitted in the green and red spectra after stimulation. Extent of glycosylation correlated with the intensity of the laser stimulated auto-fluorescence. Our particular study was to detect and monitor aberrant glycosylation and its role in etiopathogenesis. Comparisons were made between cells known to be neoplastic and normal cell controls using the same Laser Induced Autofluorescence technique. Studies were begun after extensive literature searches on using the antigen presenting potential of dendritic cells to induce proliferation of antigen specific cytotoxic T-cells. The Sendai virus served as the antigen. Our goal is to generate sufficient numbers of such cells in the simulated microgravity environment for use in autologous transplants of virally infected individuals including those positive for hepatitis and HIV.
Author
In Vitro Methods And Tests; Cells (Biology); Blood; Bioreactors; Microgravity; Environment Simulation

20030064071 University of Southern Colorado, Pueblo, CO, USA
Development of a Multi-Channel, High Frequency QRS Electrocardiograph
DePalma, Jude L.; National Aeronautics and Space Administration (NASA)/American Society of Engineering Education (ASEE) Summer Faculty Fellowship Program - 2000; March 2003, pp. 3-1 - 3-12; In English; See also 20030064055
Contract(s)/Grant(s): NAG9-867; No Copyright; Avail: CASI; A03, Hardcopy

With the advent of the ISS era and the potential requirement for increased cardiovascular monitoring of crewmembers during extended EVAs, NASA flight surgeons would stand to benefit from an evolving technology that allows for a more rapid diagnosis of myocardial ischemia compared to standard electrocardiography. Similarly, during the astronaut selection process, NASA flight surgeons and other physicians would also stand to benefit from a completely noninvasive technology that, either at rest or during maximal exercise tests, is more sensitive than standard ECG in identifying the presence of ischemia. Perhaps most importantly, practicing cardiologists and emergency medicine physicians could greatly benefit from such a device as it could augment (or even replace) standard electrocardiography in settings where the rapid diagnosis of myocardial ischemia (or the lack thereof) is required for proper clinical decision-making. A multi-channel, high-frequency QRS electrocardiograph is currently under development in the Life Sciences Research Laboratories at JSC. Specifically the project consisted of writing software code, some of which contained specially-designed digital filters, which will be incorporated into an existing commercial software program that is already designed to collect, plot and analyze conventional 12-lead ECG signals on a desktop, portable or palm PC. The software will derive the high-frequency QRS signals, which will be analyzed (in numerous ways) and plotted alongside of the conventional ECG signals, giving the PC-viewing clinician advanced diagnostic information that has never been available previously in all 12 ECG leads simultaneously. After the hardware and software for the advanced digital ECG monitor have been fully integrated, plans are to use the monitor to begin clinical studies both on healthy subjects and on patients with known coronary artery disease in both the outpatient and hospital settings. The ultimate goal is to get the technology out into the clinical world, where it has the potential to save lives.
Author
Electrocardiography; Ischemia; Diagnosis; Computer Programs

20030064200 Pennsylvania Univ., Philadelphia, PA
Instrumentation to Track Performance Relative to Behavior, Physiology and Blood Chemistry
Dinges, David F.; Feb. 2001; 2 pp.; In English
Contract(s)/Grant(s): F49620-00-1-0338; Proj-2313
Report No.(s): AD-A411778; AFRL-SR-AR-TR-03-0059; No Copyright; Avail: CASI; A01, Hardcopy

This grant made possible technical advances at the University of Pennsylvania site of the AFOSR PRET Center, substantially improving this site's capability to study the neurobehavioral and neurobiological deficits associated with sleep deprivation, excessive work demands, stressors, night shift activities, jet lag, and the development of countermeasures in the context of simulated sustained operations. The instrumentation purchased has markedly enhanced our laboratory's ability to track in a discrete temporal range (from milliseconds to minutes) human performance errors in stressful situations relative to behavior (time-locking video), physiology (cardiovascular ECG and EEG), and stress hormones (glucocorticoids, catecholamines).
DTIC
Sleep Deprivation; Human Behavior; Stress (Psychology); Chemical Composition; Blood Plasma

20030064219 Army Research Inst. of Environmental Medicine, Natick, MA
The Zone Diet Phenomenon: A Closer Look at the Science Behind the Claims
Cheuvront, Samuel N.; Jan. 2003; 10 pp.; In English
Report No.(s): AD-A412648; MISC 02-13; No Copyright; Avail: CASI; A02, Hardcopy

Low carbohydrate diets represent a popular form of recrudescent food faddism. Although most revolve around the emphatic theme that carbohydrates are to blame for many chronic diseases, their specific ideologies are more variable and in some cases quite sophisticated. The Zone Diet phenomenon represents a new generation of modern low carbohydrate food fad with sales placing it among the most popular diet books in recent history. The Zone is a 40\% carbohydrate, 30\% protein, and 30\% fat eating plan that advocates only sparing use of grains and starches. The precise .75 protein to carbohydrate ratio required with each meal is promoted to reduce the insulin to glucagon ratio, which purportedly affects eicosanoid metabolism and ultimately produces a cascade of biological events leading to a reduction in chronic disease risk, enhanced immunity, maximal physical and mental performance, increased longevity, and permanent weight loss. There is presently little scientific support for the connections made between diet, endocrinology, and cicosanoid metabolism. In fact, a review of the literature suggests that there are scientific contradictions in the Zone Diet hypothesis that cast unquestionable doubt on its potential efficacy. The purpose of this review is to evaluate the scientific merit of the Zone Diet and its health claims in an effort to help delineate what is and what is not sound nutrition science.
DTIC
Diets; Diseases; Endocrinology; Nutrition

20030064318 Nanyang Technological Univ., Nanyang, Singapore
Visualizing Skin Temperature Before, During and After Exercise for Dynamic Area Telethermometry
Wang, Jian-Gang; Toh, Hock Lye; Oct. 25, 2001; 6 pp.; In English; Original contains color illustrations
Report No.(s): AD-A411896; No Copyright; Avail: CASI; A02, Hardcopy

The dynamic behavior of human skin temperature has potential clinical diagnosis values. The method and material for acquiring and implementing thermal data plays an important role for obtaining a confirmed thermographic diagnosis. High resolution, both temperature and spatial, is required in order to see a dramatically different behavior between the data obtained in a group of patients and the one observed in a group of normal subjects. In this paper, a specific exercise is designed; we visualize the skin temperature before, during and after the exercise. Over 2000 frames during the period were captured, and the skin temperature of the regions of interest is analyzed statistically. In order to visualize the FFT to yield the relative contributions of its underlying frequency over the series of frames, the average temperature of the region of interest is obtained in order to average out some of the spurious noise. The subareas of interest are detected automatically using region-growing technique. The results are obtained using an infrared imaging system at a frame rate 30 frames per second.
DTIC
Skin Temperature (Biology); Physical Exercise; Diagnosis

20030065052 NASA Johnson Space Center, Houston, TX, USA
Proceedings of the Space Station Freedom Clinical Experts Seminar
Billica, Roger P., Editor; Lloyd, Charles W., Editor; Doarn, Charles R., Editor; April 1991; 161 pp.; In English; Space Station Freedom Clinical Experts Seminar, 27-29 Aug. 1990, Houston, TX, USA; See also 20030065053 - 20030065075
Contract(s)/Grant(s): NAS9-17720
Report No.(s): NASA-CP-10069; S-634; NAS 1.55:10069; No Copyright; Avail: CASI; A08, Hardcopy

These are the proceedings of the Space Station Freedom Health Maintenance Facility 1990 Clinical Experts Seminar held August 27-29, 1990, at the Nassau Bay Hilton, Houston, Texas. Contained within are the agenda, list of medical consultants, executive summary, individual presentations, and the comments generated from the working groups. Issues include the adequacy of current Health Maintenance Facility for Space Station Freedom; impact of having, or not having, an ACRV or physician on board Space Station Freedom; new and developing technologies, techniques, and medications and their impact on the evolving Space Station Freedom, considerations surrounding x-ray, ultrasound, lab, decontamination, blood transfusion, nutrition, safe-haven, computer/telemedicine; suggestions as to how to train the Crew Medical Officer; and, how the consultant network will interface over the next several years.
Author
Aerospace Medicine; Space Station Freedom; Clinical Medicine; Education; Conferences

20030065053 Temple Univ., Philadelphia, PA, USA
Cardiovascular Disease and Management Considerations for Space Station Freedom
Bove, Alfred; Proceedings of Space Station Freedom Clinical Experts Seminar; April 1991, pp. 1-4; In English; See also 20030065052; No Copyright; Avail: CASI; A01, Hardcopy

A discussion by Alfred Bove, M.D., on the topic of cardiovascular disease and management considerations for Space Station Freedom is presented.
CASI
Cardiovascular System; Heart Diseases; Space Station Freedom; Aerospace Medicine

20030065054 Christus Saint John Sports Medicine Center, Naussau Bay, TX, USA
Orthopedic Considerations: Strains, Splints, and Fractures
ONeill, Daniel B.; Proceedings of Space Station Freedom Clinical Experts Seminar; April 1991, pp. 29-30; In English; See also 20030065052; No Copyright; Avail: CASI; A01, Hardcopy

This presentation by a sport medicine orthopedist addresses the use of splinting and traction devices in an aerospace environment. Topics covered include: fractures in space, light-weight traction or splinting devices, non-standard x-ray imaging, use of heat and cold in treating injuries, and ongoing research efforts.
CASI
Aerospace Medicine; Orthopedics; X Ray Imagery; Injuries; Splints

20030065055 Johns Hopkins Univ., Baltimore, MD, USA

Gynecologic Diseases: Issues and Concerns

Rock, John; Proceedings of the Space Station Freedom Clinical Experts Seminar; April 1991, pp. 31-32; In English; See also 20030065052; No Copyright; Avail: CASI; A01, Hardcopy

This presentation considers the problems raised by gynecolgic disease in an aerospace environment. Three major questions are posed: (1) Is pregnancy possible?; (2) Will female astronauts undergo ovulatory suppression?; (3) Should there be selective screening to reduce the risks of acquired disease on the space station?

CASI

Aerospace Medicine; Pregnancy; Gynecology; Females

20030065056 Texas Univ., TX, USA

ENT: Traumatic and Infectious Pathologies

Stiernberg, Charles M.; Proceedings of the Space Station Freedom Clinical Experts Seminar; April 1991, pp. 41-43; In English; See also 20030065052; No Copyright; Avail: CASI; A01, Hardcopy

In this paper, a presentation by Charles Stiernber, M.D., is given on the infectious and traumatic pathologies of the Ear Nose and Throat (ENT) specialty.

CASI

Pathology; Clinical Medicine; Infectious Diseases; Respiratory System

20030065057 LDS Hospital, Salt Lake, UT, USA

Criteria for Medical Transport and Transport Considerations

Thomas, Frank; Proceedings of the Space Station Freedom Clinical Experts Seminar; April 1991, pp. 45-47; In English; See also 20030065052; No Copyright; Avail: CASI; A01, Hardcopy

A presentation by Frank Thomas, M.D., is given on what criteria he would use to transport someone from the Space Station Freedom to the ground.

CASI

Space Station Freedom; Medical Science; Telemedicine

20030065059 Texas Univ., Dallas, TX, USA

Requirements and Considerations for Clinical Laboratory Capabilities

Wu, Alan; Proceedings of the Space Station Freedom Clinical Experts Seminar; April 1991, pp. 59-61; In English; See also 20030065052; No Copyright; Avail: CASI; A01, Hardcopy

When planning for the medical equipment and tests available to a space station crew, it is necessary to justify each procedure desired on board the station, since some procedures unlikely to be needed require heavy pieces of equipment. For instance the presenter believes that a space station can go without a blood centrifuge and use whole blood for tests. However, when a commitment is made to a particular test or treatment, it is advisable to follow up if it is easy to do so on board the station. The presenter cites the usefulness of therapeutic drug monitoring in following up on several types of drug therapy. On board a space station it should be possible to determine which types of microbes are present, and also which type has infected an astronaut.

CASI

Space Stations; Medical Equipment; Spacecrews; Medical Services

20030065060 Texas Univ. Health Science Center, TX, USA

Dentistry Considerations

Young, John; Proceedings of the Space Station Freedom Clinical Experts Seminar; April 1991, pp. 67-69; In English; See also 20030065052; No Copyright; Avail: CASI; A01, Hardcopy

This presentation discusses potential dental problems such as broken and/or fractured teeth, soft and hard tissues lacerations, and dental procedures in the context of a spacecraft environment. Additional topics mentioned include oral hygiene and potential infections resulting from dental procedures.

CASI

Dentistry; Tooth Diseases; Teeth; Aerospace Environments

20030065061 NASA Johnson Space Center, Houston, TX, USA

Does the Health Maintenance Facility Provide Speciality Capabilities?

Boyce, Joey; Wurgler, James; Broadwell, Kim; Martin, William; Stiernberg, Charles M.; Bove, Alfred; Fromm, Rob; O'Neill, Daniel; Proceedings of the Space Station Freedom Clinical Experts Seminar; April 1991, pp. 73-81; In English; See also 20030065052; No Copyright; Avail: CASI; A02, Hardcopy

The Health Maintenance Facility (HMF) is capable of handling all minor illnesses, most moderate illnesses, and some major illnesses on board a space station. Its primary purpose should be to treat problems that are mission threatening, not life threatening. The HMF will have greater medical capabilities than those currently on Navy submarines. Much of the discussion in this document focuses on the possibilities of treating specific medical conditions on board a space station. The HMF will be limited to caring for critically ill patients for a few days, so a crew return vehicle will be important.

CASI

Space Stations; Aerospace Medicine; Medical Services; Medical Equipment

20030065062 Johns Hopkins Medical Institutions, Baltimore, MD, USA

Crew Medical Officer Training

Rock, John; Donner, Howard; Masarie, Fred; Stiernberg, Charles M.; Thomas, Frank; Proceedings of the Space Station Freedom Clinical Experts Seminar; April 1991, pp. 109-114; In English; See also 20030065052; No Copyright; Avail: CASI; A02, Hardcopy

A group discussion on how to approach the curricula of a Crew Medical Officer (CMO) who may only possess the knowledge level of an Emergency Medical Technician (EMT) is presented. The speakers include: John Rock, Howard Donner, Fred Masarie, Charles Sriernberg and Frank Thomas.

CASI

Aerospace Medicine; Spacecrews; Education; Medical Personnel

20030065064 Air Force School of Aerospace Medicine, USA

Ophthalmologic Concerns for Space Station

Tredici, Thomas J.; Proceedings of the Space Station Freedom Clinical Experts Seminar; April 1991, pp. 49-53; In English; See also 20030065052; No Copyright; Avail: CASI; A01, Hardcopy

This paper presents a discussion by Thomas Tredici M.D., on the Ophthalmologic problems that spacecrews may encounter while aboard the Space Station.

CASI

Space Stations; Ophthalmology; Spacecrews; Eye (Anatomy)

20030065065 Duke Univ., NC, USA

HMF Mission Profile and the Need for Diagnostic Laboratory Equipment, Chronic Nutrition and Blood Transfusions

Broadwell, Kim; Proceedings of Space Station Freedom Clinical Experts Seminar; April 1991, pp. 5-7; In English; See also 20030065052; No Copyright; Avail: CASI; A01, Hardcopy

The presenter addresses the capabilities which are needed, and those which are superfluous, for the Health Maintenance Facility (HMF) on a space station. Her presentation covers microbiology examinations, tests for organ systems, antibiotics, the medical certification of flight hardware, chronic nutritional support, and blood transfusions. She also makes observations about the feasibility of telemedicine and crew evacuation under different circumstances.

CASI

Space Stations; Diagnosis; Spacecrews; Clinical Medicine; Health

20030065066 Clifton Medical and Surgical Clinic Association, Clifton, TX, USA

General Surgical Capabilities for HMF and the 'Implications' on Crew Medical Officer (CMO) Training, X-Rays and Wound Healing

Campbell, Mark; Proceedings of Space Station Freedom Clinical Experts Seminar; April 1991, pp. 9-11; In English; See also 20030065052; No Copyright; Avail: CASI; A01, Hardcopy

The Crew Medical Officer (CMO) on a space station will need at least some surgical capabilities, such as the ability to put in chest tubes and central lines, close lacerations, and perform peritoneal lavage and appendectomies. Preferably, the CMO will be an M.D.. Hands-on training is very important for these procedures whether the CMO is an M.D. or not. X-ray capability will be very useful on a space station, especially in determining whether or not to evacuate a crew member. Wound

healing and the containment of bleeding in zero gravity are important factors which need to be better understood.
CASI
Aerospace Medicine; Astronaut Training; Spacecrews; Space Stations; Surgery

20030065067 Wilderness Medicine, Bozeman, MT, USA
Application of Wilderness Medicine and Mountaineering to HMF Capabilities
Donner, Howard; Proceedings of Space Station Freedom Clinical Experts Seminar; April 1991, pp. 13-16; In English; See also 20030065052; No Copyright; Avail: CASI; A01, Hardcopy

The experience of providing medical support to mountaineering expeditions provides insight on how to assemble a medical kit for a space station crew. On board a station, X ray capabilities will be most useful for chest injury and pulmonary processes. In rare cases, they will be very useful in C-spine evaluation. The presenter believes, based on his mountaineering experience, that most types of fractures could be treated on a space station without X ray capabilities. Microscopic capabilities are needed to diagnose infectious diseases. The NASA SOMS Kit, or a similar medical kit, is recommended for a space station. As a minimum, the speaker recommends a first aid kit for splinting and soft issue injuries, and a short list of injectable and oral mediciations. If room is available, IV capabilities and a traction device are recommended. It will be very difficult to treat multiple injured crew members on a space station.
CASI
Aerospace Medicine; Space Stations; Spacecrews; Medical Equipment; Kits; X Ray Apparatus

20030065068 Aeropsych Associates, San Antonio, TX, USA
Psychiatric Issues: Comnunications and Support Requirements During Crises
Jones, David; Proceedings of Space Station Freedom Clinical Experts Seminar; April 1991, pp. 17-24; In English; See also 20030065052; No Copyright; Avail: CASI; A02, Hardcopy

Experience from the military and other fields gives insight on how to prepare for and respond to the loss of an astronaut, the loss of a spacecrew, and mental illness on board a spacecraft. It is very important for procedures to be developed prior to a mission on how to handle the bodies of dead crew members, how to conduct a ceremony to achieve closure, and how to handle media attention. Military experience suggests that astronauts will have a strong desire to retrieve a fellow crewmember's body. Formal ceremonies are necessary for their beneficial pyschological effect, which extends to the public. Official remarks from high officials, such as the President of the USA, are important for these occasions. Policies are also needed for regulating media coverage of a doomed crew and determing the crew's final activities. Procedures for the treatment and restraint of mentally ill crew members are also needed, since decisions in this area are difficult to make in the field. The basis of authority for giving and following orders on board a spacecraft also needs to be established.
CASI
Spacecrews; Mental Health; Accidents; Policies; Death; Space Psychology

20030065072 Saint John Hospital and Medical Center, Detroit, MI, USA
Assured Crew Return Vehicle (ACRV) Impacts and Capabilities of the Crew Medical Officer
Martin, William; Stiernberg, Charles M.; Thomas, Frank; Fromm, Rob; Rock, John; Broadwell, Kim; Proceedings of Space Station Freedom Clinical Experts Seminar; April 1991, pp. 83-87; In English; See also 20030065052; No Copyright; Avail: CASI; A01, Hardcopy

The paper discusses what are the impacts of having or not having the assured crew return vehicle (ACRV) (i.e., changing length of required medical intensive care capability from 45 to 14 days). Dr. Lloyd's group was the radiology, laboratory medicine, pharmaceutical, and computers and believe that if you reduce the scenario from 45 to 14 days, you markedly reduce the quantities of some of the supply items, but not for pharmacy or medical supplies. Charles Stiernberg spent considerably more time on this topic and a general statement that we can make about the ACRV is that the presence of an ACRV increases the possibility of a crew member surviving a Class III or Level III illness. It's only logical that if you have an ambulance to take you to a tertiary hospital from a non-tertiary place for a Level III injury or illness (or a helicopter - look what helicopters did for emergency medicine) it increases the survivability of the patient. Frank Thomas group consisted of a surgeon, two critical care specialists also trained in transport, and physicians with hyperbaric medicine and cardiology expertise. The group ran a little differently than the emphasis toward M.D. There was much debate with regards to the M.D. versus non-M.D. Rob From Regarding ACRV capabilities, our group strongly advocated that this be given great consideration. There is going to be a subset of potentially salvageable individuals who are not going to be manageable with the resources of present HMF, (mainly from a personnel standpoint). John Rock group took a lot of time to discuss Essentially, the fundamental assumption for

planning the HMF capabilities was that a crew emergency rescue vehicle would be included in the Space Station design. It is absolutely imperative to medical missions to include a ACRV to conform to the weight limitations, to limit training requirements, and to limit the morbidity and mortality of specific injuries and illnesses. Kim Broadwell As far as the ACRV, we are not sure how it affects what HMF designers have to do now, given program constraints. It is an obligation to do an aggressive 'ER' job for a little while, and if the person does well after that and improves, they stay; if they don't, you evacuate them. If you don't have the capability, you don't evacuate them.
CASI
Assured Crew Return Vehicle; Ambulances; Emergencies; Pharmacology

20030065073 Texas Univ., TX, USA
Technology Watch
Stiernberg, Charles M.; Bove, Alfred; Schienberg, Sam; Wurgler, James; Martin, William; Stiernberg, Charles M.; Proceedings of the Space Station Freedom Clinical Experts Seminar; April 1991, pp. 89-92; In English; See also 20030065052; No Copyright; Avail: CASI; A01, Hardcopy

This presentation provides an overview of a working group discussion considering 'what new or developing technologies, medications, and techniques would you recommend for consideration' for the HMF. Suggestions included: portable x-ray machine, medical database software, chemistry laboratory, and lexiscope.
CASI
Medical Equipment; Aerospace Environments

20030065074 Seaberg Co., Newport, OR, USA
Orthopedic Considerations
Scheinberg, Sam; Proceedings of Space Station Freedom Clinical Experts Seminar; April 1991, pp. 33-35; In English; See also 20030065052; No Copyright; Avail: CASI; A01, Hardcopy

Interestingly enough, in orthopedics, with the kind of treatment we will need on space station, it may not be a physician necessarily because as it turns out the splinting of fractures and the immobilizing of fractures probably will be commonly handled by paramedics and EMT's who, by and large, are much more skillful and knowledgeable than physicians. Dr. Campbell's recommendation that training should be required, because if it's a doctor or if it's an EMT, they need to understand how to handle orthopedic problems. There is just no way to do it except to do it, and these people need to rotate through a busy emergency room and have hands-on experience in looking at fractures, sprains and strains as a basis. The next thing is risks/benefits. The risks/benefits ratio, what the risks were compared to the benefits. So with that in mind, and the rest of the group contributing. There is more danger with the use of inserting prongs and someone drilling holes in heads than the benefits. Most of these things seem to relate to cervical injury, but the truth is that you generally have some history of head trauma, unconsciousness, or something to give you some clues to the seriousness of cervical injury. The most common cause of cervical pain in my emergency room is the cervical collar that's been applied. Usually when we get it off the patient, they're so grateful that it's the best thing you can do. So that's what I'm talking about in getting a trained individual.
Derived from text
Education; Emergencies; Hazards; Injuries

20030065075 Grand Canyon Clinic, Grand Canyon, AZ, USA
Lessons from Wilderness Medicine
Wurgler, James; Proceedings of the Space Station Freedom Clinical Experts Seminar; April 1991, pp. 63-65; In English; See also 20030065052; No Copyright; Avail: CASI; A01, Hardcopy

This informal presentation is a discussion about the usefulness of certain medical equipment in either remote or hostile environments. The presenter discusses x-ray machines, the chemistry analyzing machine and the similarities of submarine medical environments and aerospace environments.
Derived from text
Aerospace Medicine; Aerospace Environments; Medical Equipment

20030065272 Army Soldier Systems Command, Natick, MA, USA
Inertial Properties of an External-Frame Backpack Device
Norton, Karen; Hasselquist, Leif; Schiffman, Jeffrey; LaFiandra, Michael; Piscitelle, Louis; Apr. 2003; 62 pp.; In English
Report No.(s): AD-A413300; NATICK/TR-03/020; No Copyright; Avail: CASI; A04, Hardcopy

Previously, an external-frame backpack device (35 kg) was fabricated allowing for the placement of a 24.9-kg lead brick load in nine different positions. The purpose of this report was to determine the moment of inertia (MOI) of the backpack for the nine load positions relative to: the backpack's center of mass (COM); reference axes originating on the backpack frame; the COM for the human torso and backpack combined; and the COM for the human body and backpack combined. For the backpack about its COM, the lowest MOI values were found when the COM was located intermediate/central and intermediate/close relative to the load-carrier's trunk. For the backpack relative to the reference axes, the lowest MOI values were found when the COM was located low/central and low/close to the trunk. For the torso and backpack system and for the body and backpack system, the lowest MOI values were found when the COM relative to the trunk was in the intermediate/close or high/close position and the low/close or intermediate/close position, respectively. These data will be used in research examining the effects of manipulations of the COM and the MOI of backpack loads on load carriers' biomechanical and physiological responses.
DTIC
Fabrication; Moments Of Inertia; Display Devices; Human Performance

20030065301 Old Dominion Univ., Norfolk, VA, USA
Workshop on Dielectric Properties and Electrical Breakdown of Biological Membranes
Schoenbach, Karl H.; Dec. 2002; 29 pp.; In English
Contract(s)/Grant(s): F49620-02-1-0110
Report No.(s): AD-A413207; ODURF-221101; AFRL-SR-AR-TR-03-0109; No Copyright; Avail: CASI; A03, Hardcopy

'Dielectric Properties and Electrical Breakdown of Biological Membranes' was the topic of a workshop at the Conference on Electrical Insulation and Dielectric Phenomena on October 20, 2002, in Mexico. The workshop, supported by the IEEE Dielectrics and Electrical Insulation Society, the US AFOSR and ONR, was organized by Karl H. Schoenbach. The presentations focused on nonthermal biological effects caused by high power pulsed electric fields. The interest in this topic was stimulated by recent observations of modifications in cell functions and induction of apoptosis in cells when exposed to ultrashort electrical pulses. Prominent scientists from various countries presented invited talks on membrane structures and functions, dielectric properties, electroporation, and applications. The funding was utilized to support the travel expenses of invited speakers. A special issue on 'Dielectric Properties and Electrical Breakdown of Biological Membranes' with J. Weaver MIT) and K. H. Schoenbach (ODU) will be published (in October 2003) in the IEEE Transactions on Dielectrics and Electrical Insulation.
DTIC
Dielectric Properties; Membrane Structures; Conferences; Biological Effects

53
BEHAVIORAL SCIENCES

Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric research.

20030053062 NASA Ames Research Center, Moffett Field, CA, USA
Non-Invasive Investigation of Bone Adaptation in Humans to Cumulative Daily Mechanical Loading
Whalen, Robert; Cleek, Tammy; Sode, Miki; [2003]; 1 pp.; In English; NASA Bioastronautics Workshop, 13-15 Jan. 2003, Galveston, TX, USA; No Copyright; Avail: CASI; A01, Hardcopy

The goal of our research is to better understand the functional relationship between cumulative daily skeletal loading generated by daily activity and the regulation of bone density and bone structure. We have proposed the calcaneus and tibia as useful model bone sites loaded by internal forces in equilibrium with the ground reaction force during gait. The daily history of the ground reaction force is a good relative measure of daily lower limb and calcaneal loading that can be compared to bone density and structure of the calcaneus and cross-sectional geometry of the tibia and fibula. Over the past several years, we have developed image-processing technologies to improve our ability to measure bone density and structure in the calcaneus and lower leg non-invasively with computed tomography and bone densitometry, or DXA. The objective of our current research effort is to determine the accuracy and precision of our CT and DXA image processing methods.
Author
Adaptation; Bones; Tibia; Tomography

20030065286 Air Force Research Lab., Brooks AFB, TX, USA

An Overview of the Utility of Stimulants as a Fatigue Countermeasure for Aviators

Caldwell, John; Feb. 2003; 24 pp.; In English

Contract(s)/Grant(s): Proj-7757

Report No.(s): AD-A413128; AFRL-HE-BR-TR-2003-0024; No Copyright; Avail: CASI; A03, Hardcopy

Sleepiness and fatigue are common in the aviation environment even during peacetime, but during combat, fatigue can reach critical levels due to the necessity for sustained operations and the consequent requirement for lengthy duty schedules. Effective nonpharmacological countermeasures are often difficult to implement in these settings due to the situational demands and the unpredictable nature of war. Thus, during combat, pharmacological countermeasures (stimulants or Go Pills) may represent the only feasible alternative for the maintenance of aviator performance when sleep deprivation is inevitable. Caffeine is a first line choice, but might not be sufficiently effective for long durations or for those who are heavy caffeine users. Modafinil is a new alertness-promoting compound that appears to hold promise for use in military aviation, but is not yet recommended because of a lack of field-oriented aviation research. Dextroamphetamine has been successfully used by the military in past conflicts, and its effectiveness and safety are well established. Commanders, flight surgeons, and individual aviators may wish to examine what has been determined from past research in order to make the best possible decision concerning the appropriateness of Go Pills for future aviation sustained operations.

DTIC

Flight Fatigue; Sleep Deprivation; Warfare; Aircraft Pilots; Countermeasures; Stimulants

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*.

20030064056 University of South Alabama, Mobile, AL, USA

Mathematical Modeling of Food Supply for Long Term Space Missions Using Advanced Life Support

Cruthirds, John E.; National Aeronautics and Space Administration (NASA)/American Society of Engineering Education (ASEE) Summer Faculty Fellowship Program - 2000; March 2003, pp. 1-1 - 1-10; In English; See also 20030064055

Contract(s)/Grant(s): NAG9-867; No Copyright; Avail: CASI; A03, Hardcopy

A habitat for long duration missions which utilizes Advanced Life Support (ALS), the Bioregenerative Planetary Life Support Systems Test Complex (BIO-Plex), is currently being built at JSC. In this system all consumables will be recycled and reused. In support of this effort, a menu is being planned utilizing ALS crops that will meet nutritional and psychological requirements. The need exists in the food system to identify specific physical quantities that define life support systems from an analysis and modeling perspective. Once these quantities are defined, they need to be fed into a mathematical model that takes into consideration other systems in the BIO-Plex. This model, if successful, will be used to understand the impacts of changes in the food system on the other systems and vice versa. The Equivalent System Mass (ESM) metric has been used to describe systems and subsystems, including the food system options, in terms of the single parameter, mass. There is concern that this approach might not adequately address the important issues of food quality and psychological impact on crew morale of a supply of fiesh food items. In fact, the mass of food can also depend on the quality of the food. This summer faculty fellow project will involve creating an appropriate mathematical model for the food plan developed by the Food Processing System for BIO-Plex. The desired outcome of this work will be a quantitative model that can be applied to the various options of supplying food on long-term space missions.

Author

Mathematical Models; Nutritional Requirements; Space Missions; Spacecrews; Life Support Systems

20030064067 Houston Univ.-Clear Lake, Houston, TX, USA

Growth and Metabolism of the Green Alga, Chlorella Pyrenoidosa, in Simulated Microgravity

Mills, W. Ronald; National Aeronautics and Space Administration (NASA)/American Society of Engineering Education (ASEE) Summer Faculty Fellowship Program - 2000; March 2003, pp. 10-1 - 10-14; In English; See also 20030064055; Original contains black and white illustrations

Contract(s)/Grant(s): NAG9-867; No Copyright; Avail: CASI; A03, Hardcopy

The effect of microgravity on living organisms during space flight has been a topic of interest for some time, and a substantial body of knowledge on the subject has accumulated. Despite this, comparatively little information is available

regarding the influence of microgravity on algae, even though it has been suggested for long duration flight or occupancy in space that plant growth systems, including both higher plants and algae, are likely to be necessary for bioregenerative life support systems. High-Aspect-Ratio Rotating-Wall Vessel or HARV bioreactors developed at Johnson Space Center provide a laboratory-based approach to investigating the effects of microgravity on cellular reactions. In this study, the HARV bioreactor was used to examine the influence of simulated microgravity on the growth and metabolism of the green alga, Chlorella pyrenoidosa. After the first 2 days of culture, cell numbers increased more slowly in simulated microgravity than in the HARV gravity control; after 7 days, growth in simulated microgravity was just over half (58\%) that of the gravity control and at 14 days it was less than half (42\%). Chlorophyll and protein were also followed as indices of cell competence and function; as with growth, after 2-3 days, protein and chlorophyll levels were reduced in modeled microgravity compared to gravity controls. Photosynthesis is a sensitive biochemical index of the fitness of photosynthetic organisms; thus, CO2-dependent O2 evolution was tested as a measure of photosynthetic capacity of cells grown in simulated microgravity. When data were expressed with respect to cell number, modeled microgravity appeared to have little effect on CO2 fixation. Thus, even though the overall growth rate was lower for cells cultured in microgravity, the photosynthetic capacity of the cells appears to be unaffected. Cells grown in simulated microgravity formed loose clumps or aggregates within about 2 days of culture, with aggregation increasing over time. Presently, the basis for, or significance of, the cell aggregation is unknown. The results from this study suggest that cell growth and morphological characteristics of green algae may be altered by culture in simulated microgravity. The data obtained to date should provide a solid basis for additional experimentation regarding the influence of modeled microgravity on cell morphology, physiological activity, protein production and possibly gene expression in algal and plant cell systems. The final aim of the study is to provide useful information to elucidate the underlying mechanism for the biological effects of microgravity on cells.
Author
Microgravity; Closed Ecological Systems; Chlorella; Bioreactors; Culture Techniques; Gravitational Effects

20030064279 Embry-Riddle Aeronautical Univ., USA
The Impact of Visor Transmissivity and Reflectivity on Pilot Visual Acuity and Target Acquisition Range
Silva, David W., II; Aug. 2001; 86 pp.; In English
Contract(s)/Grant(s): Proj-7184
Report No.(s): AD-A411608; AFRL-HE-WP-TR-2002-0227; No Copyright; Avail: CASI; A05, Hardcopy

The purpose of this study was to experimentally determine the impact of varying degrees of visor transmissivity and reflectivity on visual acuity. This study measured pilot's target detection range when wearing six different visor configurations: (a) no visor, (b) USAF tinted visor, (c) the Visually Coupled Acquisition and Targeting System (VCATS) 25\% transmissive visor with a 9\% reflective coating, (d) the VCATS 25\% transmissive uncoated visor, (e) the VCATS 35\% transmissive uncoated visor with a 13\% reflective coating. The results of this study showed that detection range decreased as transmissivity was decreased while detection range remained unchanged as reflectivity was increased.
DTIC
Visors; Visual Acuity; Transmissivity; Reflectance; Pilot Performance

20030065222 Army Aeromedical Research Lab., Fort Rucker, AL
Fitting Issues Survey for the AH-64 Integrated Helmet and Display Sighting System
Rash, C.; Stelle, J.; Isaak, M.; Nelson, J.; Archie, S.; Mar. 2003; 130 pp.; In English
Report No.(s): AD-A413136; USAARL-2003-06; No Copyright; Avail: CASI; A07, Hardcopy

The Integrated Helmet and Display Sighting System (IHADSS), employed in the U.S. Army's AH-64 Apache helicopter, is used to present pilotage and targeting imagery and symbology. Therefore, in addition to the standard comfort and protection requirements of a helmet system, the IHADSS must provide a stable optical alignment. Fielded in the early 1950's, the IHADSS is still the Army's only integrated helmet-mounted display (HMD). In an attempt to perform both the standard protective role of a helmet and to serve as a mounting platform for an optical sight, the IHADSS had to make certain design compromises that have resulted in some user satisfaction issues. A joint survey of U.S. and U.K. AH-64 aviators was conducted to identify and quantify these issues. Survey findings indicated that while a majority of aviators found the quality comfort and satisfaction of fit to be acceptable, a significant proportion of aviators have encountered problems associated with obtaining proper helmet size, availability of replacement components, and substantial variation in fitting expertise. Results of this survey can assist in ongoing and future HMD helmet system designs.
DTIC
Ah-64 Helicopter; Helmet Mounted Displays; Aircraft Pilots; Optical Equipment

20030065266 Delaware Univ., Newark, DE, USA
Sensitivity of Spores to Hydrostatic Pressure Mechanisms of Inactivation, Injury and Repair Phase II
Hoover, Dallas G.; Shearer, Adrienne E. H.; Sikes, Anthony; Dunne, C. P.; Mar. 2003; 41 pp.; In English
Contract(s)/Grant(s): DAAK60-95-C-2060
Report No.(s): AD-A413318; NATICK-TR-03/018; No Copyright; Avail: CASI; A03, Hardcopy

Over the past fifteen years, it has been established that high-hydrostatic pressure processing (HPP) has significant potential to function as an effective nonthermal method in the destruction of microorganisms in foods with little effect on the sensory qualities of the food product. However, bacterial endospores are very pressure-resistant and have been shown to require a hurdle approach for inactivation when HPP is employed. This study investigated the inhibitory effect of approved emulsifiers (sucrose esters) in comparison to the widely studied mono-glyceride, monolaurin (Lauricidin) on Bacillus sp., Clostridium sporogenes, and Alicyclobacillus sp. The combined treatments of sucrose laurate, HPP and mild heat were evaluated on spores of Bacillus and Alicyclobacillus in foods. The minimum inhibitory concentrations (MICs) of the sucrose esters were higher for Bacillus, Clostridium, and Alicyclobacillus spp. than of Lauricidin. Sucrose stearates and sucrose palmitate were less effective and less soluble than sucrose laurates. A combined treatment (sucrose laurate L1695 CONCNS 0.1 AND 0.5\%, 392 megaPascals MPa at 45 C for 10 to 15 min) provided 4.5-to 5.5-log(sub 10) CFU/mL reductions from initial populations of 106 CFU/mL for Bacillus subtilis 168 in milk, Bacillus cereus 14579 in beef, Bacillus coagulans 7050 in tomato juice (pH 4.5), Alicyclobacillus sp. N1089 in tomato juice (pH 4.5) and Ali clobacillus s . N1098 in apple juice. DTIC

Spores; Food Processing; Hydrostatic Pressure; Food; Decontamination

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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*.

20030063983 Research Inst. for Advanced Computer Science, Moffett Field, CA, USA
Modified Kneser-Ney Smoothing of n-gram Models
James, Frankie; October 2000; 18 pp.; In English
Report No.(s): RIACS-TR-00.07; No Copyright; Avail: CASI; A03, Hardcopy

This report examines a series of tests that were performed on variations of the modified Kneser Ney smoothing model outlined in a study by Chen and Goodman. We explore several different ways of choosing and setting the discounting parameters, as well as the exclusion of singleton contexts at various levels of the model.
Author

Mathematical Models; Algorithms; Data Smoothing; Independent Variables; Statistical Tests; Revisions

20030064150 NASA Ames Research Center, Moffett Field, CA, USA
Detailed Vibration Analysis of Pinion Gear with Time-Frequency Methods
Mosher, Marianne; Pryor, Anna H.; Lewicki, David G.; June 2003; 44 pp.; In English
Contract(s)/Grant(s): UPN 704-01-32
Report No.(s): NASA/TM-2003-212269; NAS 1.15:212269; No Copyright; Avail: CASI; A03, Hardcopy

In this paper, the authors show a detailed analysis of the vibration signal from the destructive testing of a spiral bevel gear and pinion pair containing seeded faults. The vibration signal is analyzed in the time domain, frequency domain and with four time-frequency transforms: the Short Time Frequency Transform (STFT), the Wigner-Ville Distribution with the Choi-Williams kernel (WV-CW), the Continuous Wavelet' Transform (CWT) and the Discrete Wavelet Transform (DWT). Vibration data of bevel gear tooth fatigue cracks, under a variety of operating load levels and damage conditions, are analyzed using these methods. A new metric for automatic anomaly detection is developed and can be produced from any systematic numerical representation of the vibration signals. This new metric reveals indications of gear damage with all of the time-frequency transforms, as well as time and frequency representations, on this data set. Analysis with the CWT detects changes in the signal at low torque levels not found with the other transforms. The WV-CW and CWT use considerably more resources than the STFT and the DWT. More testing of the new metric is needed to determine its value for automatic anomaly detection and to develop fault detection methods for the metric.
Author

Vibration; Anomalies; Bevel Gears; Destructive Tests; Kernel Functions

20030064217 Institut des Hautes Etudes Scientifiques, Bures-sur-Yvette
Cyclic Cohomology, Quantum Group Symmetries and the Local Index Formula for SU(sub q)(2)
Connes, A.; Sep. 2002; 64 pp.; In English
Report No.(s): PB2003-104820; IHES/M/02/68; Copyright; Avail: National Technical Information Service (NTIS)

The authors analyze the NC-space underlying the quantum group SU(sub q)(2) from the spectral point of view which is the basis of noncommutative geometry, and show how the general theory developed in the authors' joint work with H. Moscovici applies to the specific spectral triple defined by Chakraborty and Pal. This provides the pseudo-differential calculus, the Wodzciki-type residue, and the local cyclic cocycle giving the index formula. The cochain whose coboundary is the difference between the original Chern character and the local one is given by the remainders in the rational approximation of the logarithmic derivative of the Dedekind eta function. This specific example allows the authors to illustrate the general notion of locality in NCG.
NTIS
Differential Calculus; Symmetry; Approximation; Geometry

20030064218 Institut des Hautes Etudes Scientifiques, Bures-sur-Yvette
E(sub 10) and a 'Small Tension Expansion' of M Theory
Damour, T.; Henneaux, M.; Nicolai, H.; Jul. 2002; 10 pp.; In English
Report No.(s): PB2003-104821; IHES/P/02/48; No Copyright; Avail: CASI; A02, Hardcopy

A formal 'small tension' expansion of D=11 supergravity near a spacelike singularity is shown to be equivalent, at least up to 30th order in height, to a null geodesic motion in the infinite dimensional coset space E(sub 10)/K(E(sub 10)), where K(E(sub 10)) is the maximal compact subgroup of the hyperbolic Kac-Moody group E(sub 10)(R). For the proof the authors make use of a novel decomposition of E(sub 10) into irreducible representations of its SL(10, R) subgroup. The authors explicitly show how to identify the first four rungs of the (E(sub 10)) coset fields with the values of geometric quantities constructed from D = 11 supergravity fields and their spatial gradients taken at some commoving special point.
NTIS
Supergravity; String Theory; Theoretical Physics

20030064337 Technische Univ., Delft, Netherlands
Numerical Modelling of Stationary and Static Electric and Magnetic Fields
Lager, I. E.; Dec. 1998; 70 pp.; In English
Report No.(s): PB2003-104362; ET/EM-1998-32; Copyright; Avail: National Technical Information Service (NTIS)

A global analysis of numerical methods aimed at the direct computation of the field quantities in case of stationary and static electromagnetic fields is presented. The examined numerical methods allow similar computer code implementations around general purpose, finite element software kernel. The fundamentally different character of the methods is a direct consequence of the different interpretation given to the field quantities and of the choices made for their discretization.
NTIS
Numerical Analysis; Electromagnetic Fields; Magnetostatic Fields; Kernel Functions

20030064407 California Univ., Lawrence Livermore Lab., Livermore, CA, USA
User Documentation for SensIDA, A Variant of IDA for Sensitivity Analysis
Lee, S. L.; Hindmarsh, A. C.; Oct. 08, 2001; 44 pp.; In English
Report No.(s): DE2003-15003403; UCRL-MA-145712; No Copyright; Avail: Department of Energy Information Bridge

SensIDA and IDA are general-purpose codes for solving differential-algebraic equation (DAE) initial value problems. SensIDA is a variant of IDA that includes options for simultaneously computing the DAE solution together with its first-order sensitivity coefficients with respect to model parameters. SensIDA is written in ANSI-standard C and it is mainly based on IDA, DASPK3.0, and SensPVODE. IDA is based on DASPK2.0. DASPK3.0 is a Fortran77 code for the sensitivity analysis of DAE initial value problems. SensPVODE is a sensitivity analysis variant of the parallel ordinary differential equation solver PVODE.
NTIS
Differential Equations; Sensitivity Analysis; Algebra; Computer Programs

20030065241 Eidgenoessische Technische Hochschule, Zurich, Switzerland
On the Instability of Methods for the Integration of Ordinary Differential Equations
Rutishauser, Heinz; ZAMP, Kurze Mitteilungen; April 1956; Volume 3, pp. 65-74; In English
Report No.(s): NACA-TM-1403; No Copyright; Avail: CASI; A03, Hardcopy

Examples and a criterion for stability of integration methods is provided. The criterion is applied to well-known integration formulas.
Author
Differential Equations; Stability

20030065245 National Advisory Committee for Aeronautics. Langley Aeronautical Lab., Langley Field, VA, USA
On the Calculation of Shallow Shells
Ambartsumyan, S. A.; Prikladnaya Matematika i Mekhanika; December 1956; Volume 11, pp. 527-532; In English
Report No.(s): NACA-TM-1425; No Copyright; Avail: CASI; A03, Hardcopy

This paper considers a sufficiently thin shallow shell of nonzero Gaussian curvature. It also presents a system of symmetrically constructed differential equations, constructed by the mixed method through the stress function and the displpacement function.
CASI
Thin Walled Shells; Stress Functions; Differential Equations

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COMPUTER OPERATIONS AND HARDWARE

Includes hardware for computer graphics, firmware and data processing. For components see *33 Electronics and Electrical Engineering*. For computer vision see *63 Cybernetics, Artificial Intelligence and Robotics*.

20030063098 Winston-Salem State Univ., Winston-Salem, NC, USA
P2P Technology for High-Performance Computing: An Overview
Follen, Gregory J., Technical Monitor; Berry, Jason; HBCUs/OMUs Research Conference Agenda and Abstracts; February 2003, pp. 33; In English; See also 20030063082; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The transition from cluster computing to peer-to-peer (P2P) high-performance computing has recently attracted the attention of the computer science community. It has been recognized that existing local networks and dedicated clusters of headless workstations can serve as inexpensive yet powerful virtual supercomputers. It has also been recognized that the vast number of lower-end computers connected to the Internet stay idle for as long as 90\% of the time. The growing speed of Internet connections and the high availability of free CPU time encourage exploration of the possibility to use the whole Internet rather than local clusters as massively parallel yet almost freely available P2P supercomputer. As a part of a larger project on P2P high-performance computing, it has been my goal to compile an overview of the 2P2 paradigm. I have studied various P2P platforms and I have compiled systematic brief descriptions of their most important characteristics. I have also experimented and obtained hands-on experience with selected P2P platforms focusing on those that seem promising with respect to P2P high-performance computing. I have also compiled relevant literature and web references. I have prepared a draft technical report and I have summarized my findings in a poster paper.
Author
Parallel Processing (Computers); Supercomputers; General Overviews; Technology Utilization

20030064385 Fermi National Accelerator Lab., Batavia, IL, USA, European Organization for Nuclear Research, Geneva, Switzerland
Large Scale Cluster Computing Workshop
Silverman, A.; Skow, D.; 2001; 10 pp.; In English
Report No.(s): DE2003-806223; FERMILAB-CONF-01/255-E; CERN-IT-2001-006; No Copyright; Avail: Department of Energy Information Bridge

Recent revolutions in computer hardware and software technologies have paved the way for the large-scale deployment of clusters of commodity computers to address problems heretofore the domain of tightly coupled SMP processors. Near term projects within High Energy Physics and other computing communities will deploy clusters of scale 1000s of processors and be used by 1000s of independent users. This will expand the reach in both dimensions by an order of magnitude from the current successful production facilities.
NTIS
Computer Programs; Software Engineering; High Energy Interactions

20030065160 NASA Marshall Space Flight Center, Huntsville, AL, USA

Infrared Database for Process Support Materials

Bennett, K. E.; Boothe, R. E.; Burns, H. D.; June 2003; 20 pp.; In English

Report No.(s): NASA/TM-2003-212503; NAS 1.15:212503; M-1078; No Copyright; Avail: CASI; A03, Hardcopy

Process support materials' compatibility with cleaning processes is critical to ensure final hardware cleanliness and that performance requirements are met. Previous discovery of potential contaminants in process materials shows the need for incoming materials testing and establishment of a process materials database. The Contamination Control Team of the Materials, Processes, and Manufacturing (MP&M) Department at Marshall Space Flight Center (MSFC) has initiated the development of such an infrared (IR) database, called the MSFC Process Materials IR database, of the common process support materials used at MSFC. These process support materials include solvents, wiper cloths, gloves, bagging materials, etc. Testing includes evaluation of the potential of gloves, wiper cloths, and other items to transfer contamination to handled articles in the absence of solvent exposure, and the potential for solvent exposure to induce material degradation. This Technical Memorandum (TM) summarizes the initial testing completed through December 2002. It is anticipated that additional testing will be conducted with updates provided in future TMs.Materials were analyzed using two different IR techniques: (1) Dry transference and (2) liquid extraction testing. The first of these techniques utilized the Nicolet Magna 750 IR spectrometer outfitted with a horizontal attenuated total reflectance (HATR) crystal accessory. The region from 650 to 4,000 wave numbers was analyzed, and 50 scans were performed per IR spectrum. A dry transference test was conducted by applying each sample with hand pressure to the HATR crystal to first obtain a spectrum of the parent material. The material was then removed from the HATR crystal and analyzed to determine the presence of any residues. If volatile, liquid samples were examined both prior to and following evaporation.The second technique was to perform an extraction test with each sample in five different solvents.Once the scans were complete for both the dry transference and the extraction tests, the residue from each scan was interpreted.

Author

Data Bases; Infrared Spectra; Compatibility; Solvent Extraction; Cleanliness; Exposure; Contamination

20030065239

Knowledge Desk Limited Objective Experiment (LOE)

Oonk, H. M.; Schermerhorn, J. H.; Glaser, D.; Morrison, J. G.; Mar. 2003; 51 pp.; In English; Original contains color illustrations

Report No.(s): AD-A413070; SSC-TR-1896; No Copyright; Avail: CASI; A04, Hardcopy

Multiple monitor workstations are becoming more and more common in the military command and control environment due to the requirement to monitor and access large quantities of information while performing complex tasks and making complex decisions. The Office of Naval Research (ONR) sponsored Command 21 project addressed this requirement by developing a six-monitor display designed to facilitate information production and consumption by an individual user. Known as a Knowledge Desk (K-Desk), these displays were employed during several wargames as well as aboard ships to support command-level decision-making in operational command centers. Although the value of having additional monitors has been widely acknowledged, the question of how many monitors the warfighter really needs to support his/her various tasks (cognitive and otherwise) remains unanswered. To address that question, a Limited Objective Experiment (LOE) was conducted that assessed the relative costs and benefits of different display configurations from a performance standpoint. The results of the LOE provided recommendations that relate to requirements for future Fleet procurements and installations.

DTIC

Display Devices; Command And Control; Monitors

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COMPUTER PROGRAMMING AND SOFTWARE

Includes software engineering, computer programs, routines, algorithms, and specific applications, e.g., CAD/CAM. For computer software applied to specific applications, see also the associated category.

20030053058 Aerospace Corp., Los Angeles, CA, USA

The NASA/GSFC Advanced Data Grid: A Prototype for Future Earth Science Ground System Architectures

Gasster, Samuel D.; Lee, Craig; Davis, Brooks; Clark, Matt; AuYeung, Mike; Wilson, John R.; Ladwig, Debra M.; [2003]; 23 pp.; In English; Ground System Architectures Workshop, 4-6 Mar. 2003, Manhattan Beach, CA, USA; Original contains black and white illustrations; Copyright; Avail: CASI; A03, Hardcopy

Contents include the following: Background and motivation. Grid computing concepts. Advanced data grid (ADG) prototype development. ADG requirements and operations concept. ADG architecture. ADG implementation. ADG test plan. ADG schedule. Summary and status.
CASI
Architecture (Computers); Data Bases; Earth Sciences; Computational Grids

20030063090 Winston-Salem State Univ., Winston-Salem, NC, USA
Generic Divide and Conquer Internet-Based Computing
Follen, Gregory J., Technical Monitor; Radenski, Atanas; HBCUs/OMUs Research Conference Agenda and Abstracts; February 2003, pp. 32; In English; See also 20030063082; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The growth of Internet-based applications and the proliferation of networking technologies have been transforming traditional commercial application areas as well as computer and computational sciences and engineering. This growth stimulates the exploration of Peer to Peer (P2P) software technologies that can open new research and application opportunities not only for the commercial world, but also for the scientific and high-performance computing applications community. The general goal of this project is to achieve better understanding of the transition to Internet-based high-performance computing and to develop solutions for some of the technical challenges of this transition. In particular, we are interested in creating long-term motivation for end users to provide their idle processor time to support computationally intensive tasks. We believe that a practical P2P architecture should provide useful service to both clients with high-performance computing needs and contributors of lower-end computing resources. To achieve this, we are designing dual -service architecture for P2P high-performance divide-and conquer computing; we are also experimenting with a prototype implementation. Our proposed architecture incorporates a master server, utilizes dual satellite servers, and operates on the Internet in a dynamically changing large configuration of lower-end nodes provided by volunteer contributors. A dual satellite server comprises a high-performance computing engine and a lower-end contributor service engine. The computing engine provides generic support for divide and conquer computations. The service engine is intended to provide free useful HTTP-based services to contributors of lower-end computing resources. Our proposed architecture is complementary to and accessible from computational grids, such as Globus, Legion, and Condor. Grids provide remote access to existing higher-end computing resources; in contrast, our goal is to utilize idle processor time of lower-end Internet nodes. Our project is focused on a generic divide and conquer paradigm and on mobile applications of this paradigm that can operate on a loose and ever changing pool of lower-end Internet nodes.
Author
Internets; Software Engineering; Technology Utilization; Computer Networks

20030063946 NASA Marshall Space Flight Center, Huntsville, AL, USA
Technology for a NASA Space-Based Science Operations Grid
Bradford, Robert N.; Redman, Sandra H.; [2003]; 15 pp.; In English; Spring 2003 Internet2 Member Meeting, 9-11 Apr. 2003, Arlington, VA, USA; Copyright; Avail: CASI; A03, Hardcopy

This viewgraph representation presents an overview of a proposal to develop a space-based operations grid in support of space-based science experiments. The development of such a grid would provide a dynamic, secure and scalable architecture based on standards and next-generation reusable software and would enable greater science collaboration and productivity through the use of shared resources and distributed computing. The authors propose developing this concept for use on payload experiments carried aboard the International Space Station. Topics covered include: grid definitions, portals, grid development and coordination, grid technology and potential uses of such a grid.
CASI
Space Shuttle Payloads; Spaceborne Experiments; Computer Networks; Architecture (Computers); Computer Systems Design; Space Communication

20030063968 QSS Group, Inc., Moffett Field, CA, USA
Simulation-Based Verification of Livingstone Applications
Lindsey, Anthony E.; Pecheur, Charles; May 07, 2003; 5 pp.; In English; 2003 Dependable Systems and Networks Workshop on Model Checking for Dependable Software-Intensive Systems, 2003; No Copyright; Avail: CASI; A01, Hardcopy

AI software is viewed as a means to give greater autonomy to automated systems, capable of coping with harsh and unpredictable environments in deep space missions. Autonomous systems pose a serious challenge to traditional test-based

verification approaches, because of the enormous space of possible situations that they aim to address. Before these systems are put in control of critical applications, appropriate new verification approaches need to be developed. This article describes Livingstone PathFinder (LPF), a verification tool for autonomous diagnosis applications based on NASA's Livingstone model-based diagnosis system. LPF applies state space exploration algorithms to an instrumented testbed, consisting of the Livingstone diagnosis system embedded in a simulated operating environment. The article describes different facets of LPF and reports some experimental results from applying LPF to a Livingstone model of the main propulsion feed subsystem of the X-34 space vehicle. This paper describes Livingstone PathFinder (LPF), a verification tool for autonomous diagnosis applications based on NASA's Livingstone model-based diagnosis system. LPF applies state space exploration algorithms to an instrumented testbed, consisting of the Livingstone diagnosis system embedded in a simulated operating environment. Section 2 provides an overview of Livingstone; Section 3 describes the LPF architecture; Section 4 discusses its applicability; Section 5 reviews some experimental results; Section 6 compares LPF to related verification approaches; Section 7 draws conclusions and discusses some perspectives.
Author
Computerized Simulation; Program Verification (Computers); Automatic Control; Architecture (Computers); Applications Programs (Computers); Software Engineering

20030064014
[Earth and Space Sciences Project Services for NASA HPCC]
Merkey, Phillip; July 2002; 5 pp.; In English
Contract(s)/Grant(s): NAG5-8796; No Copyright; Avail: CASI; A01, Hardcopy

This grant supported the effort to characterize the problem domain of the Earth Science Technology Office's Computational Technologies Project, to engage the Beowulf Cluster Computing Community as well as the High Performance Computing Research Community so that we can predict the applicability of said technologies to the scientific community represented by the CT project and formulate long term strategies to provide the computational resources necessary to attain the anticipated scientific objectives of the CT project. Specifically, the goal of the evaluation effort is to use the information gathered over the course of the Round-3 investigations to quantify the trends in scientific expectations, the algorithmic requirements and capabilities of high-performance computers to satisfy this anticipated need.
Author
Aerospace Engineering; Earth Sciences; NASA Space Programs; Software Engineering; Computer Networks

20030064022 NASA Marshall Space Flight Center, Huntsville, AL, USA
Development Status of the Phantom Code for Turbomachinery
Dorney, D. J.; Sondak, D. L.; [2003]; 56 pp.; In English; NASA/MSFC Spring Fluids Workshop, 22-24 Apr. 2003, Birmingham, AL, USA; Copyright; Avail: CASI; A04, Hardcopy

Contents include the following: Motivation. Code details. Test cases: aardvark (2D), phantom (3D). Algorithm basics. New feature I, II, and III. UTRC LSRR 1 - 1/2 stage turbine. Supersonic turbine. UTRC LSRR single-stage turbine. LOX elbow duct. Computational grid. High-pressure fuel pump inducer. Development plan. Summary. Appendix - Background.
CASI
Computational Grids; Fuel Pumps; Turbomachinery

20030064036 Research Inst. for Advanced Computer Science, Moffett Field, CA, USA
Synthesizing Certified Code
Whalen, Michael; Schumann, Johann; Fischer, Bernd; March 2002; 13 pp.; In English; Original contains black and white illustrations
Contract(s)/Grant(s): NCC2-1006
Report No.(s): RIACS-TR-02.03; Copyright; Avail: CASI; A03, Hardcopy

Code certification is a lightweight approach to demonstrate software quality on a formal level. Its basic idea is to require producers to provide formal proofs that their code satisfies certain quality properties. These proofs serve as certificates which can be checked independently. Since code certification uses the same underlying technology as program verification, it also requires many detailed annotations (e.g., loop invariants) to make the proofs possible. However, manually adding theses annotations to the code is time-consuming and error-prone. We address this problem by combining code certification with automatic program synthesis. We propose an approach to generate simultaneously, from a high-level specification, code and all annotations required to certify generated code. Here, we describe a certification extension of AUTOBAYES, a synthesis

tool which automatically generates complex data analysis programs from compact specifications. AUTOBAYES contains sufficient high-level domain knowledge to generate detailed annotations. This allows us to use a general-purpose verification condition generator to produce a set of proof obligations in first-order logic. The obligations are then discharged using the automated theorem E-SETHEO. We demonstrate our approach by certifying operator safety for a generated iterative data classification program without manual annotation of the code.
Author
Computer Programs; Program Verification (Computers); Certification; Classifications; Proving

20030064037 Research Inst. for Advanced Computer Science, Moffett Field, CA, USA
Addressing Dynamic Issues of Program Model Checking
Lerda, Flavio; Visser, Willem; March 2001; 25 pp.; In English; 8th International SPIN Workshop, 19-20 May 2001, Toronto, Canada; Original contains black and white illustrations
Contract(s)/Grant(s): NCC2-1006
Report No.(s): RIACS-TR-01.05; Copyright; Avail: CASI; A03, Hardcopy

Model checking real programs has recently become an active research area. Programs however exhibit two characteristics that make model checking difficult: the complexity of their state and the dynamic nature of many programs. Here we address both these issues within the context of the Java PathFinder (JPF) model checker. Firstly, we will show how the state of a Java program can be encoded efficiently and how this encoding can be exploited to improve model checking. Next we show how to use symmetry reductions to alleviate some of the problems introduced by the dynamic nature of Java programs. Lastly, we show how distributed model checking of a dynamic program can be achieved, and furthermore, how dynamic partitions of the state space can improve model checking. We support all our findings with results from applying these techniques within the JPF model checker.
Author
Software Reliability; Computer Programs; Java (Programming Language); Reliability Analysis; Computer Programming; Coding; Protocol (Computers)

20030064048 Research Inst. for Advanced Computer Science, Moffett Field, CA, USA
Efficient Translation of LTL Formulae into Buchi Automata
Giannakopoulou, Dimitra; Lerda, Flavio; June 2001; 19 pp.; In English
Contract(s)/Grant(s): NCC2-1006
Report No.(s): RIACS-TR-01.29; Copyright; Avail: CASI; A03, Hardcopy

Model checking is a fully automated technique for checking that a system satisfies a set of required properties. With explicit-state model checkers, properties are typically defined in linear-time temporal logic (LTL), and are translated into B chi automata in order to be checked. This report presents how we have combined and improved existing techniques to obtain an efficient LTL to B chi automata translator. In particular, we optimize the core of existing tableau-based approaches to generate significantly smaller automata. Our approach has been implemented and is being released as part of the Java PathFinder software (JPF), an explicit state model checker under development at the NASA Ames Research Center.
Author
Automata Theory; Temporal Logic; Algorithms; Linearity; Mathematical Models; Translating

20030064060 Vanderbilt Univ., Nashville, TN, USA
Design Through Manufacturing: The Solid Model - Finite Element Analysis Interface
Rubin, Carol; National Aeronautics and Space Administration (NASA)/American Society of Engineering Education (ASEE) Summer Faculty Fellowship Program - 2000; March 2003, pp. 14-1 - 14-13; In English; See also 20030064055; Original contains black and white illustrations
Contract(s)/Grant(s): NAG9-867; No Copyright; Avail: CASI; A03, Hardcopy

State-of-the-art computer aided design (CAD) presently affords engineers the opportunity to create solid models of machine parts which reflect every detail of the finished product. Ideally, these models should fulfill two very important functions: (1) they must provide numerical control information for automated manufacturing of precision parts, and (2) they must enable analysts to easily evaluate the stress levels (using finite element analysis - FEA) for all structurally significant parts used in space missions. Today's state-of-the-art CAD programs perform function (1) very well, providing an excellent model for precision manufacturing. But they do not provide a straightforward and simple means of automating the translation from CAD to FEA models, especially for aircraft-type structures. The research performed during the fellowship period

investigated the transition process from the solid CAD model to the FEA stress analysis model with the final goal of creating an automatic interface between the two. During the period of the fellowship a detailed multi-year program for the development of such an interface was created. The ultimate goal of this program will be the development of a fully parameterized automatic ProE/FEA translator for parts and assemblies, with the incorporation of data base management into the solution, and ultimately including computational fluid dynamics and thermal modeling in the interface.
Author
Finite Element Method; Computer Aided Design; Computer Programs; Information Transfer

20030064069 Texas A&M Univ., Galveston, TX, USA
Development and Engineering Design in Support of 'Rover Ranch': A K-12 Outreach Software Project
Pascali, Raresh; National Aeronautics and Space Administration (NASA)/American Society of Engineering Education (ASEE) Summer Faculty Fellowship Program - 2000; March 2003, pp. 12-1 - 12-7; In English; See also 20030064055; Original contains black and white illustrations
Contract(s)/Grant(s): NAG9-867; No Copyright; Avail: CASI; A02, Hardcopy

A continuation of the initial development started in the summer of 1999, the body of work performed in support of 'ROVer Ranch' Project during the present fellowship dealt with the concrete concept implementation and resolution of the related issues. The original work performed last summer focused on the initial examination and articulation of the concept treatment strategy, audience and market analysis for the learning technologies software. The presented work focused on finalizing the set of parts to be made available for building an AERCam Sprint type robot and on defining, testing and implementing process necessary to convert the design engineering files to VRML files. Through reverse engineering, an initial set of mission critical systems was designed for beta testing in schools. The files were created in ProEngineer, exported to VRML 1.0 and converted to VRML 97 (VRML 2.0) for final integration in the software. Attributes for each part were assigned using an in-house developed JAVA based program. The final set of attributes for each system, their mutual interaction and the identification of the relevant ones to be tracked, still remain to be decided.
Author
Software Engineering; Computer Programs; Education; Robotics

20030064181 L-3 Communications Corp., New York, NY, USA
National Institute of Justice (NIJ) Center Requirements Definition, Technical Assistance, and Analysis
Frantz, Frederick K.; Feb. 2003; 21 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F30602-97-D-0070; Proj-NIJR
Report No.(s): AD-A412657; AFRL-IF-RS-TR-2003-31; No Copyright; Avail: CASI; A03, Hardcopy

The mission of the National Law Enforcement and Corrections Technology Center - Northeast Region (NLECTC-NE), in conjunction with the Air Force Research Laboratory/Information Directorate (AFRL/IF), is to facilitate the identification, development, and adoption of new products and technologies specifically designed for law enforcement, corrections, and other criminal justice applications. The current technology thrust areas for the Northeast Region are Concealed Weapons Detection, Secure Communications, Computer Forensics, Information Management, AGILE, and various technical assistance projects. This report outlines the major accomplishments of the NLECTC-NE under the L-3 Analytics Task Ordering Contract (TOC), and identifies on-going technology efforts. These accomplishments include outreach activities, scientific and engineering assistance, AGILE development and technology demonstration activities, cyber crime initiatives, and Integrated Border Enforcement Teams (IBET) technology support.
DTIC
Applications Programs (Computers); Law (Jurisprudence); Police

20030064186 Research Inst. for Advanced Computer Science, Moffett Field, CA, USA, NASA Ames Research Center, Moffett Field, CA, USA
Practical Formal Verification of Diagnosability of Large Models via Symbolic Model Checking
Cavada, Roberto; Pecheur, Charles; January 2003; 17 pp.; In English
Contract(s)/Grant(s): NAS2-00065; NCC2-1006
Report No.(s): RIACS-TR-03.03; Copyright; Avail: CASI; A03, Hardcopy

This document reports on the activities carried out during a four-week visit of Roberto Cavada at the NASA Ames Research Center. The main goal was to test the practical applicability of the framework proposed, where a diagnosability problem is reduced to a Symbolic Model Checking problem. Section 2 contains a brief explanation of major techniques

currently used in Symbolic Model Checking, and how these techniques can be tuned in order to obtain good performances when using Model Checking tools. Diagnosability is performed on large and structured models of real plants. Section 3 describes how these plants are modeled, and how models can be simplified to improve the performance of Symbolic Model Checkers. Section 4 reports scalability results. Three test cases are briefly presented, and several parameters and techniques have been applied on those test cases in order to produce comparison tables. Furthermore, comparison between several Model Checkers is reported. Section 5 summarizes the application of diagnosability verification to a real application. Several properties have been tested, and results have been highlighted. Finally, section 6 draws some conclusions, and outlines future lines of research.
Derived from text
Program Verification (Computers); Mathematical Models; Heuristic Methods; Symbolic Programming

20030064229 Daresbury Nuclear Physics Lab., UK
Mixed MPI. OpenMP Programming: A Study in Parallelisation of a CFD Multiblock
Fowler, R. F.; Greenough, C.; Apr. 2003; 26 pp.; In English
Report No.(s): PB2003-104824; RAL-TR-2003-012; Copyright; Avail: National Technical Information Service (NTIS)
Two of the most common and best standardized methods for parallel coding of scientific and engineering applications are OpenMP and MPI. OpenMP is now widely supported on shared memory systems while MPI is available on almost all distributed and shared memory machines. With the advent of more machines that combine both shared and distributed memory architectures it is becoming more common to combine both techniques in a single application. In this report the authors look at a simple case study of the parallelization of a multiblock CFD code using both methods. The objective was to rapidly add some parallelism to an existing serial code to exploit a small Beowulf cluster of dual processor PC nodes. It is shown that combining both techniques can yield better performance than either method on its own, without much additional work in code and algorithm restructuring.
NTIS
Parallel Processing (Computers); Parallel Programming; Architecture (Computers); Distributed Memory

20030064248 Sandia National Labs., Albuquerque, NM
Development of a Java-Based Tool for Multifidelity Modeling of Coupled Systems: LDRD
Gardner, D. R.; Castro, J. P.; Hennigan, G. L.; Gonzales, M. A.; Young, M. F.; Nov. 14, 2002; In English
Report No.(s): DE2003-805874; SAND2002-3783; No Copyright; Avail: National Technical Information Service (NTIS)
This report describes research and development of methods to couple vastly different subsystems and physical models and to encapsulate these methods in a JavaTM-based framework. The work described here focused on developing a capability to enable design engineers and safety analysts to perform multifidelity, multiphysics analyses more simply. In particular this report describes a multifidelity algorithm for thermal radiative heat transfer and illustrates its performance. Additionally, it describes a module-based computer software architecture that facilitates multifidelity, multiphysics simulations. The architecture is currently being used to develop an environment for modeling the effects of radiation on electronic circuits in support of the FY 2003 Hostile Environments Milestone for the Accelerated Strategic Computing Initiative.
NTIS
Java (Programming Language); Design Analysis

20030064338 Technische Univ., Delft, Netherlands
User's Guide for threeArray The C + + Template for 3D Vector Operations
Lager, I.; Mur, G.; Jun. 1999; 64 pp.; In English
Report No.(s): PB2003-104363; ET/EM-1999-11; Copyright; Avail: National Technical Information Service (NTIS)
The library is delivered as a compilable C++ source code. The user has unrestricted access to the source code and can modify it according to her or his requirements. The library is provided 'as is' without warranty of any kind. The authors make no warranties, express or implied, that it is free of error. The authors disclaim all liability for direct, indirect, or consequential damages resulting from the use of the library. The libraries described in this guide were written in order to enable the construction of complex expressions involving scalars, 3-dimensional vectors and/or 3 X 3 matrices, by using the standard mathematical notation and in a manner which is consistent with the algebra of the vector space of 3-dimensional real/complex vectors and 3 X 3 real/complex matrices.
NTIS
Vector Spaces; C++ (Programming Language); Matrices (Mathematics)

20030064375 Department of Energy, Richland, WA, USA, California Univ., Lawrence Berkeley National Lab., Berkeley, CA, USA

Creating Science-Driven Computer Architecture: A New Path to Scientific Leadership

Oct. 10, 2002; In English

Report No.(s): DE2003-806195; No Copyright; Avail: National Technical Information Service (NTIS)

The purpose of the new program proposed here is to bring into existence a new class of computational capability in the USA that is optimal for science. In recent years scientific computing has increasingly become dependent on hardware that is designed and optimized for commercial applications. However, while science in this country has benefited from the improvements in computers that derive from advances in microprocessors following Moores Law, a strategy of relying on machines optimized primarily for business applications has handicapped American science. The performance of the recently completed Earth Simulator in Japan exposed the seriousness of this problem in the critical arena of American scientific supercomputing. Typical scientific applications are now able to extract only 5 to 10 percent of the power of supercomputers essentially built from commercial web and data servers. By contrast, the design of the Earth Simulator makes 30 to 50 percent of its power accessible to the majority of types of scientific calculations. The combination of its 40 trillion operations per second and its optimization for scientific computing gives researchers using it a clear advantage over those without access to such capability.

NTIS

Architecture (Computers); Computer Systems Performance; Microprocessors

20030064429 Aristotle Univ. of Thessaloniki, Greece

WAP-Based Personalised Health Care Services

Petsas, S.; Tzovaras, D.; Makris, L.; Strintzis, M. G.; Oct. 25, 2001; 5 pp.; In English; Original contains color illustrations

Report No.(s): AD-A411676; No Copyright; Avail: CASI; A01, Hardcopy

This paper presents a new approach in the field of mobile access to web-based health-care services, Specifically, a web-based health-care system was designed and implemented to support not only web-access but also mobile access through the use of the WAP protocol. Personalized access to the system is also supported in both Web and WAP based access tools, Application screenshots of the developed application are presented in the results section of the paper.

DTIC

Wide Area Networks; Medical Services

20030064452 Lawrence Livermore National Lab., Livermore, CA

Multi-Programmatic and Institutional Computing Capacity Resource Attachment 2 Statement of Work

Seager, M.; Apr. 15, 2002; 70 pp.; In English

Report No.(s): DE2003-15002965; UCRL-CR-148022; No Copyright; Avail: Department of Energy Information Bridge

Lawrence Livermore National Laboratory (LLNL) has identified high-performance computing as a critical competency necessary to meet the goals of LLNL's scientific and engineering programs. Leadership in scientific computing demands the availability of a stable, powerful, well-balanced computational infrastructure, and it requires research directed at advanced architectures, enabling numerical methods and computer science. To encourage all programs to benefit from the huge investment being made by the Advanced Simulation and Computing Program (ASCI) at LLNL, and to provide a mechanism to facilitate multi-programmatic leveraging of resources and access to high-performance equipment by researchers, M&IC was created. The Livermore Computing (LC) Center, a part of the Computations Directorate Integrated Computing and Communications (ICC) Department can be viewed as composed of two facilities, one open and one secure. This acquisition is focused on the M&IC resources in the Open Computing Facility (OCF). For the M&IC program, recent efforts and expenditures have focused on enhancing capacity and stabilizing the TeraCluster 2000 (TC2K) resource.

NTIS

Architecture (Computers); Computers; Computer Programming; Software Engineering

20030064453 Lawrence Livermore National Lab., Livermore, CA

Multi-Programmatic and Institutional Computing Capacity Resource Attachment 3 Proposal Evaluation and Proposal Preparation Instructions

Seager, M.; Apr. 15, 2002; 22 pp.; In English

Report No.(s): DE2003-15002966; UCRL-CR-148020; No Copyright; Avail: Department of Energy Information Bridge

Table of Contents: Proposal evaluation; General proposal information; Technical proposal (Volume I); Business proposals

(Volume II); Price proposal (Volume III) and Other Documents (Volume IV).
NTIS
Computerized Simulation; Computer Programming; Computers; Software Engineering

20030064455 Lawrence Livermore National Lab., Livermore, CA, USA
SUNDIALS: Suite of Nonlinear/DIfferental/ALge Braic Equation Solvers
Hindmarsh, A. C.; Aug. 01, 2002; 36 pp.; In English
Report No.(s): DE2003-15002968; UCRL-JC-149711; No Copyright; Avail: Department of Energy Information Bridge
No abstract available
NTIS
Differential Equations; Nonlinearity; Algebra; Computer Programming

20030064468 Rennes Univ., France
3D Reconstruction and Morphological Quantization of a Human Embryo Heart for the Validation of a Virtual Model
Dillenseger, J. -L.; Schleich, J. -M.; Oct. 25, 2001; 3 pp.; In English; Original contains color illustrations
Report No.(s): AD-A411225; No Copyright; Avail: CASI; A01, Hardcopy
This paper will present the methodology used for the reconstruction of a human 13 Weeks of Age (WOA) embryo heart. This reconstructed heart is visualized and some quantitative measurements are performed in order to allow the validation of a virtual computer generated heart model.
DTIC
Embryos; Heart; Morphology; Three Dimensional Models; Image Reconstruction

20030064904 Fluor Daniel Hanford, Inc., Richland, WA, USA
Honeywell Modular Automation System Computer Software Documentation for the Magnesium Hydroxide Precipitation Process
Stubbs, A. M.; January 2001; 114 pp.; In English
Report No.(s): DE2003-806015; No Copyright; Avail: Department of Energy Information Bridge
The purpose of this Computer Software Document (CSWD) is to provide configuration control of the Honeywell Modular Automation System (MAS) in use at the Plutonium Finishing Plant (PFP) for the Magnesium Hydroxide Precipitation Process in Rm 23OC/234-52. This CSWD describes hardware and PFP/FFS developed software for control of Magnesium Hydroxide Precipitation process located in room 230, 234-52. The Honeywell and Plant Scape software generate limited configuration reports for the developed control software. These reports are described in the following section and are attached as addendum's. This plan applies to PFP Engineering Manager, Thermal Stabilization Cognizant Engineers, Solutions Stabilization Engineers, and the Shift Technical Advisors responsible for the Honeywell MAS software/hardware and administration of the Honeywell System.
NTIS
Computer Systems Programs; Configuration Management; Magnesium; Hydroxides; Precipitation (Chemistry)

20030065103 Army Research Inst. for the Behavioral and Social Sciences, Alexandria, VA
Measurement Methods for Human Performance in Command and Control Simulation Experiments
Sanders, William R.; Apr. 2003; 51 pp.; In English
Contract(s)/Grant(s): Proj-2O262785A790
Report No.(s): AD-A413273; ARI-RN-2003-11; No Copyright; Avail: CASI; A04, Hardcopy
The U.S. Army's proposed Future Combat System of Systems (FCS) will include automated Command and Control (C2) capabilities that will allow tactical commanders, assisted by a small command group, to effectively lead a future force composed of large numbers of manned and robotic elements. This paper describes research conducted by the U.S. Army Research Institute (ARI) to develop measurement methods to enhance the existing Human Functional Analysis (HFA) approach (Sanders, Lickteig, 2002) for estimating human performance requirements associated with FCS C2 design concepts. Measurement techniques are demonstrated that can address C2 human performance requirements through the evaluation of verbal communications, Human-Computer Interaction (HCI) behavior events, and subjective survey data. Specifically, automated word count, and task-time estimation methods were applied to existing HFA data sets to provide estimates of the frequency and time duration of verbal communications for individual members of the FCS C2 command group, and task time estimates for all HCI actions. Data gathered in a series of U.S. Army battle simulation experiments were reanalyzed to

demonstrate how the new methods can provide estimates of human performance that support decisions regarding workload, task allocation. and training requirements.
DTIC
Command And Control; Human Performance; Computerized Simulation; Combat; Automatic Control

20030065125 California Univ., Los Angeles, CA
Computer Simulations of Microwave Generation from Relativistic Electron Beams
Lin, Anthony T.; Mar. 15, 2003; 17 pp.; In English
Contract(s)/Grant(s): F49620-00-1-0185; Proj-2301
Report No.(s): AD-A413299; AFRL-SR-AR-TR-03-0090; No Copyright; Avail: CASI; A03, Hardcopy

This is the Final Technical Report on work performed under the support of the Air Force Office of Scientific Research on the subject of simulating microwave generation. This report contains the write-ups that we sent for the upcoming book on power vacuum electronics. The first section (Chapter 10) describes the simulation algorithm based on mode expansion technique developed at UCLA while the second section (Chapter 5) gives the real amplification mechanism for the Phigtron.
DTIC
Algorithms; Computerized Simulation; Microwaves; Relativistic Electron Beams; Frequencies

20030065162 NASA Langley Research Center, Hampton, VA, USA
Flight Guidance System Requirements Specification
Miller, Steven P.; Tribble, Alan C.; Carlson, Timothy M.; Danielson, Eric J.; January 6, 2003; 173 pp.; In English
Contract(s)/Grant(s): NCC1-01001; 728-30-10-03
Report No.(s): NASA/CR-2003-212426; NAS 1.26:212426; No Copyright; Avail: CASI; A08, Hardcopy

This report describes a requirements specification written in the RSML-e language for the mode logic of a Flight Guidance System of a typical regional jet aircraft. This model was created as one of the first steps in a five-year project sponsored by the NASA Langley Research Center, Rockwell Collins Inc., and the Critical Systems Research Group of the University of Minnesota to develop new methods and tools to improve the safety of avionics designs. This model will be used to demonstrate the application of a variety of methods and techniques, including safety analysis of system and subsystem requirements, verification of key properties using theorem provers and model checkers, identification of potential sources mode confusion in system designs, partitioning of applications based on the criticality of system hazards, and autogeneration of avionics quality code. While this model is representative of the mode logic of a typical regional jet aircraft, it does not describe an actual or planned product. Several aspects of a full Flight Guidance System, such as recovery from failed sensors, have been omitted, and no claims are made regarding the accuracy or completeness of this specification.
Author
Avionics; Flight Management Systems; Applications Programs (Computers); Software Reliability; Software Development Tools; Program Verification (Computers); Computer Programming; Systems Analysis

20030065180 NASA Langley Research Center, Hampton, VA, USA
Collaborative Software Development in Support of Fast Adaptive AeroSpace Tools (FAAST)
Kleb, William L.; Nielsen, Eric J.; Gnoffo, Peter A.; Park, Michael A.; Wood, William A.; [2003]; 20 pp.; In English; 16th AIAA Computational Fluid Dynamics Conference, 23-26 Jun. 2003, Orlando, FL, USA
Report No.(s): AIAA Paper 2003-3978; No Copyright; Avail: CASI; A03, Hardcopy

A collaborative software development approach is described. The software product is an adaptation of proven computational capabilities combined with new capabilities to form the Agency's next generation aerothermodynamic and aerodynamic analysis and design tools. To efficiently produce a cohesive, robust, and extensible software suite, the approach uses agile software development techniques; specifically, project retrospectives, the Scrum status meeting format, and a subset of Extreme Programming's coding practices are employed. Examples are provided which demonstrate the substantial benefits derived from employing these practices. Also included is a discussion of issues encountered when porting legacy Fortran 77 code to Fortran 95 and a Fortran 95 coding standard.
Author
Aerothermodynamics; Software Development Tools; Software Engineering; Adaptive Control; Applications Programs (Computers)

20030065188 Air Force Inst. of Tech., Wright-Patterson AFB, OH, USA

Joining the Department of Defense Enterprise Resource Planning Team: The Air Force's Role in the Enterprise

Mueller, Coreen R.; Mar. 25, 2003; 146 pp.; In English; Original contains color illustrations

Report No.(s): AD-A413382; AFIT/GLM/ENS/03-08; No Copyright; Avail: CASI; A07, Hardcopy

Over time, the Air Force (AF) built customized legacy logistics data and information systems, which have evolved into an inflexible network of obsolete systems that are costly to maintain and upgrade, and struggle to share data in a timely and coherent manner. The Department of Defense (DoD), to include the Defense Logistics Agency (DLA), the US AF, the US Army, and the US Navy, have all recognized the need to modernize and integrate their legacy systems to improve warfighter support. The DLA, the US Army, and the US Navy all see Enterprise Resource Planning (ERP) technology as a commercial best practice, and consequently as the best way to replace their legacy systems. They are all in the process of implementing ERP pilot tests. The AF has adopted a watch and learn' position on ERP, while continuing to upgrade its legacy systems piecemeal.

DTIC

Information Systems; Logistics; Military Operations

20030065207 Louisiana State Univ., Baton Rouge, LA

Observation and Modeling - An Integrated Study of Transport through the Strait of Bab al Mandab

Inoue, Masamichi; Jan. 1996; 157 pp.; In English

Contract(s)/Grant(s): N00014-96-1-1227

Report No.(s): AD-A413143; No Copyright; Avail: CASI; A08, Hardcopy

All field components of the project have been successfully completed, and various modeling efforts have been carried out. The modeling efforts address various phenomena with differing time scales ranging from tidal to seasonal variations in the throughflow transport at the strait. The field program has generated vast amount of very useful data that shed light on various aspects of throughflow transport at the strait, providing guidance in the modeling component of this project.

DTIC

Straits; Computer Programs

20030065208 Naval Research Lab., Washington, DC

Analyzing Security-Enhanced Linux Policy Specifications

Archer, Myla; Leonard, Elizabeth; Pradella, Matteo; Mar. 27, 2003; 15 pp.; In English

Contract(s)/Grant(s): N00014-02-WX-30011

Report No.(s): AD-A413151; NRL/MR/5540--03-8659; No Copyright; Avail: CASI; A03, Hardcopy

NSA's Security-Enhanced (SE) Linux enhances Linux by providing a specification language for security policies and a Flask-like architecture with a security server for enforcing policies defined in the language. While the security server refers to an internal form of the policy compiled from the policy specification, the description of the policy most understandable to the user is its source' specification in the policy language. It is natural for users to expect to be able to analyze the properties of the policy from this source specification. But the policy language is very low level making the high level properties of a policy difficult to deduce by inspection. For this reason, tools to help users with the analysis are necessary. The NRL project on analyzing SE Linux policies aims first to use mechanized support to analyze an example policy specification and then to customize this support for use by practitioners in the open source software community. This report describes how we model policies in the analysis tool TAME, the kinds of analysis we can support, and prototype mechanical support to enable others to model example policies in TAME. The report concludes with some general observations on desirable properties for a policy language.

DTIC

Operating Systems (Computers); Computer Programming

20030065234 Pennsylvania State Univ., University Park, PA

Development of a Computer Aided Weld Design Tool

Michaleris, Panagiotis; Mar. 2003; 71 pp.; In English

Contract(s)/Grant(s): N00014-00-1-0741; Proj-00PR07429

Report No.(s): AD-A413048; No Copyright; Avail: CASI; A04, Hardcopy

Contributed to the development of a Lagrangial thermo-mechanical process optimization approach. The methodology was demonstrated in the optimization of the thermal tensioning process for the minimization of welding residual stress elimination

of buckling distortion. Developed eigenvalue sensitivity analysis capabilities for the prediction and elimination of buckling distortion in large welded structures. Initiated research on the coupled multi-scale thermo-mechanical process modeling of large structures. The approach combines adaptivity and domain decomposition for both temporal and spatial multi-scale problems.
DTIC
Computer Aided Design; Welding; Welded Structures; Sensitivity Analysis

20030065243 Naval Research Lab., Stennis Space Center, MS
Designing and Building a Vector Feature Database
Gendron, Marlin; Edwards, Stephanie S.; Layne, Geary; Jan. 23, 2003; 10 pp.; In English
Report No.(s): AD-A413088; NRL/PP/7440--03-1005; No Copyright; Avail: CASI; A02, Hardcopy

High-resolution imagery can be stored on the computer in digital form as a picture, for example, a digital raster map image file. These images then can be geo-registered by computing coefficients from points with known latitude and longitude locations. Features such as roads and airports can be extracted by applying image-processing techniques to the geo-registered raster image. Attributes describing these features and their geographical locations are stored in a 'vector feature database.' The vector feature database contains many feature types and is considered accurate to a given map scale. In a realtime processing system there is a need to input attributes and their locations and subsequently retrieve such feature attributes from the database with minimum processing time. The overall size of the database is also a consideration. This paper explores the design and construction of a vector feature database to 1) optimize the size of the database by reducing the number of attributes while still maintaining an adequate and unique description of the feature, and 2) enable high-speed input and retrieval of features. Several data structures that might be used to construct the database are discussed, including hash tables, binary-trees, quad-trees, and R-trees. Ultimately a quadtree structure modified to use geographic bitmaps is implemented and evaluated.
DTIC
Data Bases; Image Processing; Mapping; Raster Scanning

20030065246 Naval Research Lab., Stennis Space Center, MS
Parallel Software for Processing Hydrographic Data
Miller, M. J.; Sarnowski, Krzysztof; Layne, Geary; Dec. 2002; 11 pp.; In English; Original contains color illustrations
Report No.(s): AD-A413091; NRL/PP/7440--03-1008; No Copyright; Avail: CASI; A03, Hardcopy

The Naval Research Laboratory's (NRL) Code 7440 Production Enhancement Team at the Stennis Space Center has been tasked to develop ways to speedup hydrographic data processing at the Naval Oceanographic Office (NAVO). This paper presents the final development of a parallelized version of the Pfm_loader application customized to run on a Beowulf cluster. Parallel programming techniques have been used for years to develop processing software that does the same work in only a fraction of the time. The research in this paper focuses on the I/0 problem associated with a parallel application writing to a single physical disk. Included in our research are the original ideas that led to the first version of the parallel software, subsequent versions of the software derived from lessons learned from benchmark results, and speedup results of each version. The platform used was a custom built Linux Beowulf cluster running a standard Linux kernel and the MPICH parallel message-passing library. The underlying purpose of this software is to process hydrographic data having a complicated, multi-tiered format. The data processing involves reading tens to hundreds of files containing raw date, filtering out extraneous data values, and writing the filtered data to a single file used in additional processing. The problem is not computationally intensive, but bound by the system's file writing capability. Subsequent versions of the parallel software developed exploit the strengths of the system's hardware to write the output file in the most time efficient manner. Each software version uses advanced software architecture schemes to achieve better results. Results show that the more responsible the software was for organizing the data before writing, the better the speedup. The critical factor for writing data efficiently involved the limitation of writing data over a single I/0 controller. Our parallel software has fantastic utility where system specifications do not allow for the 7
DTIC
Computer Programs; Parallel Processing (Computers); Computer Programming; Architecture (Computers)

20030065259 Air Force Research Lab., Wright-Patterson AFB, OH
4-Powers Air Refueling Technologies Long Term Technology Project System Specifications/Requirements Necessary for Interfacing with D-Six Simulation Environment
Williams, Glenn; Mar. 2003; 4 pp.; In English
Report No.(s): AD-A412935; AFRL-VA-WP-TM-2003-3019; No Copyright; Avail: CASI; A01, Hardcopy

This paper discusses a method of interfacing the D-Six Simulation Environment running under MS Windows 2000 on a 1.7GHz Pentium 4 PC with existing simulator cockpits that are available to ART LTTP members. For some insight into the rational for doing this, refer to the ART LTTP white paper entitled 'Universal Auto Air-to-Air Refueling Simulation.'
DTIC
Simulators; Refueling

20030065276 Matis, Inc., Atlanta, GA
New Methods for Repair of Geometry and Topology of CAD Models
Oliker, Elena; Dec. 2002; 23 pp.; In English
Contract(s)/Grant(s): F49620-01-C-0050
Report No.(s): AD-A413304; AFRL-SR-AR-TR-03-0166; No Copyright; Avail: CASI; A03, Hardcopy

The overall objective of this work is to introduce a drastically innovative technology for repair and automatic extraction of high-order geometric data from platform models developed with CAD (Computer Aided Design) software tools. The results will have applications to large-scale CEM analysis of low observable aircraft by high-order fast solvers as well as to a variety of other computational problems requiring high accuracy geometry representation. The effort carried out under this project was planned as an assessment of the current capabilities of GeomFix, a software system developed recently by Matis for efficient and reliable repair of geometric deficiencies in CAD models intended for use with computational electromagnetics methods.
DTIC
Mathematical Models; Computer Aided Design; Software Development Tools

20030065282 Massachusetts Inst. of Tech., Cambridge, MA
Computational Video for Collaborative Applications
McMillan, Leonard; Gifford, David; Mar. 2003; 90 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F30602-97-1-0283; Proj-F305
Report No.(s): AD-A412979; AFRL-IF-RS-TR-2003-62; No Copyright; Avail: CASI; A05, Hardcopy

The Computational Video for Collaborative Applications effort was devoted to the research of video compression/decompression virtual telepresence, and real-time processing of streaming data-types. Compression techniques were focused on overcoming the problem of delivering streaming content over unreliable packet-switching networks. Virtual telepresence work was in the development of video streaming with the end user having more control over how the video is presented. Real-time processing of streaming data types involves the fusing together of multiple video streams. A derivative of this work is the development of a new method for constructing virtual camera views from multiple live video streams by using dynamically reparameterized light fields (DRLFs). This technique has the advantage of providing visualizations of a remote scene's background and foreground objects. Extensive involvement at the Siggraph computer graphics conventions over the past several years has furthered the reach and applications of this important research.
DTIC
Video Signals; Video Compression; Data Transmission

20030065292 Simmetrix, Inc., Troy, NY, USA
Toolkit to Support Parallel Adaptive Computations on Unstructured Meshes
Tourtellott, John; Tendulkar, Saurabh; Beall, Mark; Shephard, Mark; Apr. 4, 2003; 16 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAAD19-02-C-0080
Report No.(s): AD-A413057; ARO-44141.1-MA-ST1; No Copyright; Avail: CASI; A03, Hardcopy

Report developed under STTR contract for topic ARMY02-T003. The initial development of a software toolkit to support parallel adaptive numerical analysis is described. The tools are focused on unstructured adaptive techniques which are among the most difficult to implement in parallel. To support dynamic load balancing software was developed to capture and utilize a hardware model, which represents the set of computing resources available for a given problem (analysis) at hand Mesh refinement software was extended for parallel operation, by adding mesh migration steps that enable modifications to be made to mesh entities lying on partition boundaries. The resulting capabilities were demonstrated in a parallel adaptive Navier-Stokes analysis. A new methodology for solution transfer, which combines the update of solution information with the mesh modification, was also implemented and compared to a global solution transfer procedure used in a commercial finite element code. The results showed that the new procedure leads to smaller relative difference in strain norm. Methods for reducing the storage required for adaptively evolving meshes were also investigated. An approach based on storing differences

between successive mesh iterations showed that a significant reduction in file space is feasible.
DTIC
Computation; Unstructured Grids (Mathematics); Grid Generation (Mathematics); Navier-Stokes Equation; Computer Programs

62
COMPUTER SYSTEMS

Includes computer networks and distributed processing systems. For information systems see *82 Documentation and Information Science*. For computer systems applied to specific applications, see the associated category.

20030064047 Research Inst. for Advanced Computer Science, Moffett Field, CA, USA
Research Institute for Advanced Computer Science: Annual Report October 1998 through September 1999
Leiner, Barry M.; Gross, Anthony R., Technical Monitor; [1999]; 76 pp.; In English; Original contains black and white illustrations
Contract(s)/Grant(s): NCC2-1006; No Copyright; Avail: CASI; A05, Hardcopy

The Research Institute for Advanced Computer Science (RIACS) carries out basic research and technology development in computer science, in support of the National Aeronautics and Space Administration's missions. RIACS is located at the NASA Ames Research Center (ARC). It currently operates under a multiple year grant/cooperative agreement that began on October 1, 1997 and is up for renewal in the year 2002. ARC has been designated NASA's Center of Excellence in Information Technology. In this capacity, ARC is charged with the responsibility to build an Information Technology Research Program that is preeminent within NASA. RIACS serves as a bridge between NASA ARC and the academic community, and RIACS scientists and visitors work in close collaboration with NASA scientists. RIACS has the additional goal of broadening the base of researchers in these areas of importance to the nation's space and aeronautics enterprises. RIACS research focuses on the three cornerstones of information technology research necessary to meet the future challenges of NASA missions: (1) Automated Reasoning for Autonomous Systems. Techniques are being developed enabling spacecraft that will be self-guiding and self-correcting to the extent that they will require little or no human intervention. Such craft will be equipped to independently solve problems as they arise, and fulfill their missions with minimum direction from Earth. (2) Human-Centered Computing. Many NASA missions require synergy between humans and computers, with sophisticated computational aids amplifying human cognitive and perceptual abilities; (3) High Performance Computing and Networking Advances in the performance of computing and networking continue to have major impact on a variety of NASA endeavors, ranging from modeling and simulation to data analysis of large datasets to collaborative engineering, planning and execution. In addition, RIACS collaborates with NASA scientists to apply information technology research to a variety of NASA application domains. RIACS also engages in other activities, such as workshops, seminars, and visiting scientist programs, designed to encourage and facilitate collaboration between the university and NASA information technology research communities.
Derived from text
Artificial Intelligence; Supercomputers; Human-Computer Interface; Information Systems; Machine Learning; Systems Engineering; Software Engineering

20030064058 South Dakota State Univ., Brookings, SD, USA
Countermeasure Evaluation and Validation Project (CEVP) Database Requirement Documentation
Shin, Sung Y.; National Aeronautics and Space Administration (NASA)/American Society of Engineering Education (ASEE) Summer Faculty Fellowship Program - 2000; March 2003, pp. 15-1 - 15-13; In English; See also 20030064055; Original contains black and white illustrations
Contract(s)/Grant(s): NAG9-867; No Copyright; Avail: CASI; A03, Hardcopy

The initial focus of the project by the JSC laboratories will be to develop, test and implement a standardized complement of integrated physiological test (Integrated Testing Regimen, ITR) that will examine both system and intersystem function, and will be used to validate and certify candidate countermeasures. The ITR will consist of medical requirements (MRs) and non-MR core ITR tests, and countermeasure-specific testing. Non-MR and countermeasure-specific test data will be archived in a database specific to the CEVP. Development of a CEVP Database will be critical to documenting the progress of candidate countermeasures. The goal of this work is a fully functional software system that will integrate computer-based data collection and storage with secure, efficient, and practical distribution of that data over the Internet. This system will provide the foundation of a new level of interagency and international cooperation for scientific experimentation and research, providing intramural, international, and extramural collaboration through management and distribution of the CEVP data. The research

performed this summer includes the first phase of the project. The first phase of the project is a requirements analysis. This analysis will identify the expected behavior of the system under normal conditions and abnormal conditions; that could affect the system's ability to produce this behavior; and the internal features in the system needed to reduce the risk of unexpected or unwanted behaviors. The second phase of this project have also performed in this summer. The second phase of project is the design of data entry screen and data retrieval screen for a working model of the Ground Data Database. The final report provided the requirements for the CEVP system in a variety of ways, so that both the development team and JSC technical management have a thorough understanding of how the system is expected to behave.
Author
Data Bases; Countermeasures; Computer Information Security

20030064114 Research Inst. for Advanced Computer Science, Moffett Field, CA, USA
Research Institute for Advanced Computer Science
Gross, Anthony R., Technical Monitor; Leiner, Barry M.; [2000]; 100 pp.; In English; Original contains black and white illustrations
Contract(s)/Grant(s): NCC2-1006; No Copyright; Avail: CASI

The Research Institute for Advanced Computer Science (RIACS) carries out basic research and technology development in computer science, in support of the National Aeronautics and Space Administration's missions. RIACS is located at the NASA Ames Research Center. It currently operates under a multiple year grant/cooperative agreement that began on October 1, 1997 and is up for renewal in the year 2002. Ames has been designated NASA's Center of Excellence in Information Technology. In this capacity, Ames is charged with the responsibility to build an Information Technology Research Program that is preeminent within NASA. RIACS serves as a bridge between NASA Ames and the academic community, and RIACS scientists and visitors work in close collaboration with NASA scientists. RIACS has the additional goal of broadening the base of researchers in these areas of importance to the nation's space and aeronautics enterprises. RIACS research focuses on the three cornerstones of information technology research necessary to meet the future challenges of NASA missions: (1) Automated Reasoning for Autonomous Systems. Techniques are being developed enabling spacecraft that will be self-guiding and self-correcting to the extent that they will require little or no human intervention. Such craft will be equipped to independently solve problems as they arise, and fulfill their missions with minimum direction from Earth; (2) Human-Centered Computing. Many NASA missions require synergy between humans and computers, with sophisticated computational aids amplifying human cognitive and perceptual abilities; (3) High Performance Computing and Networking. Advances in the performance of computing and networking continue to have major impact on a variety of NASA endeavors, ranging from modeling and simulation to data analysis of large datasets to collaborative engineering, planning and execution. In addition, RIACS collaborates with NASA scientists to apply information technology research to a variety of NASA application domains. RIACS also engages in other activities, such as workshops, seminars, and visiting scientist programs, designed to encourage and facilitate collaboration between the university and NASA information technology research communities.
Derived from text
Artificial Intelligence; Machine Learning; Human-Computer Interface; Supercomputers; Information Systems; Computer Networks; Systems Engineering; Software Engineering

20030065168 NASA Langley Research Center, Hampton, VA, USA
An Architectural Concept for Intrusion Tolerance in Air Traffic Networks
Maddalon, Jeffrey M.; Miner, Paul S.; [2003]; 6 pp.; In English; 3rd Integrated Communication, Navigation and Surveillance Conference, 19-22 May 2003, Annapolis, MD, USA; Original contains color and black and white illustrations; No Copyright; Avail: CASI; A02, Hardcopy

The goal of an intrusion tolerant network is to continue to provide predictable and reliable communication in the presence of a limited number of compromised network components. The behavior of a compromised network component ranges from a node that no longer responds to a node that is under the control of a malicious entity that is actively trying to cause other nodes to fail. Most current data communication networks do not include support for tolerating unconstrained misbehavior of components in the network. However, the fault tolerance community has developed protocols that provide both predictable and reliable communication in the presence of the worst possible behavior of a limited number of nodes in the system. One may view a malicious entity in a communication network as a node that has failed and is behaving in an arbitrary manner. NASA/Langley Research Center has developed one such fault-tolerant computing platform called SPIDER (Scalable Processor-Independent Design for Electromagnetic Resilience). The protocols and interconnection mechanisms of SPIDER may be adapted to large-scale, distributed communication networks such as would be required for future Air Traffic Management systems. The predictability and reliability guarantees provided by the SPIDER protocols have been formally

verified. This analysis can be readily adapted to similar network structures.
Author
Air Traffic; Fault Tolerance; Security; Computer Security; Intrusion Detection (Computers)

63
CYBERNETICS, ARTIFICIAL INTELLIGENCE AND ROBOTICS

Includes feedback and control theory, information theory, machine learning, and expert systems. For related information see also *54 Man/System Technology and Life Support*.

20030063947 Research Inst. for Advanced Computer Science, Moffett Field, CA, USA
Design and Control of Large Collections of Learning Agents
Agogino, Adrian; April 2001; 11 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): NCC2-1006
Report No.(s): RIACS-TR-1.07; No Copyright; Avail: CASI; A03, Hardcopy

The intelligent control of multiple autonomous agents is an important yet difficult task. Previous methods used to address this problem have proved to be either too brittle, too hard to use, or not scalable to large systems. The 'Collective Intelligence' project at NASA/Ames provides an elegant, machine-learning approach to address these problems. This approach mathematically defines some essential properties that a reward system should have to promote coordinated behavior among reinforcement learners. This work has focused on creating additional key properties and algorithms within the mathematics of the Collective Intelligence framework. One of the additions will allow agents to learn more quickly, in a more coordinated manner. The other will let agents learn with less knowledge of their environment. These additions will allow the framework to be applied more easily, to a much larger domain of multi-agent problems.
Author
Artificial Intelligence; Machine Learning; Optimization; Mathematical Logic

20030063960 NASA Ames Research Center, Moffett Field, CA, USA
Team Formation and Communication Restrictions in Collectives
Agogino, Adrian K.; Turner, Kagan; January 2003; 2 pp.; In English; AAMAS 2003, 14-18 Jul. 2003, Melbourne, Australia
Contract(s)/Grant(s): NCC2-1006; NCC2-5482; Copyright; Avail: CASI; A01, Hardcopy

A collective of agents often needs to maximize a 'world utility' function which rates the performance of an entire system, while subject to communication restrictions among the agents. Such communication restrictions make it difficult for agents which try to pursue their own 'private' utilities to take actions that also help optimize the world utility. Team formation presents a solution to this problem, where by joining other agents, an agent can significantly increase its knowledge about the environment and improve its chances of both optimizing its own utility and that its doing so will contribute to the world utility. In this article we show how utilities that have been previously shown to be effective in collectives can be modified to be more effective in domains with moderate communication restrictions resulting in performance improvements of up to 75\%. Additionally we show that even severe communication constraints can be overcome by forming teams where each agent of a team shares the same utility, increasing performance an additional 25\%. We show that utilities and team sizes can be manipulated to form the best compromise between how 'aligned' an agent s utility is with the world utility and how easily an agent can learn that utility.
Author
Domains; Utilities; Economics

20030063978 NASA Ames Research Center, Moffett Field, CA, USA, Research Inst. for Advanced Computer Science, Moffett Field, CA, USA
The Digital Space Shuttle, 3D Graphics, and Knowledge Management
Gomez, Julian E.; Keller, Paul J.; [2003]; 1 pp.; In English; ACM SIGGRAPH 2003, 2003
Contract(s)/Grant(s): NCC2-1006; No Copyright; Avail: CASI; A01, Hardcopy

The Digital Shuttle is a knowledge management project that seeks to define symbiotic relationships between 3D graphics and formal knowledge representations (ontologies). 3D graphics provides geometric and visual content, in 2D and 3D CAD forms, and the capability to display systems knowledge. Because the data is so heterogeneous, and the interrelated data

structures are complex, 3D graphics combined with ontologies provides mechanisms for navigating the data and visualizing relationships.
Author
Display Devices; Digital Systems; Computer Graphics; Knowledge Representation; Space Shuttle Orbiters; Three Dimensional Models

20030064068 Trinity Univ., San Antonio, TX, USA
EVA Robotic Assistant Project: Platform Attitude Prediction
Nickels, Kevin M.; National Aeronautics and Space Administration (NASA)/American Society of Engineering Education (ASEE) Summer Faculty Fellowship Program - 2000; March 2003, pp. 11-1 - 11-12; In English; See also 20030064055; Original contains black and white illustrations
Contract(s)/Grant(s): NAG9-867; No Copyright; Avail: CASI; A03, Hardcopy

The Robotic Systems Technology Branch is currently working on the development of an EVA Robotic Assistant under the sponsorship of the Surface Systems Thrust of the NASA Cross Enterprise Technology Development Program (CETDP). This will be a mobile robot that can follow a field geologist during planetary surface exploration, carry his tools and the samples that he collects, and provide video coverage of his activity. Prior experiments have shown that for such a robot to be useful it must be able to follow the geologist at walking speed over any terrain of interest. Geologically interesting terrain tends to be rough rather than smooth. The commercial mobile robot that was recently purchased as an initial testbed for the EVA Robotic Assistant Project, an ATRV Jr., is capable of faster than walking speed outside but it has no suspension. Its wheels with inflated rubber tires are attached to axles that are connected directly to the robot body. Any angular motion of the robot produced by driving over rough terrain will directly affect the pointing of the on-board stereo cameras. The resulting image motion is expected to make tracking of the geologist more difficult. This will either require the tracker to search a larger part of the image to find the target from frame to frame or to search mechanically in pan and tilt whenever the image motion is large enough to put the target outside the image in the next frame. This project consists of the design and implementation of a Kalman filter that combines the output of the angular rate sensors and linear accelerometers on the robot to estimate the motion of the robot base. The motion of the stereo camera pair mounted on the robot that results from this motion as the robot drives over rough terrain is then straightforward to compute. The estimates may then be used, for example, to command the robot s on-board pan-tilt unit to compensate for the camera motion induced by the base movement. This has been accomplished in two ways: first, a standalone head stabilizer has been implemented and second, the estimates have been used to influence the search algorithm of the stereo tracking algorithm. Studies of the image motion of a tracked object indicate that the image motion of objects is suppressed while the robot crossing rough terrain. This work expands the range of speed and surface roughness over which the robot should be able to track and follow a field geologist and accept arm gesture commands from the geologist.
Author
Extravehicular Activity; Robots; Attitude (Inclination); Prediction Analysis Techniques; Robot Dynamics

20030064070 Vanderbilt Univ., Nashville, TN, USA
Sensory Motor Coordination in Robonaut
Peters, Richard Alan, II; National Aeronautics and Space Administration (NASA)/American Society of Engineering Education (ASEE) Summer Faculty Fellowship Program - 2000; March 2003, pp. 31-1 - 13-12; In English; See also 20030064055; Original contains black and white illustrations
Contract(s)/Grant(s): NAG9-867; No Copyright; Avail: CASI; A03, Hardcopy

As a participant of the year 2000 NASA Summer Faculty Fellowship Program, I worked with the engineers of the Dexterous Robotics Laboratory at NASA Johnson Space Center on the Robonaut project. The Robonaut is an articulated torso with two dexterous arms, left and right five-fingered hands, and a head with cameras mounted on an articulated neck. This advanced space robot, now driven only teleoperatively using VR gloves, sensors and helmets, is to be upgraded to a thinking system that can find, interact with and assist humans autonomously, allowing the Crew to work with Robonaut as a (junior) member of their team. Thus, the work performed this summer was toward the goal of enabling Robonaut to operate autonomously as an intelligent assistant to astronauts. Our underlying hypothesis is that a robot can develop intelligence if it learns a set of basic behaviors (i.e., reflexes - actions tightly coupled to sensing) and through experience learns how to sequence these to solve problems or to accomplish higher-level tasks. We describe our approach to the automatic acquisition of basic behaviors as learning sensory-motor coordination (SMC). Although research in the ontogenesis of animals development from the time of conception) supports the approach of learning SMC as the foundation for intelligent, autonomous behavior, we do not know whether it will prove viable for the development of autonomy in robots. The first step

in testing the hypothesis is to determine if SMC can be learned by the robot. To do this, we have taken advantage of Robonaut's teleoperated control system. When a person teleoperates Robonaut, the person's own SMC causes the robot to act purposefully. If the sensory signals that the robot detects during teleoperation are recorded over several repetitions of the same task, it should be possible through signal analysis to identify the sensory-motor couplings that accompany purposeful motion. In this report, reasons for suspecting SMC as the basis for intelligent behavior will be reviewed. A robot control system for autonomous behavior that uses learned SMC will be proposed. Techniques for the extraction of salient parameters from sensory and motor data will be discussed. Experiments with Robonaut will be discussed and preliminary data presented.
Author
Sensorimotor Performance; Robots; Telerobotics; Artificial Intelligence

20030064075 Trinity Univ., San Antonio, TX, USA
Performance Evaluation and Software Design for EVA Robotic Assistant Stereo Vision Heads
DiPaolo, Daniel; National Aeronautics and Space Administration (NASA)/American Society of Engineering Education (ASEE) Summer Faculty Fellowship Program - 2000; March 2003, pp. 19-1 - 19-11; In English; See also 20030064055
Contract(s)/Grant(s): NAG9-867; No Copyright; Avail: CASI; A03, Hardcopy

The purpose of this project was to aid the EVA Robotic Assistant project by evaluating and designing the necessary interfaces for two stereo vision heads - the TracLabs Biclops pan-tilt-verge head, and the Helpmate Zebra pan-tilt-verge head. The first half of the project consisted of designing the necessary software interface so that the other modules of the EVA Robotic Assistant had proper access to all of the functionalities offered by each of the stereovision heads. This half took most of the project time, due to a lack of ready-made CORBA drivers for either of the heads. Once this was overcome, the evaluation stage of the project began. The second half of the project was to take these interfaces and to evaluate each of the stereo vision heads in terms of usefulness to the project. In the key project areas such as stability and reliability, the Zebra pan-tilt-verge head came out on top. However, the Biclops did have many more advantages over the Zebra, such as: lower power consumption, faster communications, and a simpler, cleaner API. Overall, the Biclops pan-tilt-verge head outperformed the Zebra pan-tilt-verge head.
Author
Performance Tests; Stereoscopic Vision; Computer Vision; Software Engineering

20030064367 Boeing Co., Philadelphia, PA, USA
Analysis, Design, and Optimization of the Helicopter Active Control Technology (HACT) Flight Control System
Johnson, Christopher K.; Mittleider, Dave; Tischler, Mark B.; Cheung, Kenny K.; [2002]; 15 pp.; In English; American Helicopter Society 58th Annual Forum, 11-13 Jun. 2002, Montreal, Canada; Copyright; Avail: CASI; A03, Hardcopy

This paper outlines the analysis, design, and optimization of the Helicopter Active Control Technology (HACT) Flight Control System (HFCS). The HACT program's use of a high fidelity aircraft model and advanced design tools and methods is reviewed. The Control Designer's Unified Interface (CONDUIT(trademark)) environment is utilized as the keystone of the HACT Program's advanced design methodology task. The HACT CONDUIT model of the HFCS, the linear aircraft model, and the analytical metrics and handling qualities specifications are explained. The airframe model is a high fidelity linear representation of the AH-64D generated using Boeing's Blade Element FLYRT (BEFLYRT) modeling and simulation tool. The linearization process and verification of the model are discussed. The HACT analytical handling qualities metrics are used in CONDUIT to evaluate the HFCS and to optimize the control law parameters. The current results of the analysis and optimization are presented.
Author
Helicopter Control; Active Control; Flight Control

20030065106 iRobot Corp., Somerville, MA, USA
Deployer: A Robot-Deploying Robot
Pook, Polly; Apr. 2003; 41 pp.; In English
Contract(s)/Grant(s): DAAD16-00-C-9219
Report No.(s): AD-A413255; NATICK-TR-03/022; No Copyright; Avail: CASI; A03, Hardcopy

This report documents a program to develop techniques for launching and controlling heterogeneous teams of robots. The key goal is to combine the physical and computational power of a large, sophisticated robot (the Deployer) with the robustness and flexibility of a swarm of distributed microrobots. Under this program, iRobot developed proof-of-concept systems for two objectives. The first objective is the ability to strategically emplace microbots and microsensors. A high mobility platform (the

iRobot Urban Robot) is equipped to launch grenade-sized robot mock-ups through 1st, 2nd, and 3rd story windows in urban terrain. The second objective is the ability to command and control the robots once emplaced. This task includes coordinating among the heterogeneous robots to extend the capability of each type, providing the operator with distributed remote presence at a minimized cognitive load, and intelligently collecting, filtering, and presenting a coherent view of the data.
DTIC
Deployment; Robots; Command And Control; Robot Dynamics; Heterogeneity

20030065203 Naval Postgraduate School, Monterey, CA
Development of Precision Pointing Controllers with and Without Vibration Suppression for the NPS Precision Pointing Hexapod
Bishop, Ronald M., Jr; Dec. 2002; 116 pp.; In English; Original contains color illustrations
Report No.(s): AD-A411333; No Copyright; Avail: CASI; A06, Hardcopy

Satellite optical payloads demand better vibration control and finer precision pointing than ever before. Fortunately, the Stewart-Gough platform offers the potential of accomplishing both of these simultaneously. Using the Precision Pointing Hexapod at NPS (a Stewart-Gough platform), several controllers for precision pointing, with and without vibration disturbances, were developed. Unlike the traditional means of pointing a hexapod, (i.e. sensing and controlling strut length to orient payload), this research used the payload orientation derived from payload mounted position sensors to determine orientation and provide feedback to the actuator controller. Small and large angle controllers were developed and evaluated for accuracy using static pointing and dynamic tracking tasks. The pointing controllers were then added to an Adaptive Disturbance Canceller and evaluated for pointing accuracy and vibration suppression performance given a single tone disturbance. The results showed a static pointing accuracy of +/-O.008 and a dynamic pointing accuracy ranging from +/-0.05 to +/- 0.2 depending on the size and speed of the circular trajectory. Vibration suppression down to the noise floor was achieved in all static orientations tested. As for dynamic circle-tracking performance, at least a 20 dB reduction in the fundamental disturbance was obtained without degradation in pointing accuracy.
DTIC
Vibration Isolators; Artificial Satellites; Adaptive Control; Payloads; Vibration Damping

64
NUMERICAL ANALYSIS

Includes iteration, differential and difference equations, and numerical approximation.

20030063085 Florida Agricultural and Mechanical Univ., Tallahassee, FL, USA
Robust Fault Detection
Guo, Ten-Huei, Technical Monitor; Collins, Emmanuel G.; Song, Tinglun; Curry, Tramone; Selekwa, Majura; HBCUs/OMUs Research Conference Agenda and Abstracts; February 2003, pp. 15; In English; See also 20030063082; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

This research used mixed structured singular value theory to develop new estimator (or observer) based approaches to fault detection for dynamic systems. The initial developments were based on minimizing the H-infinity, I-1 and H2 system norms. The resultant fault detection algorithms were each shown to be successful, but the fault detection algorithm based on the I-1 norm was best able to detect abrupt faults. This latter technique was further improved by using fuzzy logic for the fault evaluation. Based on an anomaly observed in this research and apparently ignored in the literature, current research focuses on the determination of a fault using a norm of the change in the residual (the difference between the output of the system and observer) and not simply a norm of the residual itself. This research may lead to a fundamental contribution to research in fault detection and isolation.
Author
Algorithms; Robustness (Mathematics); Fault Detection

20030063093 Tuskegee Inst., AL, USA
A Nonlinear Model for Fuel Atomization in Spray Combustion
Liu, Nan-Suey, Technical Monitor; Ibrahim, Essam A.; Sree, Dave; HBCUs/OMUs Research Conference Agenda and Abstracts; February 2003, pp. 26; In English; See also 20030063082; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Most gas turbine combustion codes rely on ad-hoc statistical assumptions regarding the outcome of fuel atomization

processes. The modeling effort proposed in this project is aimed at developing a realistic model to produce accurate predictions of fuel atomization parameters. The model involves application of the nonlinear stability theory to analyze the instability and subsequent disintegration of the liquid fuel sheet that is produced by fuel injection nozzles in gas turbine combustors. The fuel sheet is atomized into a multiplicity of small drops of large surface area to volume ratio to enhance the evaporation rate and combustion performance. The proposed model will effect predictions of fuel sheet atomization parameters such as drop size, velocity, and orientation as well as sheet penetration depth, breakup time and thickness. These parameters are essential for combustion simulation codes to perform a controlled and optimized design of gas turbine fuel injectors. Optimizing fuel injection processes is crucial to improving combustion efficiency and hence reducing fuel consumption and pollutants emissions.
Author
Computerized Simulation; Combustion Efficiency; Gas Turbine Engines; Nonlinearity; Models; Fuel Consumption

20030063106 NASA Glenn Research Center, Cleveland, OH, USA
Numerical Simulation of One- and Two-Phase Flows in Propulsion Systems
Gilinsky, Mikhail; Verma, Arun; Hardin, Jay C.; Banerjee, Debrup; Blankson, Isaiah M.; Hendricks, Robert C.; Shvets, Alexander I.; HBCUs/OMUs Research Conference Agenda and Abstracts; February 2003, pp. 16; In English; See also 20030063082
Contract(s)/Grant(s): NAG3-2249; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Four subprojects were conducted using analytical methods, numerical simulation and experimental tests: (A) Shock wave mitigation by spike-shaped blunt bodies with application for the purpose of drag, lift and longitudinal momentum optimization. The main result in this subproject is: application of a single needle against a supersonic flow provides higher benefits for blunt body drag reduction and heat transfer to the body than the application of multiple needles. (B) Solid particles, liquid and air jet injection through the front of a blunt body against a supersonic flow. In this case, the research conducted and analysis of multiple previous investigations in this area have shown essential benefits and preferable application of solid particle injection. (C) Comparison of different methods of fuel injection into supersonic duct flows. Preliminary numerical simulations and theoretical analysis show promising results for Telescope-shaped inlet applications in SCRAMJET; and (D) Development of an acoustic source location method for different applications including propulsion systems.
Author (revised)
Propulsion System Performance; Shock Waves; Two Phase Flow; Heat Transfer

20030064406 Lawrence Livermore National Lab., Livermore, CA
Solving the Radiation Diffusion and Energy Balance Equations Using Pseudo Transient Continuation
Shestakov, A. I.; Bolstad, J. H.; Feb. 01, 2002; 26 pp.; In English
Report No.(s): DE2003-15003406; UCRL-JC-148874; No Copyright; Avail: Department of Energy Information Bridge

An exact solution, based on Fourier and Laplace (FL) transforms, is developed for a linearization of the system modeling the multifrequency radiation diffusion and matter energy balance equations. The model uses an ideal gas equation of state. Opacities are proportional to the inverse of the cube of the frequency, thereby simulating free-free transitions. The solution is obtained in terms of integrals over the FL coefficients of the initial conditions and explicit sources. Results are presented for two special cases. (1) No sources, initially cold radiation field, and a localized matter energy profile. (2) Initially cold matter and radiation fields and a source of matter energy extending over finite space and time intervals.
NTIS
Radiation Distribution; Energy Distribution; Fourier Transformation; Linearization

20030064882 NASA Ames Research Center, Moffett Field, CA, USA
Maneuver Classification for Aircraft Fault Detection
Oza, Nikunj C.; Tumer, Irem Y.; Tumer, Kagan; Huff, Edward M.; May 08, 2003; 19 pp.; In English; No Copyright; Avail: CASI; A03, Hardcopy

Automated fault detection is an increasingly important problem in aircraft maintenance and operation. Standard methods of fault detection assume the availability of either data produced during all possible faulty operation modes or a clearly-defined means to determine whether the data provide a reasonable match to known examples of proper operation. In the domain of fault detection in aircraft, identifying all possible faulty and proper operating modes is clearly impossible. We envision a system for online fault detection in aircraft, one part of which is a classifier that predicts the maneuver being performed by

the aircraft as a function of vibration data and other available data. To develop such a system, we use flight data collected under a controlled test environment, subject to many sources of variability. We explain where our classifier fits into the envisioned fault detection system as well as experiments showing the promise of this classification subsystem.
Author
Fault Detection; Aircraft Maneuvers; Mathematical Models; Performance Prediction; Reliability Analysis; Functions (Mathematics); Linear Systems

20030065139 NASA Langley Research Center, Hampton, VA, USA
A Computationally Efficient Meshless Local Petrov-Galerkin Method for Axisymmetric Problems
Raju, I. S.; Chen, T.; [2003]; 14 pp.; In English; 44th AIAA/ASME/ASCE/AHS/ASC Structure, Structural Dynamics Conference, 7-10 Apr. 2003, Norfolk, VA, USA
Report No.(s): AIAA Paper 2003-1673; No Copyright; Avail: CASI; A03, Hardcopy

The Meshless Local Petrov-Galerkin (MLPG) method is one of the recently developed element-free methods. The method is convenient and can produce accurate results with continuous secondary variables, but is more computationally expensive than the finite element method. To overcome this disadvantage, a simple Heaviside test function is chosen. The computational effort is significantly reduced by eliminating the domain integral for the axisymmetric potential problems and by simplifying the domain integral for the axisymmetric elasticity problems. The method is evaluated through several patch tests for axisymmetric problems and example problems for which the exact solutions are available. The present method yielded very accurate solutions. The sensitivity of several parameters of the method is also studied.
Author
Galerkin Method; Symmetry

20030065191 Naval Research Lab., Bay Saint Louis, MS
Implementation of a Discontinuous Galerkin Discretization of the Conversation of Mass Equation in QUODDY
Guillot, M. J.; Blain, C. A.; Dawson, C. N.; Mar. 19, 2003; 19 pp.; In English; Original contains color illustrations
Report No.(s): AD-A413152; NRL/FR/7322--03-10; 050; No Copyright; Avail: CASI; A03, Hardcopy

Two variations of a discontinuous Galerkin method are investigated for the primitive form of the time-dependent, 2-D, depth-averaged conservation of mass equation for shallow water. Linear approximating functions are employed, which are defined locally on each element, providing three degrees of freedom per element. In the first method, the degrees of freedom are the nodal values for each element. Analytical integration rules are developed to evaluate the volume integrals, and Gaussian quadrature is to evaluate the element edge integrals produced by the finite element approximation. Time integration is achieved using a second-order Runge-Kutta method. The method is implemented into the computer code QUODDY, replacing the generalized wave continuity equation (GWCE) formulation into the code. The implementation is validated on a test case involving tidal boundary conditions in the Gulf of Maine.
DTIC
Computer Programs; Mathematical Models; Galerkin Method; Finite Element Method

20030065281 North Carolina State Univ., Raleigh, NC, USA
Finite Element Methods and Iterative Refinement Techniques for Partial Differential Equations Involving Interfaces
Li, Zhilin; Ito, Kazufumi; Mar. 30, 2003; 8 pp.; In English
Contract(s)/Grant(s): DAAD19-99-1-0189
Report No.(s): AD-A413105; ARO-39676.31-MA; No Copyright; Avail: CASI; A02, Hardcopy

A second order finite difference method has been developed for elliptic interface problems that involve discontinuous coefficients, singular source terms, non-smooth or even discontinuous coefficients across an arbitrary interface. The method is based on Cartesian grids and coupled with a multigrid solver. The new method will preserve the discrete maximum principle. The convergence of the new method has been proved. Two different finite element spaces and corresponding Galerkin methods for elliptic interface problems using Cartesian grids have been developed. Some theoretical results about these finite element methods are also obtained. We believe that we are the first to develop these new finite element spaces over Cartesian grids. Some public subroutines of fast solvers for Helmholtz and Poisson equations on irregular domains either exterior or interior with various boundary conditions have been developed and made public. In collaboration with J. K. Hunter of UC Davis and H. K. Zhao of UC Irvine, we formulate a model for the spreading on a surface of a drop that deposits an

autophobic monolayer of surfactant We present numerical solutions of the model equations using an immersed interface method and a level set method.
DTIC
Finite Element Method; Partial Differential Equations

20030065291 Air Force Inst. of Tech., Wright-Patterson AFB, OH, USA
Analysis of Scheduling Policies for a M/G/1 Queue with Rework
Hendrixson, Jennifer K.; Mar. 2003; 55 pp.; In English
Report No.(s): AD-A413188; AFIT/GOR/ENS/03-09; No Copyright; Avail: CASI; A04, Hardcopy

This thesis analyzes a multi-class M/G/1 priority queueing system in which distinct job types require one service cycle and, with non-zero probability, require a second service cycle. The main objective is to find a new heuristic scheduling policy that minimizes the long-run expected holding and preemption costs. Arrival rates, service rates, and the probability of undertaking second service are all class specific. A mean value analysis (MVA) approach was employed to derive the long-run mean time in queue for each job type under each policy, thereby providing the appropriate cost equations. Numerical experiments suggest that the preemptive resume scheduling policy yields the lowest cost most frequently.
DTIC
Queueing Theory; Policies; Heuristic Methods; Scheduling; Analysis (Mathematics)

65
STATISTICS AND PROBABILITY

Includes data sampling and smoothing; Monte Carlo method; time series analysis; and stochastic processes.

20030064886 Harvard Univ., Cambridge, MA
Decoding in Neural Systems: Stimulus Reconstruction From Nonlinear Encoding
Stanley, Garrett B.; Boloori, Alireza S.; Oct. 25, 2001; 5 pp.; In English
Report No.(s): AD-A411623; No Copyright; Avail: CASI; A01, Hardcopy

The encoding of information about the outside world in the temporal activity of sensory neurons is an extremely complex process that has eluded the understanding of the scientific Community for decades. The reconstruction of sensory stimuli from observed neuronal activity provides a basis within which we might ascertain the nature of the sensory information encoded by the cells. We present a decoding strategy for predicting the sensory stimulus from the neuronal response that is based on the mechanisms of encoding. For a class of encoding mechanisms characterized by a linear function followed by a memoryless nonlinearity referred to as Wiener systems the Bayesian estimator is derived from the transformational properties of the nonlinearity. The result is a reconstruction paradigm in which the ability to predict sensory stimuli from the neuronal response depends heavily upon how well the encoding process has been characterized and thus provides a measure of our understanding of the underlying physiological process.
DTIC
Nonlinear Programming; Neurons; Neurophysiology; Stimulation; Decoding

20030065097 Air Force Inst. of Tech., Wright-Patterson AFB, OH, USA
Comparing Clustering Algorithms for Use with Genomic and Proteomic Data
Olson, Rebecca A.; Sep. 2002; 72 pp.; In English
Report No.(s): AD-A413235; AFIT/GAM/ENC/02S-1; No Copyright; Avail: CASI; A04, Hardcopy

The Human Genome Project and related projects have resulted in the development of a number of new experimental and analytic tools for use in genomic and proteomic research. In the area of toxicogenomics, researchers are concerned with how genes react to exposure to certain chemicals. The USA Air Force is interested in the effect of exposure to mission-essential chemicals. Although military personnel may come into contact with chemicals such as hydrazine, risk assessment is usually very limited. On the genomic level, risk assessment is a multi-stop and multi-disciplinary process. The process begins with an experiment that exposes cells to the chemical. Data from the experiment are obtained using gene chips, The data can then be analyzed. This research explores the methods of pre-processing and analyzing data. Several different data sets are used to compare the effectiveness of various clustering algorithms and their implementations. Genomic and proteomic data obtained

from a hydrazine exposure experiment are then analyzed. A relationship is established between the genomic and proteomic data sets and is used in further analyses.
DTIC
Algorithms; Cluster Analysis; Genome; Proteome; Toxicology; Genes; Statistical Analysis

20030065270 Duke Univ., Durham, NC, USA
Computer Aid for the Decision to Biopsy Breast Lesions
Floyd, Carey E.; Jul. 2002; 41 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-99-1-9174
Report No.(s): AD-A413260; No Copyright; Avail: CASI; A03, Hardcopy

The goal of this project is to improve the accuracy of the diagnosis of breast cancer from mammograms by using a computer-based system to provide the physician with a second opinion on whether or not to perform a biopsy. An estimated 2\% to 10\% of true cancers are not biopsied but are instead followed, while between 60\% and 90\% of breast biopsies are performed on benign lesions. This report documents progress that has been made in improving the accuracy of diagnoses from mammograms using a Case-Based Reasoning (CBR) approach. The CBR approach predicts the outcome of a biopsy from the known biopsy outcomes for similar cases. The current version of the CBR performs with an accuracy of 61\% on a retrospective set of consecutive cases for which the clinical diagnostic accuracy was 35\%. The CBR algorithm has four fundamental tasks: (1) specify a reference set of cases, (2) define a metric for the distance between cases, (3) define a rule (based on the distance metric) for selecting 'similar' cases from the reference set, and (4) specify a classification technique for predicting the outcome of biopsy from the known outcomes of the selected similar reference cases. The reference database for this study contained about 1500 cases that were referred for biopsy at Duke University Medical Center between 1992 and 2000. Each case included the mammographer's description of the lesion using the BI-RADS (TM) lexicon, known risk factors, and outcomes in the form of benign or malignant status as determined by biopsy. The author concludes that CBR is a promising technique for identifying benign cases.
DTIC
Cancer; Lesions; Mammary Glands; Computer Techniques; Decision Making; Clinical Medicine

66
SYSTEMS ANALYSIS AND OPERATIONS RESEARCH

Includes mathematical modeling of systems; network analysis; mathematical programming; decision theory; and game theory.

20030064959 Research Inst. for Advanced Computer Science, Moffett Field, CA, USA
A Preliminary Data Model for Orbital Flight Dynamics in Shuttle Mission Control
ONeill, John; Shalin, Valerie L.; September 2000; 21 pp.; In English
Report No.(s): RIACS-TR-00.09; No Copyright; Avail: CASI; A03, Hardcopy

The Orbital Flight Dynamics group in Shuttle Mission Control is investigating new user interfaces in a project called RIOTS [RIOTS 2000]. Traditionally, the individual functions of hardware and software guide the design of displays, which results in an aggregated, if not integrated interface. The human work system has then been designed and trained to navigate, operate and integrate the processors and displays. The aim of RIOTS is to reduce the cognitive demands of the flight controllers by redesigning the user interface to support the work of the flight controller. This document supports the RIOTS project by defining a preliminary data model for Orbital Flight Dynamics. Section 2 defines an information-centric perspective. An information-centric approach aims to reduce the cognitive workload of the flight controllers by reducing the need for manual integration of information across processors and displays. Section 3 describes the Orbital Flight Dynamics domain. Section 4 defines the preliminary data model for Orbital Flight Dynamics. Section 5 examines the implications of mapping the data model to Orbital Flight Dynamics current information systems. Two recurring patterns are identified in the Orbital Flight Dynamics work the iteration/rework cycle and the decision-making/information integration/mirroring role relationship. Section 6 identifies new requirements on Orbital Flight Dynamics work and makes recommendations based on changing the information environment, changing the implementation of the data model, and changing the two recurring patterns.
Derived from text
Human-Computer Interface; Display Devices; Mathematical Models; Ground Based Control; Flight Management Systems; Workloads (Psychophysiology); Information Systems

67
THEORETICAL MATHEMATICS

Includes algebra, functional analysis, geometry, topology, set theory, group theory and number theory.

20030064475 Universite de Technologie de Compiegne, France
Denoising EMG and EEG for Monitoring Small Animal Models During NMR experiments
Fokapu, O.; Chahboune, H.; Armenean, M.; Desgoutte, P.; Cespuglio, R.; Oct. 25, 2001; 5 pp.; In English
Report No.(s): AD-A411564; No Copyright; Avail: CASI; A01, Hardcopy

The present growing field of molecular imaging, including multimodality microimaging techniques and spectroscopic approaches, is mainly based on small animal studies. Monitoring such models requires an efficient treatment and use of electrophysiological signals which may be spoiled by environmental effects especially when working with nuclear magnetic resonance (NMR) since radiofrequency (RF) pulses and magnetic field gradient commutations may create spurious supplementary signals. In this work, a method is given for FEG and EMG denoising of signals acquired during phosphorous magnetic resonance (MR) brain spectroscopy data acquisition on a rat model developed for sleep/awake studies. The proposed approach is based on wavelet decomposition and the key method is to turn into profit the shape variations of EMG during the time course of sleep/awake cycles. Statistical properties of the noise are studied using EMG recorded during paradoxical sleep as noise model. A specific estimation of noise level using FMG recorded during slow sleep leads to an optimal wavelet coefficients thresholding. This approach is well suited to improve signal to noise ratio of EFG and EMG and to preserve small amplitude electrophysiological signals.
DTIC
Animals; Electroencephalography; Electromyography; Electrophysiology; Imaging Techniques; Models; Nuclear Magnetic Resonance

20030064912 Auvergne Univ., Clermont-Ferrand, France
Segmentation of the Striatum Using Data Fusion
Frenoux, Emmanuelle; Barra, Vincent; Boire, Jean-Yves; Oct. 25, 2001; 5 pp.; In English; Original contains color illustrations
Report No.(s): AD-A411838; No Copyright; Avail: CASI; A01, Hardcopy

This article proposes a new segmentation scheme to detect cerebral structures in MRI acquisitions using numerical information contained in the image and expert knowledge brought by a specialist. This process is divided in three steps: first, information contained in the MR image is extracted using a fuzzy clustering algorithm, and theoretical information concerning the structure to segment is modeled using possibility theory. Information fusion is then processed, followed by a decision step ending the structure segmentation. Heads of caudate nuclei and putamens are segmented using this method. Results are promising and validation is performed using both numerical indexes and assessment by an expert. This method can be applied to any cerebral structure in an MR image, provided that it can be described in terms of shape, direction and distance by an expert and that the contrast and resolution of the MRI are sufficient.
DTIC
Image Processing; Fuzzy Sets; Algorithms

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*.

20030064300
BTEV: A Dedicated B Experiment at the Tevatron
Christian, D.; Dec. 2002; In English
Report No.(s): DE2003-805890; FERMILAB-CONF-02/334-E; No Copyright; Avail: National Technical Information Service (NTIS)

BTeV is a dedicated b-physics experiment that is expected to begin operation at the Fermilab Tevatron in 2008. BTeV is designed to take full advantage of the large production cross section of b particles (including Bs) in high energy hadron collisions. A quick description of the BTeV spectrometer is given in this paper. Two unique aspects of BTeV, the pixel-based

trigger and the high quality lead tungstate electromagnetic calorimeter, are described in slightly greater detail.
NTIS
Particle Accelerators; Beta Particles; Particle Theory; Calorimeters; Electromagnetism

20030064363 Fermi National Accelerator Lab., Batavia, IL, USA
Beauty, Charm and Hyperon Production at Fixed-Target Experiments
Gottschalk, E. E.; Dec. 2002; In English
Report No.(s): DE2003-805787; FERMILAB-CONF-02/323-E; No Copyright; Avail: National Technical Information Service (NTIS)

Over the years fixed-target experiments have performed numerous studies of particle production in strong interactions. The experiments have been performed with different types of beam particles of varying energies, and many different target materials. Since the physics of particle production is still not understood, ongoing research of phenomena that we observe as beauty, charm and strange-particle production is crucial if we are to gain an understanding of these fundamental processes. It is in this context that recent results from fixed-target experiments on beauty, charm, and hyperon production will be reviewed.
NTIS
Hyperons; Charm (Particle Physics); Particle Interactions

20030064369 Fermi National Accelerator Lab., Batavia, IL, USA
Physics Reach of BTeV
Kasper, P.; Dec. 2002; In English
Report No.(s): DE2003-805826; FERMILAB-CONF-02/324-E; No Copyright; Avail: National Technical Information Service (NTIS)

BTeV is a collider program at the Fermilab Tevatron dedicated to the study of CP violation, mixing, and rare decays in beauty and charm hadrons. The detector is a forward spectrometer sited at the C-Zero interaction region.
NTIS
Particle Accelerators; Cp Violation

20030064370 Fermi National Accelerator Lab., Batavia, IL, USA
Real-Time Data Reorganizer for the DO Central Fiber Tracker Trigger System at Fermilab
Rapisarda, S. M.; Wilcer, N. G.; Olsen, J. T.; Dec. 2002; 8 pp.; In English
Report No.(s): DE2003-805842; FERMILAB-CONF-02/311-E; No Copyright; Avail: Department of Energy Information Bridge

The DO experiment is sited at a high-energy particle accelerator, the Tevatron Collider, at the Fermi National Accelerator Laboratory (Fermilab) in Batavia, Illinois, USA. Fermilab is a High-Energy Physics research laboratory operated by Universities Research Association for the US Department of Energy. The D0 Detector is located in the Tevatron where protons and anti-protons traveling close to the speed of light in opposite directions collide. The purpose of the D0 detector is to study these high-energy particle interactions. A component of the D0 Detector is the Central Fiber Tracker (CFT). The CFT is constructed of scintillating fibers that are organized together in a very precise array of ribbons, placed onto a structure formed by eight co-axial cylinders. The energy deposited into a scintillating fiber by particle interactions is transformed into visible light. The light travels through the scintillating fiber and through an optical (clear) fiber connected to it, reaching a very sensitive light detector, the Visible Light Photon Counter (VLPC), hosted in a liquid helium cryostat.
NTIS
Actuators; Particle Accelerators; Real Time Operation; Cryostats; Optical Fibers

20030064376 Fermi National Accelerator Lab., Batavia, IL, USA
Distributed and /or Grid-Oriented Approach to BTeV Data Analysis
Butler, J. N.; Dec. 2002; 12 pp.; In English
Report No.(s): DE2003-806221; FERMILAB-CONF-02-337-E; No Copyright; Avail: Department of Energy Information Bridge

The BTeV collaboration will record approximately 2 petabytes of raw data per year. It plans to analyze this data using the distributed resources of the collaboration as well as dedicated resources, primarily residing in the very large BTeV trigger farm, and resources accessible through the developing world-wide data grid. The data analysis system is being designed from

the very start with this approach in mind. In particular, we plan a fully disk-based data storage system with multiple copies of the data distributed across the collaboration to provide redundancy and to optimize access. We will also position ourself to take maximum advantage of shared systems, as well as dedicated systems, at our collaborating institutions.
NTIS
Data Processing; Actuators

20030064389
Evidence for Light Scalar Resonances in Charm Meson Decays from Fermilab E791
Schwartz, A. J.; Jan. 07, 2003; 12 pp.; In English
Report No.(s): DE2003-807180; No Copyright; Avail: Department of Energy Information Bridge
No abstract available
NTIS
Mesons; Particle Decay; Scalars

20030064408 Lawrence Livermore National Lab., Livermore, CA, Stanford Linear Accelerator Center, Stanford, CA, USA
Structural Modeling of Tesla TDR Positron Target
Stein, W.; Sheppard, J. C.; Mar. 04, 2002; In English
Report No.(s): DE2003-15003399; UCRL-ID-148939; No Copyright; Avail: National Technical Information Service (NTIS)
Energy deposition from one pulse occurs over 1 millisecond and results in heating of the target over a 5 cm arc of material. The 22.2 MeV photon beam has a spot size of 0.75 mm and results in a maximum temperature jump of 440 degrees C. Stresses are induced in the material from thermal expansion of the hotter material. Peak effective stresses reach 38 Ksi, which is lower than the typical yield strength of a titanium alloy by a factor of about 3.
NTIS
Positrons; Targets; Models; Thermal Expansion

20030064432 Lawrence Livermore National Lab., Livermore, CA, Harvard-Smithsonian Center for Astrophysics, Cambridge, MA, USA, Oslo Univ., Norway, Notre Dame Univ., IN, USA
Unusual Optical Afterglow of the Gamma-Ray Burst GRB 021004: Color Changes and Short-Time-Scale Variability
Bersier, D.; Stanek, K. Z.; Winn, J.; Grav, T.; Holman, M. J.; Nov. 25, 2002; In English
Report No.(s): DE2003-15003344; UCRL-JC-150176; No Copyright; Avail: National Technical Information Service (NTIS)
No abstract available
NTIS
Afterglows; Color; Gamma Ray Bursts; Variability

20030064456 Lawrence Livermore National Lab., Livermore, CA
LLNL Flash X-Ray Induction Linear Accelerator (FXR)
Multhauf, L. G.; Sep. 19, 2002; In English
Report No.(s): DE2003-15003126; UCRL-JC-148534; No Copyright; Avail: National Technical Information Service (NTIS)
The FXR is an induction linear accelerator used for high-speed radiography at the Lawrence Livermore National Laboratorys Experimental Test Site. It was designed specifically for the radiography of very thick explosive objects. Since its completion in 1982, it has been very actively used for a large variety of explosives tests, and has been periodically upgraded to achieve higher performance. Upgrades have addressed machine reliability, radiographic sensitivity and resolution, two-frame imaging by double pulsing improvements that are described in detail in the paper. At the same time, the facility in which it was installed has also been extensively upgraded, first by adding space for optical and interferometric diagnostics, and more recently by adding a containment chamber to prevent the environmental dispersal of hazardous and radioactive materials. The containment addition also further expands space for new non-radiographic diagnostics. The new Contained Firing Facility is still in the process of activation. At the same time, FXR is continuing to undergo modifications aimed primarily at further increasing radiographic resolution and sensitivity, and at improving double-pulsed performance.
NTIS
Linear Accelerators; Radiography; X Rays; Imaging Techniques

20030065261 Virginia State Univ., Petersburg, VA

Microscopic Characterization of Novel Magnetic Materials With Potential for Major Technological Impact

Arrott, Anthony S.; Stronach, Carey E.; Noakes, David R.; April 09, 2003; 6 pp.; In English

Contract(s)/Grant(s): F49620-97-1-0532

Report No.(s): AD-A413310; AFRL-SR-AR-TR-03-0128; No Copyright; Avail: CASI; A02, Hardcopy

The results of a three-year study of attempts to produce magnetically soft materials by mechanical milling show that a major obstacle to the achievement of the desired results of high saturation magnetization with low magnetic anisotropy, using iron-cobalt, is the extreme hardness of the particles after milling. This is the compaction problem that must be solved for the material to be useful for technical applications. The project did result in the establishment of three research facilities that have subsequently led to major new insights into micromagnetics, magnetic random access memory, and the magnetic structure of Fe (Al) alloys. This project led to additional funding of research at Virginia State University, an Historically Black College/University, and has stimulated interest among students in physics research, subsequently leading them to seek advanced degrees in physics.

DTIC

Magnetic Properties; Magnetic Materials; Random Access Memory

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*.

20030063912 General Electric Aircraft Engines, Cincinnati, OH, USA

Acoustic Treatment Design Scaling Methods, Phase 2

Clark, L., Technical Monitor; Parrott, T., Technical Monitor; Jones, M., Technical Monitor; Kraft, R. E.; Yu, J.; Kwan, H. W.; Beer, B.; Seybert, A. F.; Tathavadekar, P.; January 07, 2003; 144 pp.; In English

Contract(s)/Grant(s): NAS3-26617; WU 781-30-14-01

Report No.(s): NASA/CR-2003-212428/PHASE2; NAS 1.26:212428/PHASE2; Copyright; Avail: CASI; A07, Hardcopy

The ability to design, build and test miniaturized acoustic treatment panels on scale model fan rigs representative of full scale engines provides not only cost-savings, but also an opportunity to optimize the treatment by allowing multiple tests. To use scale model treatment as a design tool, the impedance of the sub-scale liner must be known with confidence. This study was aimed at developing impedance measurement methods for high frequencies. A normal incidence impedance tube method that extends the upper frequency range to 25,000 Hz. without grazing flow effects was evaluated. The free field method was investigated as a potential high frequency technique. The potential of the two-microphone in-situ impedance measurement method was evaluated in the presence of grazing flow. Difficulties in achieving the high frequency goals were encountered in all methods. Results of developing a time-domain finite difference resonator impedance model indicated that a re-interpretation of the empirical fluid mechanical models used in the frequency domain model for nonlinear resistance and mass reactance may be required. A scale model treatment design that could be tested on the Universal Propulsion Simulator vehicle was proposed.

Author

Aircraft Noise; Impedance Measurement; Scale Models; Acoustic Properties

20030063924 NASA Langley Research Center, Hampton, VA, USA

Measurement Of Trailing Edge Noise using Directional Array and Coherent Output Power Methods

Hutcheson, Florence V.; Brooks, Thomas F.; Aeroacoustics; [2002]; Volume 1, No. 4, pp. 329-353; In English; Copyright; Avail: CASI; A03, Hardcopy

The use of a directional array of microphones for the measurement of trailing edge (TE) noise is described. The capabilities of this method are evaluated via measurements of TE noise from a NACA 63-215 airfoil model and from a cylindrical rod. This TE noise measurement approach is compared to one that is based on the cross spectral analysis of output signals from a pair of microphones (COP method). Advantages and limitations of both methods are examined. It is shown that the microphone array can accurately measures TE noise and captures its two-dimensional characteristic over a large frequency range for any TE configuration as long as noise contamination from extraneous sources is within bounds. The COP method is shown to also accurately measure TE noise but over a more limited frequency range that narrows for increased TE thickness. Finally, the applicability and generality of an airfoil self-noise prediction method was evaluated via comparison to the

experimental data obtained using the COP and array measurement methods. The predicted and experimental results are shown to agree over large frequency ranges.
Author
Trailing Edges; Noise Measurement; Aeroacoustics; Aerodynamic Noise; Frequency Ranges; Spectrum Analysis; Prediction Analysis Techniques

20030063969 Honeywell Engines, Systems and Services, Phoenix, AZ, USA
Small Engine Technology (SET) Task 24 Business and Regional Aircraft System Studies
Lieber, Lysbeth; May 2003; 325 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): NAS3-27483; 781-20-12-01
Report No.(s): NASA/CR-2003-212399; NAS 1.26:212399; Rept-21-11147; No Copyright; Avail: CASI; A14, Hardcopy

This final report has been prepared by Honeywell Engines & Systems, Phoenix, Arizona, a unit of Honeywell International Inc., documenting work performed during the period June 1999 through December 1999 for the National Aeronautics and Space Administration (NASA) Glenn Research Center, Cleveland, Ohio, under the Small Engine Technology (SET) Program, Contract No. NAS3-27483, Task Order 24, Business and Regional Aircraft System Studies. The work performed under SET Task 24 consisted of evaluating the noise reduction benefits compared to the baseline noise levels of representative 1992 technology aircraft, obtained by applying different combinations of noise reduction technologies to five business and regional aircraft configurations. This report focuses on the selection of the aircraft configurations and noise reduction technologies, the prediction of noise levels for those aircraft, and the comparison of the noise levels with those of the baseline aircraft.
Author
Aircraft Configurations; Noise Reduction; Computerized Simulation; Noise Prediction (Aircraft); Systems Engineering; Aircraft Design; Aircraft Noise

20030063989 Defence Science and Technology Organisation, Salisbury, Australia
Use of Spherical Objects as Calibrated Mine Hunting Sonar Targets
Anstee, Stuart; Dec. 2002; 34 pp.; In English
Report No.(s): AD-A411950; DSTO-TN-0425; DODA-AR-012-312; X5-X5; No Copyright; Avail: CASI; A03, Hardcopy

Solid, water-filled and air-filled spheres are investigated for suitability as calibrated targets for active mine hunting sonars operating in the range 10KHz to 200kHz. It is found that all solid and water-filled designs have target strengths that are strongly frequency-dependent, but some air-filled designs are not frequency dependent. It is found that thick-walled spherical glass floats are suitable for some frequency ranges, and thin-walled stainless steel spheres are suitable over the whole frequency range, if they are sufficiently well made and conditions allow their deployment.
DTIC
Sonar; Calibrating; Mine Detectors

20030064027 Institute of Sound and Vibration Research, Southampton, UK
Model for the Control of the Flow-Induced Noise Transmitted through a Stiffened Tensioned Double-Panel
Maury, C.; Gardonio, P.; Elliott, S. J.; June 2003; 37 pp.; In English
Contract(s)/Grant(s): N21529/01
Report No.(s): ISVR-TR-300; Copyright; Avail: Other Sources

The first objective of this report is to describe an extension of the analytical models already developed by the authors to predict, above 500 Hz, the Turbulent Boundary Layer-induced noise transmitted through aircraft panels (single and double panel models) towards the low-frequency range by considering TBL-excited tensioned and stiffened double-panel systems. A modal formulation coupled to a transfer matrix procedure has been developed and the analytical model is detailed in Section 2. Parametric studies including comparisons between different models of aircraft fuselage panels are analysed in Section 3. The second objective of this study is to determine the best possible noise levels reduction that can be achieved using idealised feedback control of the boundary layer noise transmitted through the tensioned and stiffened double-panel partition. These results are discussed in Section 4. One important conclusion of this study is that the prediction of the sound power inwardly radiated by an aircraft panel excited by a TBL should account for the dynamics of discretely stiffened skin panels since significant differences can be observed if the elastic stringers are replaced by simple-support boundary conditions. However, accounting for the stiffening effect of stringers on the skin panel does not modify drastically the conclusions previously reached concerning the performance of active feedback control of the boundary layer induced noise for the double-panel

model with rigid reinforcements: it is the strategy based on the active suppression of the skin panel structural modes that is the most efficient in terms of the broadband attenuation of the total sound power inwardly radiated.
Author
Active Control; Feedback Control; Noise Intensity; Aerodynamic Noise; Turbulent Boundary Layer; Stiffening; Acoustic Attenuation

20030064084 Taitech, Inc., Beavercreek, OH, USA
Nonlinear Aeroacoustics Computations by the Space-Time CE/SE Method
Loh, Ching Y.; June 2003; 23 pp.; In English; Regional Research Conference: Mathematical Methods in Nonlinear Wave Propagation, 15-19 May 2002, Greensboro, NC, USA; Original contains color and black and white illustrations
Contract(s)/Grant(s): NAS3-03072; WBS 22-708-90-25
Report No.(s): NASA/CR-2003-212388; E-13965; NAS 1.26:212388; No Copyright; Avail: CASI; A03, Hardcopy

The Space-Time Conservation Element and Solution Element Method, or CE/SE Method for short, is a recently developed numerical method for conservation laws. Despite its second order accuracy in space and time, it possesses low dispersion errors and low dissipation. The method is robust enough to cover a wide range of compressible flows: from weak linear acoustic waves to strong discontinuous waves (shocks). An outstanding feature of the CE/SE scheme is its truly multi-dimensional, simple but effective non-reflecting boundary condition (NRBC), which is particularly valuable for computational aeroacoustics (CAA). In nature, the method may be categorized as a finite volume method, where the conservation element (CE) is equivalent to a finite control volume (or cell) and the solution element (SE) can be understood as the cell interface. However, due to its careful treatment of the surface fluxes and geometry, it is different from the existing schemes. Currently, the CE/SE scheme has been developed to a matured stage that a 3-D unstructured CE/SE Navier-Stokes solver is already available. However, in the present review paper, as a general introduction to the CE/SE method, only the 2-D unstructured Euler CE/SE solver is chosen and sketched in section 2. Then applications of the 2-D and 3-D CE/SE schemes to linear, and in particular, nonlinear aeroacoustics are depicted in sections 3, 4, and 5 to demonstrate its robustness and capability.
Author
Space-Time Ce/Se Method; Aeroacoustics; Nonlinearity; Navier-Stokes Equation; Sound Waves; Conservation Laws

20030064175 NASA Glenn Research Center, Cleveland, OH, USA
A 3-D CE/SE Navier-Stokes Solver With Unstructured Hexahedral Grid for Computation of Near Field Jet Screech Noise
Loh, Ching Y.; Himansu, Ananda; Hultgren, Lennart S.; June 2003; 15 pp.; In English; Ninth Aeroacoustics Conference and Exhibit, 12-14 May 2003, Hilton Head, SC, USA; Original contains color illustrations
Contract(s)/Grant(s): WBS 22-708-90-25
Report No.(s): NASA/TM-2003-212314; AIAA Paper 2003-3207; NAS 1.15:212314; E-13903; Copyright; Avail: CASI; A03, Hardcopy

A 3-D space-time CE/SE Navier-Stokes solver using an unstructured hexahedral grid is described and applied to a circular jet screech noise computation. The present numerical results for an underexpanded jet, corresponding to a fully expanded Mach number of 1.42, capture the dominant and nonaxisymmetric 'B' screech mode and are generally in good agreement with existing experiments.
Author
Unstructured Grids (Mathematics); Jet Aircraft Noise; Navier-Stokes Equation; Sound Waves

20030064372 Department of the Navy, Washington, DC
Speech to Visual Aid Translator Assembly and Method
Belenger, Robert V., Inventor; Lopriore, Gennaro R., Inventor; Nov. 12, 2002; 17 pp.; In English
Patent Info.: Filed 12 Nov. 2002; US-Patent-Appl-SN-10/292955
Report No.(s): AD-D020064; No Copyright; Avail: Other Sources

This invention is a speech-to-visual-display translator assembly and method that can convert, or translate, spoken words into visual signals that can be seen by a hearing-impaired person at whom the spoken words are directed. The invention allows the receiving person to supplement speech sounds received with simultaneous visual signals. The invention presents phoneme sounds as phoneticized words. Essentially, it detects and converts to digital format information relating to spoken words, including frequency, relative loudness, suprasegmental information (i.e., the rhythm and rising and falling of voice pitch), and

intonation contour (i.e., the change in vocal pitch that accompanies production of a sentence). The user sees the words in a 'traveling sign' format with the intensity of the displayed phonemes dependent on the relative loudness with which they are spoken. (2 figures)
DTIC
Patent Applications; Speech; Visual Signals; Display Devices; Words (Language)

20030064914 Naval Undersea Warfare Center, Newport, RI
Optical Hydrophone and Array Using Bubble Resonance for Detecting Acoustic Signals
Stottlemyer, Thomas R., Inventor; Jun. 6, 2002; 13 pp.; In English
Patent Info.: Filed 6 Jun. 2002; US-Patent-Appl-SN-10165922
Report No.(s): AD-D020062; No Copyright; Avail: Other Sources

An optical hydrophone described herein includes a housing defining a chamber. The housing is acoustically transparent to acoustic waves at a frequency of interest. An optically transparent material fills the chamber and has air-filled voids defined therein that resonate within the material when an incoming acoustic wave impinges on the material. might introduced into the material and passed there through is affected by the air-filled voids resonating within the material. Light is transmitted to and from the material by optical fibers which are coupled to the material on either side thereof. A plurality of these optical hydrophones can be configured in a linear array through which light is passed. Such linear arrays can be used to measure incoming acoustic signals.
DTIC
Hydrophones; Optical Properties; Bubbles; Frequencies; Signal Transmission; Optical Fibers

20030064967 NASA Langley Research Center, Hampton, VA, USA
A Computational and Experimental Study of Slit Resonators
Tam, C. K. W.; Ju, H.; Jones, M. G.; Watson, W. R.; Parrott, T. L.; [2003]; 20 pp.; In English; 9th AIAA/CEAS Aeroacoustics Conference and Exhibit, 12-14 May 2003, Hilton Head, SC, USA
Report No.(s): AIAA Paper 2003-3310; Copyright; Avail: CASI; A03, Hardcopy

Computational and experimental studies are carried out to offer validation of the results obtained from direct numerical simulation (DNS) of the flow and acoustic fields of slit resonators. The test cases include slits with 90-degree corners and slits with 45-degree bevel angle housed inside an acoustic impedance tube. Three slit widths are used. Six frequencies from 0.5 to 3.0 kHz are chosen. Good agreement is found between computed and measured reflection factors. In addition, incident sound waves having white noise spectrum and a prescribed pseudo-random noise spectrum are used in subsequent series of tests. The computed broadband results are again found to agree well with experimental data. It is believed the present results provide strong support that DNS can eventually be a useful and accurate prediction tool for liner aeroacoustics. The usage of DNS as a design tool is discussed and illustrated by a simple example.
Author
Resonators; Direct Numerical Simulation; Flow Distribution; Slits

20030065120 Vermont Univ., Burlington, VT
Combining Clinical, Sonographic, and Elastographic Features to Improve the Detection of Prostate Cancer
Garra, Brian S.; Dec. 2002; 38 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-99-1-9007
Report No.(s): AD-A413287; No Copyright; Avail: CASI; A03, Hardcopy

The goal of this project is to combine features derived from ultrasound (US) images, US radio frequency (RF) data, tissue elasticity imaging, and clinical data such as PSA into a computerized system for displaying prostate images that indicate probable location(s) of cancer RF data are acquired from in-vitro prostatectomy specimens in cross sectional planes 2mm apart. These data are used to calculate RF features such as backscatter coefficient and are also used to generate images and elastograms from which image texture features and tissue strain are computed. These features are correlated with histology from the same location in the prostate to determine which feature combinations accurately predict the presence of cancer.
DTIC
Cancer; Histology; Imaging Techniques; Prostate Gland; Ultrasonics; Clinical Medicine; Detection

20030065161 NASA Langley Research Center, Hampton, VA, USA

Development of a Jet Noise Prediction Method for Installed Jet Configurations

Hunter, Craig A.; Thomas, Russell H.; [2003]; 26 pp.; In English; 9th AIAA/CEAS Aeroacoustics Conference and Exhibition, 12-14 May 2003, Hilton Head, SC, USA; Original contains color and black and white illustrations

Report No.(s): AIAA Paper 2003-3169; No Copyright; Avail: CASI; A03, Hardcopy

This paper describes development of the Jet3D noise prediction method and its application to heated jets with complex three-dimensional flow fields and installation effects. Noise predictions were made for four separate flow bypass ratio five nozzle configurations tested in the NASA Langley Jet Noise Laboratory. These configurations consist of a round core and fan nozzle with and without pylon, and an eight chevron core nozzle and round fan nozzle with and without pylon. Predicted SPL data were in good agreement with experimental noise measurements up to 121 inlet angle, beyond which Jet3D under predicted low frequency levels. This is due to inherent limitations in the formulation of Lighthill's Acoustic Analogy used in Jet3D, and will be corrected in ongoing development. Jet3D did an excellent job predicting full scale EPNL for nonchevron configurations, and captured the effect of the pylon, correctly predicting a reduction in EPNL. EPNL predictions for chevron configurations were not in good agreement with measured data, likely due to the lower mixing and longer potential cores in the CFD simulations of these cases.

Author

Jet Aircraft Noise; Noise Prediction; Predictions; Propulsion System Configurations; Installing; Flow Distribution; Three Dimensional Flow; Aeroacoustics

20030065210 Woods Hole Oceanographic Inst., MA

Acoustic Scattering by Axisymmetric Finite-Length Bodies with Application to Fish: Measurement and Modeling

Reeder, D.; Jun. 2002; 152 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): N00014-98-1-0879

Report No.(s): AD-A413398; MIT/WHOI-2002-11; No Copyright; Avail: CASI; A08, Hardcopy

This thesis investigates the complexities of acoustic scattering by finite bodies in general and by fish in particular through the development of an advanced acoustic scattering model and detailed laboratory acoustic measurements. A general acoustic scattering model is developed that is accurate and numerically efficient for a wide range of frequencies, angles of orientation, irregular axisymmetric shapes and boundary conditions The model presented is an extension of a two-dimensional conformal mapping approach to scattering by irregular, fine-length bodies of revolution. An extensive series of broadband acoustic backscattering measurements has been conducted involving alewife fish (Alosa pseudoharengus), which are morphologically similar to the Atlantic herring (Glupea harengus). A greater-than-octave bandwidth (40-95 kHz), shaped, linearly swept, frequency modulated signal was used to insonify live, adult alewife that were tethered while being rotated in 1-degree increments over all angles of orientation in two planes of rotation (lateral and dorsal/ventral) Spectral analysis correlates frequency dependencies to morphology and orientation. Pulse compression processing temporally resolves multiple returns from each individual which show good correlation with size and orientation, and demonstrate that there exists more than one significant scattering feature in the animal. Imaging technologies used to exactly measure the morphology of the scattering features of fish include very high-resolution Phase Contrast X-rays (PCX) and Computerized Tomography (CT) scans, which are used for morphological evaluation and incorporation into ;he scattering model. Studies such as this one, which combine scattering models with high-resolution morphological information and high- quality laboratory data, are crucial to the quantitative use of acoustics in the ocean.

DTIC

Acoustic Scattering; Fishes; Acoustic Measurement

20030065217 Washington Univ., Seattle, WA

2ND International Symposium on HIFU Therapy 'HIFU Seattle 2002'

Andrew, Marliee A.; Crum, Lawrence A.; Vaezy, Shahram; Dec. 2002; 585 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAMD17-01-1-0824

Report No.(s): AD-A413408; No Copyright; Avail: CASI; A25, Hardcopy

This book is a compilation of papers presented at the 2nd International Symposium on Therapeutic Ultrasound, held in Seattle, Washington, July 29-August 1,2002. The Symposium attracted 200 participants from 14 different countries. A list of the author attendees (without the requisite photograph) is included in these proceedings. Approximately 100 abstracts were accepted for presentation at the conference. Invitations to the authors to submit articles for publication in this proceedings have resulted in this volume, which contains 73 separate articles. This volume has been divided into a number of topic categories,

viz., Clinical Studies, Laboratory Studies, Simulation and Monitoring, Dosimetry, Engineering, Lithotripsy, Ultrasound-Enhanced Drug Delivery, and Sonodynamic Therapy. One can see from this topic coverage that the symposium was largely on HIFU (essentially the first five topics), yet also broad enough to cover most aspects of therapeutic ultrasound.
DTIC
Ultrasonics; Therapy; Diagnosis

73
NUCLEAR PHYSICS

Includes nuclear particles; and reactor theory. For space radiation see *93 Space Radiation*. For atomic and molecular physics see *72 Atomic and Molecular Physics*. For elementary particle physics see *77 Physics of Elementary Particles and Fields*. For nuclear astrophysics see *90 Astrophysics*.

20030063921 NASA Marshall Space Flight Center, Huntsville, AL, USA
Some Remarks on GMRES for Transport Theory
Patton, Bruce W.; Holloway, James Paul; [2003]; 11 pp.; In English; Nuclear Mathematical and Computational Sciences: A Century in Review, A Century Anew, 6-11 Apr. 2003, Gatlinburg, TN, USA; Copyright; Avail: CASI; A03, Hardcopy

We review some work on the application of GMRES to the solution of the discrete ordinates transport equation in one-dimension. We note that GMRES can be applied directly to the angular flux vector, or it can be applied to only a vector of flux moments as needed to compute the scattering operator of the transport equation. In the former case we illustrate both the delights and defects of ILU right-preconditioners for problems with anisotropic scatter and for problems with upscatter. When working with flux moments we note that GMRES can be used as an accelerator for any existing transport code whose solver is based on a stationary fixed-point iteration, including transport sweeps and DSA transport sweeps. We also provide some numerical illustrations of this idea. We finally show how space can be traded for speed by taking multiple transport sweeps per GMRES iteration. Key Words: transport equation, GMRES, Krylov subspace
Author
Transport Theory; Scattering; Flux (Rate); Linear Systems; Algorithms

20030064274 Argonne National Lab., IL, USA
Representativity of Fuel and Cladding Material Irradiations Using a Spallation Neutron Source
Naberejnev, D. G.; Salvatores, M.; 2001; In English
Report No.(s): DE2003-807354; ANL/TD/TM01-24; No Copyright; Avail: National Technical Information Service (NTIS)

No abstract available
NTIS
Neutron Sources; Spallation; Cladding; Irradiation; Nuclear Fuels

20030064278
Spallation Neutron Source and Other High Intensity Proton Sources
Chou, W.; Feb. 2003; In English
Report No.(s): DE2003-807534; FERMILAB-CONF-03/012; No Copyright; Avail: National Technical Information Service (NTIS)

This lecture is an introduction to the design of a spallation neutron source and other high intensity proton sources. It discusses two different approaches: linac-based and synchrotron-based. The requirements and design concepts of each approach are presented. The advantages and disadvantages are compared. A brief review of existing machines and those under construction and proposed is also given. An R&D program is included in an appendix.
NTIS
Spallation; Neutron Sources; Protons; Synchrotrons

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*.

20030053082 NASA Langley Research Center, Hampton, VA, USA
Apparatus and Method for Measuring Strain in Optical Fibers using Rayleigh Scatter
Froggatt, Mark E., Inventor; Moore, Jason P., Inventor; April 08, 2003; 14 pp.; In English
Patent Info.: Filed 24 Mar. 2000; US-Patent-6,545,760; US-Patent-Appl-SN-535659; US-Patent-Appl-SN-127603; NASA-Case-LAR-15508-1; No Copyright; Avail: CASI; A03, Hardcopy

An apparatus and method for measuring strain in an optical fiber using the spectral shift of Rayleigh scattered light. The interference pattern produced by an air gap reflector and backscattered radiation is measured. Using Fourier Transforms, the spectrum of any section of fiber can be extracted. Cross correlation with an unstrained measurement produces a correlation peak. The location of the correlation peak indicates the strain level in the selected portion of optical fiber.
Official Gazette of the U.S. Patent and Trademark Office
Optical Fibers; Rayleigh Scattering; Strain Measurement; Methodology; Measuring Instruments

20030063099 Alabama Agricultural and Mechanical Univ., Normal, AL, USA
All-Optical Micro Motors Based on Moving Gratings in Photosensitive Media
Adamovsky, Gregory, Technical Monitor; Curley, M.; Sarkisov, S.; Fields, A.; HBCUs/OMUs Research Conference Agenda and Abstracts; February 2003, pp. 9; In English; See also 20030063082; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

This research effort was a feasibility study of the concept of an all-optical micro motor with a rotor driven by a traveling wave. The wave was a result of a photo induced surface deformation of a photosensitive material produced by a traveling holographic grating. Two phases modulated coherent optical beams were used to generate the grating in two types of photosensitive materials. The materials that were studied were photorefractive crystals and thin polymer films. Theoretical studies were performed on lithium niobate giving predictions of deformations of the order of nanometers. The experimental deformation size was also on the order of nanometers. The deformations were deep enough to provide conditions for the implementation of the all-optical motor using lithium niobate. We also were able to align micron-size dielectric particles along the holographic gratings by means of the periodic electric forces generated by the grating. These forces can also move the particles along the surface if the grating is moving. We then turned our attention on thin films and obtained a deformation visible on the order of 100 microns. An experimental breadboard demonstration of a prototype was done in the summer of 2001 at Glenn Research Center (GRC). The demonstration included the movement of clocks mechanical workings by an optically driven motor based on a polymer film. The application of this technology can be adapted to government as well as industrial uses. One such project is to make a chemical sensor for the detection of hazardous chemicals. The thin polymer film is highly suited for this purpose since a marker dye could be easily placed on the film in order to detect chemical compounds. This system could be a self-regulating chemical monitoring system used on launches of the space shuttle or locations where hazardous chemicals are present. The project provided support for two black minority graduate students targeting MS and PhD degrees in Applied Optics.
Author
Micromotors; Gratings (Spectra); Photosensitivity; Holography; Light Beams

20030064223 Woods Hole Oceanographic Inst., MA
Physical and Optical Structures in the Upper Ocean of the East (Japan) Sea (WHOI Component)
Lee, Craig M.; Brink, Kenneth H.; Jones, Burton H.; April 08, 2003; 6 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): N00014-98-1-0369
Report No.(s): AD-A412655; No Copyright; Avail: CASI; A02, Hardcopy

We seek to understand the processes that control physical and bio-optical variability in the upper ocean of the East/Japan Sea. Specifically we are interested in: (1) the upper ocean response to strong wintertime forcing (Siberian cold air outbreaks) at the subpolar front; (2) the resulting formation subduction, and spreading of intermediate waters; (3) the dynamics of the subpolar front; and (4) contrasting seasonal and coastal/central basin bio-optical variability. Highly resolved, three-dimensional upper ocean measurements provide a unique picture of the integrated effects of wintertime water mass formation in response to strong atmospheric forcing and of frontal eddy properties. Simultaneous measurements of bio-optical properties contrasts conditions on either side of the front and permit us to study the role of dynamics in controlling bio-optical variability.

Both at the subpolar front and off the Korean coast, SeaSoar surveys provide bio-optical measurements of unprecedented synopticity and horizontal resolution.
DTIC
Optical Properties; Oceans; Atmospheric Chemistry; Meteorological Parameters

20030064271 California Univ., Lawrence Berkeley National Lab., Berkeley, CA, USA
Raman Forward Scattering of High-Intensity Chirped Laser Pulses
Schroeder, C. B.; Esarey, E.; Shadwick, B. A.; Leemans, W. P.; 2002; 18 pp.; In English
Report No.(s): DE2003-807424; No Copyright; Avail: Department of Energy Information Bridge

Raman forward scattering of a high-intensity, short-duration, frequency-chirped laser pulse propagating in an underdense plasma is examined. The growth of the direct forward scattered light is calculated for a laser pulse with a linear frequency chirp in various spatiotemporal regimes. This includes a previously undescribed regime of strongly-coupled four-wave nonresonant interaction, which is important for relativistic laser intensities. In all regimes of forward scattering, it is shown that the growth rate increases (decreases) for positive (negative) frequency chirp. The effect of chirp on the growth rate is relatively minor, i.e., a few percent chirp yields few percent changes in the growth rates. Relation of these results to recent experiments is discussed.
NTIS
Raman Spectra; Pulsed Lasers; High Power Lasers

20030064348 Lawrence Livermore National Lab., Livermore, CA
Optics Elements for Modeling Electrostatic Lenses and Accelerator Components: I. Einzel Lenses
Gillespie, G. H.; Brown, T. A.; May 1997; 14 pp.; In English
Report No.(s): DE2003-16410; No Copyright; Avail: Department of Energy Information Bridge

A set of optical models for a variety of electrostatic lenses and accelerator columns has been developed for the computer code TRACE 3-D. TRACE 3-D is an envelope (matrix) code including space charge often used to model bunched beams in magnetic transport systems and radiofrequency (RF) accelerators when the effects of beam current may be important. Several new matrix models have been developed that allow the code to be used for modeling beam lines and accelerators with electrostatic components. The new models include: (1) three einzel lenses, (2) two accelerator columns, (3) three electrostatic deflectors (prisms), and (4) an electrostatic quadrupole. A prescription for setting up the initial beam appropriate to modeling 2-D (continuous) beams has also been developed. The new models for (1) are described in this paper, selected comparisons with other calculations are presented, and a beamline application is summarized.
NTIS
Accelerators; Optics; Lenses; Electrostatics

20030064411 California Univ., Lawrence Livermore Lab., Livermore, CA, USA
Ultrasonic Testing of NIF Amplifier FAU Top Plates
Chinn, D. J.; Huber, R. D.; Haskins, J. J.; Rodriguez, J. A.; Souza, P. R.; May 07, 2002; 34 pp.; In English
Report No.(s): DE2003-15003397; UCRL-ID-148533; No Copyright; Avail: Department of Energy Information Bridge

A key component in the National Ignition Facility (NIF) laser optic system is the amplifier frame assembly unit (FAU). The cast aluminum top plate that supports the FAU is required to withstand loads that would occur during an earthquake with a recurrence period of 1000 years. The stringent seismic requirements placed on the FAU top plate induced a study of the cast aluminum material used in the top plate. Ultrasonic testing was used to aid in characterizing the aluminum material used in the plates. This report documents the work performed using contact ultrasonic testing to characterize the FAU top plate material. The ultrasonic work reported here had 3 objectives: (1) inspect the plate material before cyclic testing conducted at the Pacific Earthquake Engineering Research Center (PEER) (2) determine the overall quality of individual plates (3) detect large defects in critical areas of individual plates Section 111, 'Pre-cyclic test inspection', describes work performed in support of Objective 1. Section IV, 'Ultrasonic field measurements', describes work performed in support of Objectives 2 and 3.
NTIS
Ignition; Ultrasonic Tests; Optics; Lasers; Amplifiers

20030064416 Lawrence Livermore National Lab., Livermore, CA
Eyeglass Large Aperture, Lightweight Space Optics FY2000 - FY2002 LDRD Strategic Initiative.
Hyde, R.; Feb. 10, 2003; 140 pp.; In English
Report No.(s): DE2003-15003388; UCRL-ID-151390; No Copyright; Avail: Department of Energy Information Bridge

A series of studies by the Air Force, the National Reconnaissance Office and NASA have identified the critical role played by large optics in fulfilling many of the space related missions of these agencies. Whether it is the Next Generation Space Telescope for NASA, high resolution imaging systems for NRO, or beam weaponry for the Air Force, the diameter of the primary optic is central to achieving high resolution (imaging) or a small spot size on target (lethality). While the detailed requirements differ for each application (high resolution imaging over the visible and near-infrared for earth observation, high damage threshold but single-wavelength operation for directed energy), the challenges of a large, lightweight primary optic which is space compatible and operates with high efficiency are the same. The advantage of such large optics to national surveillance applications is that it permits these observations to be carried-out with much greater effectiveness than with smaller optics. For laser weapons, the advantage is that it permits more tightly focused beams which can be leveraged into either greater effective range, reduced laser power, andor smaller on-target spot-sizes; weapon systems can be made either much more effective or much less expensive. This application requires only single-wavelength capability, but places an emphasis upon robust, rapidly targetable optics.
NTIS
Diffractive Optics; Spaceborne Telescopes; Reconnaissance; Imaging Techniques

20030064422 Lawrence Livermore National Lab., Livermore, CA
Optics, Diagnostics and Applications for Fourth-Generation Light Sources
Wootton, A.; Feb. 05, 2003; In English
Report No.(s): DE2003-15003384; UCRL-ID-151383; No Copyright; Avail: National Technical Information Service (NTIS)
The Linac Coherent Light Source (LCLS) is a 1.5 to 15 A-wavelength free-electron laser (FEL), proposed for the Stanford Linear Accelerator Centre (SLAC). The photon output consists of high brightness, transversely coherent pulses with duration less than 300 fs, together with a broad spontaneous spectrum with total power comparable to the coherent output. The output fluence, and pulse duration, pose special challenges for optical component and diagnostic designs. We first discuss the specific requirements for the initial scientific experiments, and our proposed solutions. We then describe the supporting research and development program that includes: (1) radiation field modelling, (2) experimental and theoretical material damage studies, (3) high resolution, high fluence-tolerant optical design, fabrication, and testing, (including material manufacturing), and (4) diagnostic design and testing.
NTIS
Coherent Light; Free Electron Lasers; Light Sources; Linear Accelerators; Optical Equipment

20030065123 Rensselaer Polytechnic Inst., Troy, NY
Imaging and Collecting Spatially Structured Arrays of Ultrashort Pulses for Ultrahigh Information Rate Optics: Numerical Simulation and Modeling
Fork, Richard L.; Jun. 30, 1998; 4 pp.; In English
Contract(s)/Grant(s): F49620-93-1-0410; Proj-3484
Report No.(s): AD-A413280; AFRL-SR-AR-TR-03-0097; No Copyright; Avail: CASI; A01, Hardcopy
We propose augmentation of the principal investigator's 'parent' contract with the Air Force in the form of support for one additional graduate student. The student would perform numerical simulations and modeling relevant to the use of ultrashort optical pulses to observe a remote object at high data rate. The work would relate specifically to our recent experimental demonstration of a kinematically modelocked nonlinear loop mirror laser utilizing erbium doped fiber. This technology provides a strategy for realizing a sensitive means for sensing the motion of a remote object. The student would seek a better description of the internal dynamics of the nonlinear loop mirror laser and would examine strategies that might more fully utilize the potential of this physical behavior. Relevance to recent and ongoing work would also be addressed.
DTIC
Electromagnetic Pulses; Imaging Techniques; Mathematical Models; Augmentation; Nonlinear Optics

20030065166 Arizona Univ., Tucson, AZ
Controlling Spontaneous Emission in Semiconductor Microcavities
Khitrova, Galina; Feb. 24, 2001; 6 pp.; In English
Contract(s)/Grant(s): F49620-97-1-0401; Proj-3484
Report No.(s): AD-A413378; AFRL-SR-AR-TR-03-0126; No Copyright; Avail: CASI; A02, Hardcopy
John Prineas was the student supported by this AASERT. In our Progress Reports of July 31, 1998 and June 30, 1999, he described his research on radiatively coupled quantum wells with narrow excitation linewidths (^<0.6 meV) and with

periods in the vicinity of half the wavelength of light in the semiconducting material (X012n 830 nm/(2x3.6) 115 nm) 1-8 John won a Dean's Fellowship, so he no longer needed AASERT support for his salary. Soon after he received an unusual invitation to spend several months at Bell Laboratories in the laboratory of Jagdeep Shah AASERT funds were used for his travel and living expenses, making possible this industrial experience and leading to very significant results described in the next section and published in Physical Review Letters. John studied the resonance Rayleigh scattering of disordered periodic semiconductor multiple quantum-well structures experimentally with Jagdeep Shah at Bell Labs. Polaritonic effects were found to dominate the secondary emission dynamics due to the coexistence of several radiant modes with different radiative decay times. They give rise to polarization beating between modes and determine rise and decay times of the resonance Rayleigh scattered signals. These results have been published in Physical Review Letters 9.
DTIC
Cavities; Coupling; Quantum Wells; Semiconductor Devices

20030065177 Cincinnati Univ., OH
Novel Luminescent Material and Processes for Optical Devices
Steckl, Andrew J.; Apr. 30, 1999; 11 pp.; In English
Contract(s)/Grant(s): DAAH04-95-1-0626
Report No.(s): AD-A412709; P-34894-EL; No Copyright; Avail: CASI; A03, Hardcopy

The overall goal of this program has to develop novel light emitting optoelectronics and photonic devices. We have investigated MBB-grown GaN thin films doped with rare earth (RE) species for emission of light over a wide wavelength range from the near-ultraviolet to the near-infrared. We have shown that Er-doped GaN is an excellent emitter both in the infrared at 1.5 microns and in the visible (green light at 537 and 558 nm). This makes Er-doped GaN a very promising material candidate for light sources to be utilized in optical communication and interconnections because the IR photoluminescence at room temperature is much stronger than that in other semiconductors. Furthermore, the presence of strong and spectrally pure visible emission indicates that applications such as bright, robust display devices can be developed within the same materials technology base. We have shown the other primary visible colors can be emitted with high intensity at room temperature in RE-doped GaN: red from Pr and Bu, and blue from Tm. We conclude that bright and robust full-color displays using RE-doped GaN are technically feasible and commercially attractive.
DTIC
Emitters; Optical Equipment; Optical Communication; Photoluminescence; Luminescence

20030065226 Michigan Univ., Ann Arbor, MI
Acousto-Mechanical Imaging for Breast Cancer Detection
Emelianov, Stanislav Y.; May 2002; 12 pp.; In English
Contract(s)/Grant(s): DAMD17-01-1-0562
Report No.(s): AD-A413025; No Copyright; Avail: CASI; A03, Hardcopy

The underlying hypothesis of our study is that quantitative breast elasticity imaging is possible and provides unique information, which could increase the detection, characterization and monitoring of potentially malignant masses in the breast. The purpose of this study is to develop a new modality of medical imaging for surrogate palpation of deep lying breast lesions, namely Acousto-Mechanical Imaging, or AMI, capable of producing high-resolution images of elastic (Young's or shear) moduli. In our method, the evaluation of mechanical structure and properties of an object is accomplished via the synergy of the surface stress pattern measured by the force sensor array and the internal strain obtained by an ultrasound imager. Acousto-mechanical imaging, therefore, consists of three main components: evaluation of externally induced surface pressure and internal tissue motion; estimation of strain and stress tensor components; and reconstruction of the spatial distribution of the elastic modulus using displacement, strain and stress images. An ambitious research plan has been developed to address important engineering and clinical aspects of AMI. The overall program is designed to critically test the hypothesis that AMI can non-invasively detect and monitor breast lesions thus providing a valuable clinical tool for breast cancer diagnosis, monitoring and therapy.
DTIC
Clinical Medicine; Cancer; Diagnosis; Mammary Glands; Ultrasonics; Tissues (Biology)

20030065254 Oregon State Univ., Corvallis, OR, USA

Beam Transmission and Attenuation Coefficients: Instruments, Characterization, Field Measurements and Data Analysis Protocols

Pegau, Scott; Zaneveld, J. Ronald V.; Mueller, James L.; Ocean Optics Protocols for Satellite Ocean Color Sensor Validation, Revision 4, Volume IV: Inherent Optical Properties: Instruments, Characterizations, Field Measurements and Data Analysis Protocols; May 2003, pp. 15-26; In English; See also 20030065253; No Copyright; Avail: CASI; A03, Hardcopy

This chapter of the document discusses transmissometer design characteristics, characterization and calibration of beam transmissometers, and data analysis methods. The introduction to the chapter reads as follows: Beam transmittance (lambda, r(sub T)), over an optical path of length r(sub T) m, and the beam attenuation coefficient c(lambda) [m exp (-1)] are introduced in Chapter 1 (Sect. 1.3). The two variables are related by equation (1.6). A beam transmissometer is an instrument that combines a source of collimated spectral radiant flux phi (sub 0) (lambda, 0, 0, center dot) and a coaligned detector, to measure the flux phi (sub 0) (lambda, 0, 0, center dot) transmitted over distance r(sub T), to measure T(lambda, r(sub T). A beam transmissometer is also frequently called a beam attenuation meter, or a c-meter.

Derived from text

Attenuation Coefficients; Optical Paths; Transmissometers; Transmittance

75
PLASMA PHYSICS

Includes magnetohydrodynamics and plasma fusion. For ionospheric plasmas see *46 Geophysics*. For space plasmas see *90 Astrophysics*.

20030064269 Princeton Univ., NJ

Study of Thermonuclear Alfven Instabilities in Next Step Burning Plasma Experiments

Gorelenkov, N. N.; Berk, H. L.; Budny, R.; Cheng, C. Z.; Fu, G. Y.; Jul. 2002; In English

Report No.(s): DE2003-807248; PPPL-3717; No Copyright; Avail: National Technical Information Service (NTIS)

A study is presented for the stability of alpha-particle driven shear Alfven Eigenmodes (AE) for the normal parameters of the three major burning plasma proposals, ITER (International Thermonuclear Experimental Reactor), FIRE (Fusion Ignition Research Experiment), and IGNITOR (Ignited Torus). A study of the JET (Joint European Torus) plasma, where fusion alphas were generated in tritium experiments, is also included to attempt experimental validation of the numerical predictions. An analytic assessment of Toroidal AE (TAE) stability is first presented, where the alpha particle beta due to the fusion reaction rate and electron drag is simply and accurately estimated in 7-20 keV plasma temperature regime.

NTIS

Alpha Particles; Plasmas (Physics); Toruses; Nuclear Fusion; Magnetohydrodynamic Waves

20030064448 Lawrence Livermore National Lab., Livermore, CA, Sandia National Labs., Albuquerque, NM

Plasma Diagnostics for X-ray Driven Foils at Z

Heeter, R. F.; Emig, J.; Foord, M. E.; Springer, P. T.; Thoe, R. S.; Jun. 17, 2000; In English

Report No.(s): DE2003-15003269; UCRL-JC-138708; No Copyright; Avail: National Technical Information Service (NTIS)

We report the development of techniques to diagnose plasmas produced by X-ray photoionization of thin foils placed near the Z-pinch on the Sandia Z Machine. The development of 100+ TW X-ray sources enables access to novel plasma regimes, such as the photoionization equilibrium. To diagnose these plasmas one must simultaneously characterize both the foil and the driving pinch. The desired photoionized plasma equilibrium is only reached transiently for a 2-ns window, placing stringent requirements on diagnostic synchronization. We have adapted existing Sandia diagnostics and fielded an additional gated 3-crystal Johann spectrometer with dual lines of sight to meet these requirements. We present sample data from experiments in which 1 cm, 180 eV tungsten pinches photoionized foils composed of 200 angstroms Fe and 300 NaF co-mixed and sandwiched between 1000 angstroms layers of Lexan (CHO), and discuss the application of this work to benchmarking astrophysical models.

NTIS

Plasma Diagnostics; X Ray Sources; Foils (Materials); Astrophysics; Astronomical Models; Zeta Pinch

20030064460 Lawrence Livermore National Lab., Livermore, CA

LDRD Final Report for 01-ERD-100 FLIRT: A Magnetic Field Topology Diagnostic for Spheromaks and Other Self-Organized Magnetically Confined Plasmas

McLean, H. S.; Chen, H.; Ryutov, D. D.; Jan. 23, 2003; 8 pp.; In English

Report No.(s): DE2003-15003145; UCRL-ID-151358; No Copyright; Avail: Department of Energy Information Bridge

Tangled magnetic field lines are common in laboratory and space plasmas, but determining the geometrical structure of magnetic fields in the presence of plasma is a difficult and still unresolved problem. To address this open question we developed and tested a new technique for measuring the magnetic field-line topology in magnetically confined plasmas. Our field-line tracing diagnostic (FLIRT) uses a high-power, short-pulse laser to launch a burst of energetic electrons from a target passing through the plasma. These electrons then generally follow magnetic-field lines until they strike a solid surface, where a burst of x-rays is produced. The field-line connection length can be determined from the time delay between the laser pulse and the burst of x-rays. The topology of the field lines can be inferred by measuring the connection length as a function of initial target location inside the plasma. Measuring the spatial distribution of x-ray production provides further information on the field topology, including the effects of magnetic field fluctuations and stochasticity.

NTIS

Topology; Spheromaks; Magnetic Fields; Plasma Control; Space Plasmas

20030065186 Massachusetts Inst. of Tech., Cambridge, MA

Coherent Structures and Chaos in Beam Plasmas

Chen, Chiping; Feb. 27, 2002; 23 pp.; In English

Contract(s)/Grant(s): F49620-00-1-0007

Report No.(s): AD-A413380; AFRL-SR-AR-TR-03-0165; No Copyright; Avail: CASI; A03, Hardcopy

This report summarizes our research carried out under the auspices of the above referenced grant from December 1. 1999 to November 30, 2002. The goal of this research was to investigate coherent structures and chaos in beam plasmas in regimes relevant to the development of advanced high-power microwave (HPM) sources for directed energy applications. The report is organized as follows. In Sections 1-5, a brief summary of our research accomplishments is presented in selected areas. In Section 6, a brief description of our interactions with Air Force Research Laboratory, industries and other academic institutions is given. In Section 7, references are cited.

DTIC

Plasmas (Physics); Chaos; Beamforming

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*.

20030063102 North Carolina Agricultural and Technical State Univ., Greensboro, NC, USA

Low-Power SOI CMOS Transceiver

Fujikawa, Gene, Technical Monitor; Cheruiyot, K.; Cothern, J.; Huang, D.; Singh, S.; Zencir, E.; Dogan, N.; HBCUs/OMUs Research Conference Agenda and Abstracts; February 2003, pp. 22; In English; See also 20030063082

Contract(s)/Grant(s): NAG3-2584; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The work aims at developing a low-power Silicon on Insulator Complementary Metal Oxide Semiconductor (SOI CMOS) Transceiver for deep-space communications. RF Receiver must accomplish the following tasks: (a) Select the desired radio channel and reject other radio signals, (b) Amplify the desired radio signal and translate them back to baseband, and (c) Detect and decode the information with Low BER. In order to minimize cost and achieve high level of integration, receiver architecture should use least number of external filters and passive components. It should also consume least amount of power to minimize battery cost, size, and weight. One of the most stringent requirements for deep-space communication is the low-power operation. Our study identified that two candidate architectures listed in the following meet these requirements: (1) Low-IF receiver, (2) Sub-sampling receiver. The low-IF receiver uses minimum number of external components. Compared to Zero-IF (Direct conversion) architecture, it has less severe offset and flicker noise problems. The Sub-sampling receiver amplifies the RF signal and samples it using track-and-hold Subsampling mixer. These architectures provide low-power solution for the short- range communications missions on Mars. Accomplishments to date include: (1) System-level design and

simulation of a Double-Differential PSK receiver, (2) Implementation of Honeywell SOI CMOS process design kit (PDK) in Cadence design tools, (3) Design of test circuits to investigate relationships between layout techniques, geometry, and low-frequency noise in SOI CMOS, (4) Model development and verification of on-chip spiral inductors in SOI CMOS process, (5) Design/implementation of low-power low-noise amplifier (LNA) and mixer for low-IF receiver, and (6) Design/implementation of high-gain LNA for sub-sampling receiver. Our initial results show that substantial improvement in power consumption is achieved using SOI CMOS as compared to standard CMOS process. Potential advantages of SOI CMOS for deep-space communication electronics include: (1) Radiation hardness, (2) Low-power operation, and (3) System-on-Chip (SOC) solutions.
Author
Silicon Oxides; Product Development; Semiconductor Devices; Transmitter Receivers; Radio Frequencies; Radio Signals

20030064227 Daresbury Nuclear Physics Lab., UK
Neptunium Octupole and Hexadecapole Motif in NpO(sub 2) Directly from Electric-Dipole (E1) Enhanced x-ray Bragg Diffraction
Lovesey, S. W.; Balcar, E.; Detlefs, C.; van der Loan, G.; Sivia, D. S.; Feb. 17, 2003; 24 pp.; In English
Report No.(s): PB2003-104822; RAL-TR-2003-002; Copyright; Avail: National Technical Information Service (NTIS)
The phase transition in NpO2 at T(sub o) approximately 25.5K is accompanied by the onset of superlattice reflections in the x-ray Bragg diffraction pattern, with intensity enhanced by an electric-dipole (E1) event. Additional experiments using other techniques indicate no ordering at T(sub o) of Np magnetic moments. Absence of long-range magnetic order below T(sub o) fits with the outcome of a polarization analysis of superlattice intensities at 12K; signals are observed in both the unrotated and rotated channels of scattering while magnetic (dipole) moments would contribute only in the rotated channel. The authors demonstrate that these empirical findings, together with a narrow energy profile of the Bragg intensity at the Np M(sub 4) edge, are consistent with magnetic and charge contributions to the E1 Bragg amplitude described by Np 5f multipoles of ranks 3 (octupole) and 4 (hexadecapole).
NTIS
X Ray Diffraction; Diffraction Patterns; Neptunium Compounds

20030064250 Sandia National Labs., Albuquerque, NM, USA, California Polytechnic State Univ., San Luis Obispo, CA, USA, Michigan Univ., Ann Arbor, MI, USA
Electrical-Impedance Tomography for Opaque Multiphase Flows in Metallic (Electrically-Conducting) Vessels
Liter, S. G.; Torczynski, J. R.; Shollenberger, K. A.; Ceccio, S. L.; Nov. 2002; 88 pp.; In English
Report No.(s): DE2003-805878; SAND2002-3834; No Copyright; Avail: Department of Energy Information Bridge
A novel electrical-impedance tomography (EIT) diagnostic system, including hardware and software, has been developed and used to quantitatively measure material distributions in multiphase flows within electrically-conducting (i.e., industrially relevant or metal) vessels. The EIT system consists of energizing and measuring electronics and seven ring electrodes, which are equally spaced on a thin nonconducting rod that is inserted into the vessel. The vessel wall is grounded and serves as the ground electrode. Voltage-distribution measurements are used to numerically reconstruct the time-averaged impedance distribution within the vessel, from which the material distributions are inferred. Initial proof-of-concept and calibration was completed using a stationary solid-liquid mixture in a steel bench-top standpipe. The EIT system was then deployed in Sandia's pilot-scale slurry bubble-column reactor (SBCR) to measure material distributions of gas-liquid two-phase flows over a range of column pressures and superficial gas flow rates.
NTIS
Tomography; Multiphase Flow; Liquid-Gas Mixtures; Electrical Impedance; Calibrating

20030064281
Fermilab Data Storage Infrastructure
Bakken, J.; Berman, E.; Huang, C. H.; Moibenko, A.; Petravick, D.; Feb. 2003; 8 pp.; In English
Report No.(s): DE2003-807535; FERMILAB-CONF-03/019; No Copyright; Avail: Department of Energy Information Bridge
Fermilab, in collaboration with the DESY laboratory in Hamburg, Germany, has created a petabyte scale data storage infrastructure to meet the requirements of experiments to store and access large data sets. The Fermilab data storage infrastructure consists of the following major storage and data transfer components: Enstore mass storage system, DCache distributed data cache, ftp and Grid ftp for primarily external data transfers. This infrastructure provides a data throughput

sufficient for transferring data from experiments' data acquisition systems. It also allows access to data in the Grid framework.
NTIS
Data Acquisition; Data Storage; Computer Techniques

20030064290 Fermi National Accelerator Lab., Batavia, IL, USA, Stanford Univ., Stanford, CA, Stanford Linear Accelerator Center, Stanford, CA, USA
Effect of Cooling Water on Stability of NLC Linac Components
Le Pimpec, F.; Adiga, S.; Asiri, F.; Bowden, G.; Dell'Orco, D.; Feb. 2003; In English
Report No.(s): DE2003-807684; FERMILAB-CONF-02/369; No Copyright; Avail: National Technical Information Service (NTIS)

Vertical vibration of linac components (accelerating structures, girders and quadrupoles) in the NLC has been studied experimentally and analytically. Effects such as structural resonances and vibration caused by cooling water both in accelerating structures and quadrupoles have been considered. Experimental data has been compared with analytical predictions and simulations using ANSYS. A design, incorporating the proper decoupling of structure vibrations from the linac quadrupoles, is being pursued.
NTIS
Stability; Liquid Cooling; Linear Accelerators; Structural Vibration

20030064350 Fermi National Accelerator Lab., Batavia, IL, USA, Hawaii Univ., Honolulu, HI, USA
Synchro-Betatron Resonances in the 8 GeV Proton Driver
Ohnuma, S.; Nov. 2002; 16 pp.; In English
Report No.(s): DE2003-805246; FERMILAB-TM-2193; No Copyright; Avail: Department of Energy Information Bridge

Two reports on the design of future proton drivers have been issued at Fermilab: The Proton Driver Design Study, FERMILAB-TM-2136, December 2000 and Proton Driver Study II, Part 1, FERMILAB-TM-2169, May 2002. The major difference of these two versions is the size (circumference) and the maximum energy. In the first study, the circumference is chosen to be 711.3m, which is 1.5 times the present Booster, with the maximum energy of 16 GeV. In the second version, it is mandated to be the same as Booster together with the same maximum energy of 8 GeV. One of the major impacts of the reduced size of the ring is the inevitable reduction in the total length of available space for injection/collimation/extraction systems and for rf cavities, 14 slots of 7.43m each in the smaller ring compared with 24 slots of 6.15m each in the larger ring. Since each cavity occupies a slot of 2.35m and 22 cavities are desirable, seven or eight slots out of 14 in the smaller ring must be reserved for rf, only six or seven remaining for all other systems. The constraint in space is particularly troublesome for the extraction system since the beam loss at extraction (at the highest beam energy) is the major concern of any high intensity proton machines.
NTIS
Betatrons; Protons; Radio Frequencies; Resonance; Synchrotrons

20030064364 Fermi National Accelerator Lab., Batavia, IL, USA
Thermo-Mechanical Characterization of Insulated and Epoxy-Impregnated Nb(sub 3)Sn Composites
Imbasciati, L.; Volpini, G.; Ambrosio, G.; Chichili, D. R.; Pedrini, D.; Dec. 2002; 8 pp.; In English
Report No.(s): DE2003-805790; FERMILAB-CONF-02/299-E; No Copyright; Avail: Department of Energy Information Bridge

Nb(sub 3)Sn is, at present, the best superconductor for high field accelerator magnets. Several models using Nb(sub 3)Sn are under development in many laboratories. Knowledge of the thermo-mechanical properties of the impregnated coils is of crucial importance for the design of these magnets. In fact, the performance of epoxy-impregnated coils is sensitive to the thermal conductivity value, especially in case of heating caused by hysteretic losses, which are usually relevant in Nb(sub 3)Sn magnets, and in the case of continuous heat deposition, such as in magnets near the interaction region of a collider. Thermal contraction measurements are necessary to estimate the stresses during the magnet thermal cycle. Different insulation materials have been studied at Fermilab utilizing various design approaches and fabrication methods. Thermal conductivity and thermal contraction measurements, at cryogenic temperatures, have been performed respectively at INFN-LASA and Fermilab. The results are reported and discussed in this paper.
NTIS
Accelerators; Superconducting Magnets; Superconductors (Materials); Cryogenic Temperature; Epoxy Resins

20030065078 Fermi National Accelerator Lab., Batavia, IL, USA, California Univ., Santa Barbara, CA, USA
W Charge Asymmetry Measurement in CDF Run 2
Issever, C.; February 2003; 12 pp.; In English
Report No.(s): DE2003-807530; FERMILAB-CONF-03/006-3; No Copyright; Avail: Department of Energy Information Bridge

We present the status of the forward-backward charge asymmetry measurement for W boson production using early Run 2 data collected with the Collider Detector at Fermilab (CDF). Tracking for forward electrons is a critical component of this measurement, and we describe a new technique which combines the position and energy measurements from the calorimeter with position measurements in the silicon detector to provide tracking and charge determination for electron candidates. The performance of this algorithm is described and the sensitivity for the W charge asymmetry measurement with Run 2 data is quantified.
NTIS
Asymmetry; Bosons; Algorithms; Particle Theory; Detectors

20030065319 Arizona State Univ., Tempe, AZ, USA
Journal of Computational Electronics: Proceedings of the International Workshop on Computational Electronics (8th) (IWCE-8), Beckman Institute, University of Illinois, 15-18 October 2001. Volume 1, Issue 1-2
Ferry, D. K.; Hess, K.; Jan. 2002; 277 pp.; In English
Report No.(s): AD-A412930; No Copyright; Avail: CASI; A13, Hardcopy

The Journal of Computation Electronics fills the need tor a publication dedicated to physical simulation of devices and processes, with a focus on interdisciplinary work and large scale supercomputing applications. The community typically attending IWCE best represents the audience addressed by the Journal of Computational Electronics, but the composition of this community has grown over the years to include even more discipline areas. The emphasis of the first workshops was on classical device simulation approaches (drift-diffusion and hydrodynamics models) and particle Monte Carlo methods, while other areas have gained increasing importance at following meetings. These areas include quantum transport and quantum device simulation, opto-electronics, process simulation and, more recently, molecular devices, MEMS and transport in biological ion channels. Rapid technological advances in new directions of research and the widespread availability of high performance computers and clusters, have clearly challenged the computational electronics community to address simulation problems of increasing complexity in the nano-technology area. These efforts require even more contributions from other fields of expertise, from heat transfer and micro-fluidics to computational chemistry and computational biology.
DTIC
Monte Carlo Method; Quantum Electronics; Microelectromechanical Systems; Electro-Optics

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*.

20030064352 Fermi National Accelerator Lab., Batavia, IL, USA
Beam Simulation Tools for GEANT4 (and Neutrino Source Applications)
Elvira, V. D.; Lebrun, P.; Spentzouris, P.; Dec. 2002; 14 pp.; In English
Report No.(s): DE2003-805270; FERMILAB-CONF-02/272-E; No Copyright; Avail: Department of Energy Information Bridge

Geant4 is a tool kit developed by a collaboration of physicists and computer professionals in the High Energy Physics field for simulation of the passage of particles through matter. The motivation for the development of the Beam Tools is to extend the Geant4 applications to accelerator physics. Although there are many computer programs for beam physics simulations, Geant4 is ideal to model a beam going through material or a system with a beam line integrated to a complex detector. There are many examples in the current international High Energy Physics programs, such as studies related to a future Neutrino Factory, a Linear Collider, and a very Large Hadron Collider.
NTIS
Neutrino Beams; Computer Programs; Computerized Simulation

20030064357 Fermi National Accelerator Lab., Batavia, IL, USA
Measured Logitudinal Beam Impedance of a Tevatron Separator
Crisp, J. L.; Fellenz, B. J.; Dec. 2002; In English
Report No.(s): DE2003-805558; FERMILAB-TM-2194; No Copyright; Avail: National Technical Information Service (NTIS)

Twenty two separators are currently installed in the Tevatron. The longitudinal impedance of one of these devices was recently measured with a stretched wire. The stretched wire technique can only measure impedance below the cutoff frequency (500MHz). The geometry of a separator is similar to an un-terminated stripline beam position detector. The separator plates occupy a 13.5 inch ID vacuum tank, are 101 inch long, 7.8 inch wide, and have a 2 inch gap between them. The differential characteristic impedance between the plates is estimated to be 81 omega and the common mode impedance plate to ground is about 42 omega.

NTIS
Impedance; Separators; Particle Accelerators

20030064360 Fermi National Accelerator Lab., Batavia, IL, USA
Tevatron Stripline Turn by Turn Data Showing Differential Head-Tail Positions
Crisp, J. L.; Dec. 2002; In English
Report No.(s): DE2003-805561; FERMILAB-TM-2195; No Copyright; Avail: National Technical Information Service (NTIS)

Vic Scarpine recently collected turn by turn data from the vertical wideband stripline in the Tevatron during proton injection for store 1841. The data file name is 'PHT004.txt'. The single bunch intensity was roughly 200e9. The chromaticity was set to '+6' horizontal and '-2' vertical to induce instability. The data shown represents an extreme condition that shortly preceded losses leading to an abort. A Yokogawa DL 7200 oscilloscope was used to measure A-B and A+B simultaneously from the 1 meter long stripline. The scope has an analogue bandwidth of 500MHz with a 2 GHz sample rate. On each of the 2048 turns taken, 200 samples were saved. Vic Scarpine assembled some movie files from the same data that revealed intriguing variations in the A-B signals.

NTIS
Betatrons; Oscillations; Beams (Radiation)

20030064361 Fermi National Accelerator Lab., Batavia, IL, USA, Durham Univ., UK
Two-Loop Results of M(sub W) in the Standard Model and the MSSM
Freitas, A.; Heinemeyer, S.; Weiglein, G.; Dec. 2002; In English
Report No.(s): DE2003-805580; FERMILAB-CONF-02/312-T; No Copyright; Avail: National Technical Information Service (NTIS)

Recent higher-order results for the prediction of the W-boson mass, MW, within the Standard Model are reviewed and an estimate of the remaining theoretical uncertainties of the electroweak precision observables is given. An updated version of a simple numerical parameterization of the result for MW is presented. Furthermore, leading electroweak two-loop contributions to the precision observables within the MSSM are discussed.

NTIS
Standard Model (Particle Physics); Bosons; Particle Mass

20030064362 Fermi National Accelerator Lab., Batavia, IL, USA, Stanford Linear Accelerator Center, Stanford, CA, USA
Diagnostics Summary: Working Group T9
Pasquinelli, R. J.; Ross, M. C.; Dec. 2002; 20 pp.; In English
Report No.(s): DE2003-805581; FERMILAB-CONF-01/435; No Copyright; Avail: Department of Energy Information Bridge

The diagnostics T9 group was charged with reviewing the diagnostic requirements of the proposed accelerators for the future. The list includes the e plus e minus colliders, Muon Neutrino source, NLC, Proton Driver, Tesla, and the VLHC. While the machines vary widely on diagnostic requirements, there are many similarities that were discovered. The following sections will attempt to point out the similarities and requirements for R&D for these future accelerators.

NTIS
Diagnosis; Technology Assessment; Particle Accelerators

20030065110 Massachusetts Inst. of Tech., Lexington, MA
Solid State Research
Shaver, David C.; Apr. 11, 2003; 76 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F19628-00-C-0002
Report No.(s): AD-A413275; 2002:4; ESC-TR-2002-087; No Copyright; Avail: CASI; A05, Hardcopy

This report covers in detail the research work of the Solid State Division at Lincoln Laboratory for the period 1 August-31 October 2002 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; Bioinstrumentation

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*.

20030063922 NASA Ames Research Center, Moffett Field, CA, USA
Training Presentation for NASA Civil Helicopter Safety Website
Iseler, Laura; [2002]; 2 pp.; In English; No Copyright; Avail: Other Sources; Abstract Only

NASA civil helicopter safety News & Updates include the following: Mar. 2002. The Air Medical Operations Survey has been completed! Check it out! Also accessible via the Mission pages under Air Medical Mission. Air Medical and Law Enforcement Mission pages have been added. They are accessible via the Mission pages. The Public Use, Personal, Offshore, Law Enforcement, External Load, Business and Gyro accident pages (accessable via the Mission page) have been updated. Feb. 2002. A Words of Wisdom section has been added. You can access it by clicking the Library button. A link to a Corporate Accident Response Plan has been added to the Accident page. The AMs, Aerial Application and Instruction accident pages (accessable via the Mission page) have been updated. Jan. 2002. A new searchable safety article database has been added. You can access it by clicking the Library button. The 2001 accident summaries have been updated and the statistics have been compiled - check it out by clicking the accident tab to the left. Dec. 2001. Please read the FAA Administrator's memo regarding the latest FBI warning. 3ee the FAA column - Fall 2001 Read it now!
CASI
Medical Services; Safety; News; Helicopters

20030064927 NASA Langley Research Center, Hampton, VA, USA
Organizational Culture and Safety
Adams, Catherine A.; [2003]; 10 pp.; In English; 12th International Symposium on Aviation Psychology, 14-17 Apr. 2003, Dayton, OH, USA; No Copyright; Avail: CASI; A02, Hardcopy

'..only a fool perseveres in error.' Cicero. Humans will break the most advanced technological devices and override safety and security systems if they are given the latitude. Within the workplace, the operator may be just one of several factors in causing accidents or making risky decisions. Other variables considered for their involvement in the negative and often catastrophic outcomes include the organizational context and culture. Many organizations have constructed and implemented safety programs to be assimilated into their culture to assure employee commitment and understanding of the importance of everyday safety. The purpose of this paper is to examine literature on organizational safety cultures and programs that attempt to combat vulnerability, risk taking behavior and decisions and identify the role of training in attempting to mitigate unsafe acts.
Author
Education; Risk; Safety Management; Psychological Effects; Organizations

20030065063 Wilderness Medicine, Bozeman, MT, USA
Establishment of a Ground Consultant Network
Donner, Howard; Masarie, Fred; Stiernberg, Charles M.; Fromm, Rob; ONeill, Daniel; Proceedings of Space Station Freedom Clinical Experts Seminar; April 1991, pp. 115-121; In English; See also 20030065052; No Copyright; Avail: CASI; A02, Hardcopy

The paper discusses how approach the establishment of an ongoing ground consultant network to support Space Station Freedom (SSF) medical operations.
CASI
Management Planning; Medical Services; Supports

81
ADMINISTRATION AND MANAGEMENT

Includes management planning and research.

20030064172 NASA, Washington, DC, USA
NASA Vision, Volume 1, No. 4
July 2003; 12 pp.; In English; Original contains color and black and white illustrations; No Copyright; Avail: CASI; A03, Hardcopy

Contents in this newsletter include the following: Honor award ceremony. NASA robotic geologist named Spirit began its seven-month journey to Mars. Around the Centers. NASA web site wins Webby Award. Global garden. Grows greener. NASA newest UAV makes successful flight. Summer interns join the NASA team. NASA maps bolts of lightning. Monumental tribute. Secret lives of galaxies unveiled in deep survey. New program sends nation's teachers 'Back to school' CASI

Geological Surveys; Lightning; Robotics; Education; Periodicals

20030064336 National Park Service, Washington, DC
General Management Plan Voyageurs National Park
Jan. 2002; In English
Report No.(s): PB2003-104327; NPS-D-137; No Copyright; Avail: National Technical Information Service (NTIS)

Contents include the following: Introduction (Voyageurs National Park, The Direction for the Plan, How the Plan was Developed); The General Management Plan (Plan Highlights, Management Areas, Resources Management, Visitor Use, Park Operations and Facilities and Partnerships, Implementation Plans & Studies to Follow the General Management Plan); Appendixes ((A) Park Legislation; (B) Record of Decision; (C) Project Timeline & Public Participation; (D) Projected Implementation Costs, Glossary, Selected Bibliography, Planning Team & Consultants); Maps (General Management Plan (summer), General Management Plan (winter)).

NTIS

National Parks; Management Planning; Resources Management

20030065158 NASA Ames Research Center, Moffett Field, CA, USA
Providing Effective Access to Shared Resources: A COIN Approach
Airiau, Stephane; Wolpert, David H.; Sen, Sandip; Tumer, Kagan; [2003]; 8 pp.; In English; American Architectural Manufacturers Association (AAMA)2003, 14-18 Jul. 2003, Melbourne, Australia; Copyright; Avail: CASI; A02, Hardcopy

Managers of systems of shared resources typically have many separate goals. Examples are efficient utilization of the resources among its users and ensuring no user's satisfaction in the system falls below a preset minimal level. Since such goals will usually conflict with one another, either implicitly or explicitly the manager must determine the relative importance of the goals, encapsulating that into an overall utility function rating the possible behaviors of the entire system. Here we demonstrate a distributed, robust, and adaptive way to optimize that overall function. Our approach is to interpose adaptive agents between each user and the system, where each such agent is working to maximize its own private utility function. In turn, each such agent's function should be both relatively easy for the agent to learn to optimize, and 'aligned' with the overall utility function of the system manager - an overall function that is based on but in general different from the satisfaction functions of the individual users. To ensure this we enhance the COllective INtelligence (COIN) framework to incorporate user satisfaction functions in the overall utility function of the system manager and accordingly in the associated private utility functions assigned to the users agents. We present experimental evaluations of different COIN-based private utility functions and demonstrate that those COIN-based functions outperform some natural alternatives.

Author

Resources Management; Resource Allocation; Optimization; Artificial Intelligence

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*.

20030064113 Research Inst. for Advanced Computer Science, Moffett Field, CA, USA
Technology Requirements for Information Management
Graves, Sara; Knoblock, Craig A.; Lannom, Larry; November 2002; 35 pp.; In English
Contract(s)/Grant(s): NCC2-1006; NSF IIS-0206538
Report No.(s): RIACS-TR-2.07; Copyright; Avail: CASI; A03, Hardcopy

This report provides the results of a panel study conducted into the technology requirements for information management in support of application domains of particular government interest, including digital libraries, mission operations, and scientific research. The panel concluded that it was desirable to have a coordinated program of R&D that pursues a science of information management focused on an environment typified by applications of government interest - highly distributed with very large amounts of data and a high degree of heterogeneity of sources, data, and users.
Author
Information Management; Domains; Operations Research

20030064394 Universidad Politecnica de Valencia, Valencia, Spain
Integration of Distributed Healthcare Information Systems: Application of CEN/TC251 ENV13606
Maldonado, J. A.; Robles, M.; Cano, C.; Oct. 25, 2001; 5 pp.; In English; Original contains color illustrations
Report No.(s): AD-A411561; No Copyright; Avail: CASI; A01, Hardcopy

Everyday, more and more, the healthcare sector requires the exchange of healthcare information between professionals from different disciplines and institutions. To support co-operative work among health professionals and institutions it is necessary to share healthcare information about patients in a meaningful way. But, nowadays, in most hospitals the heath data is distributed across several heterogeneous and autonomous information systems whose interconnection is difficult to achieve. Integration of such system may bring about many advantages such as consistent patient health records or interdepartmental workflows. In this paper, an overview of a computing system prototype, currently under development using CORBA and Java, is presented. It allows healthcare professionals to access patient information stored in heterogeneous autonomous information systems through a set of formal aggregates of health data based on the healthcare record architecture ENV136O6 from CEN/tc251.
DTIC
Information Systems; Records Management

20030065099 Oklahoma Univ., Norman, OK
Biotechnology for the Environment
Suflita, Joseph M.; Wall, Judy D.; Mar. 14, 2003; 6 pp.; In English
Contract(s)/Grant(s): N00014-01-1-0069
Report No.(s): AD-A413268; No Copyright; Avail: CASI; A02, Hardcopy

Funding from the Department of Defense Office of Naval Research, the National Science Foundation, and the Department of Energy was obtained to support short-term trans-atlantic exchanges of early career scientists designed to foster collaborative interactions and enhance the professional development of the exchange fellows through the acquisition of expertise in microbial biotechnology. Applicants were recruited on a national basis from microbial ecology, molecular microbiology, and environmental science laboratories. Eleven young scientists were selected, six male and five female, and completed exchange experiences in Denmark, England, Germany, Italy, Spain and The Netherlands. The exchanges fostered the acquisition of new skills and expertise in environmental technology during the 3-week to 6-month stay in the host laboratory. Likewise, the laboratories acting as hosts acquired new skills, techniques, and perspectives from the visiting scholar. The funding allowed laboratories with collaborative interests to bolster their interaction through the exchange of personnel and to open communication lines that lead to functional cooperation.
DTIC
Biotechnology; Defense Program; Environmental Laboratories

83
ECONOMICS AND COST ANALYSIS

Includes cost effectiveness studies.

20030063091 NASA Glenn Research Center, Cleveland, OH, USA
Why Costing is Important on HBCU Grants
HBCUs/OMUs Research Conference Agenda and Abstracts; February 2003, pp. 35-42; In English; See also 20030063082; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

This paper explains why cost is important on Historically Black College and University (HBCU) Grants. The topics of discussion include: 1) Forward Funding; 2) Good and bad cost management; and 3) Recommendations for cost performance. CASI

Cost Estimates; Universities; Contract Management; Grants

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*.

20030052731 Smithsonian Astrophysical Observatory, Cambridge, MA, USA
NASA Education Forum at SAO on the Structure and Evolution of the Universe
Rosendhal, Jeffrey, Technical Monitor; Gould, Roy R.; April 2003; 8 pp.; In English
Contract(s)/Grant(s): NCC5-261; No Copyright; Avail: CASI; A02, Hardcopy

NASA's Structure and Evolution of the Universe (SEU) science theme offers an unparalleled opportunity to capture the public's imagination and inspire the next generation of scientific explorers-the generation that will determine America's lead in science and technology in the 21st century. The missions and research programs of SEU science are transporting the public to some of the universe's most exotic destinations: the beginning of time, the edge of space at the entrance to a black hole, and the great cycles of matter and energy that have slowly brought life to the universe. NASA's Office of Space Science (OSS) has put in place an Education and Public Outreach (EPO) initiative designed to do just that. Spanning all of NASA's OSS science themes, the initiative is a far-reaching partnership with the education community. As a result, NASA space science now reaches every avenue of education-from the nation's schools, science museums and planetariums, to libraries, community groups and after-school programs. As a partner in this enterprise, the,SEU Forum has successfully brought SEU science to a large and diverse audience. But this is an ongoing process, and much still needs to be done. Working with our colleagues in the OSS Support Network, and with our partners in the space science and education communities, we look forward to ensuring that the public supports and participates in the great explorations of the SEU theme. Working with the SEU missions and members of the OSS Support Network, the Forum will harness the assets of the SEU science community to: Inform, inspire, and involve the public in the explorations of the SEU science theme. Use the unique resources of the SEU science theme to enhance K-14 science, technology, and mathematics education. Identify and develop high-leverage opportunities for the SEU science community to contribute to education and outreach.
Derived from text

NASA Programs; Education; Large-Scale Structure Of The Universe; Cosmology

20030063082 NASA Glenn Research Center, Cleveland, OH, USA
HBCUs/OMUs Research Conference Agenda and Abstracts
Dutta, Sunil, Compiler; February 2003; 60 pp.; In English; Historically Black Colleges and Universities/Other Minority Universities Research Conference, 17-18 Apr. 2002, Cleveland, OH, USA; See also 20030063083 - 20030063108
Contract(s)/Grant(s): WBS 22-772-10-03
Report No.(s): NASA/TM-2003-212207; E-13318; NAS 1.15:212207; No Copyright; Avail: CASI; A04, Hardcopy

The purpose of this Historically Black Colleges and Universities (HBCUs/OMUs) Research Conference was to provide an opportunity for principal investigators and their students to present research progress reports. The abstracts included in this report indicate the range and quality of research topics such as aeropropulsion, space propulsion, space power, fluid dynamics, designs, structures and materials being funded through grants from Glenn Research Center to HBCUs. The conference

generated extensive networking between students, principal investigators, Glenn technical monitors, and other Glenn researchers.
Author
Aircraft Engines; Large Space Structures; Propulsion; Spacecraft Structures

20030063915 NASA Ames Research Center, Moffett Field, CA, USA
The Plant Research Unit: An International Space Station Habitat
Morrow, Robert; Reiss-Bubenheim, Debra; Schaefer, Ronald L.; [2003]; 1 pp.; In English; American Society for Plant Biology, 25-30 Jul. 2003, Honolulu, HI, USA
Contract(s)/Grant(s): NAS2-1463; No Copyright; Avail: Other Sources; Abstract Only

The Plant Research Unit (PRU) is one of six life science habitats being developed as part of the Space Station Biological Research Program. The PRU is designed for experiments in microgravity and will utilize the ISS Centrifuge Facility to provide gravity levels between microgravity and 29. The PRU will provide and control all aspects of a plant s needs in a nearly closed system. In other words, the shoot and root environments will not be open to the astronaut s environment except for experiment maintenance such as planting, harvesting and plant sampling. This also means that all lighting, temperature and humidity control, 'watering,' and air filtering and cleaning .must be done within strict limitations of volume, weight, power, and crew time while at the same time providing a very high level of reliability and a service life in excess of 10 years. The PRU will contain two plant chambers 31.5 cm tall, each with independent control of temperature, humidity, light level and photoperiod, CO2 level, nutrient and water delivery, and video and data acquisition. The PRU is currently in the preliminary design phase and a number of subsystem components have been prototyped for testing, including the temperature and humidity control systems, the plant chambers, the LED lighting system, the atmospheric control system and a variety of nutrient delivery systems. The LED prototype provides independent feedback control of 5 separate spectral bands and variable output between 0 and 1000 micro-mol sq m/sec. The water and nutrient delivery system (WNDS) prototypes have been used to test particulate based, thin film, and gel-based WNDS configurations.
Author
Life Sciences; Habitats; Plants (Botany); International Space Station; Microgravity; Carbon Dioxide

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ASTRONOMY

Includes observations of celestial bodies; astronomical instruments and techniques; radio, gamma-ray, x-ray, ultraviolet, and infrared astronomy; and astrometry.

20030053046 NASA Ames Research Center, Moffett Field, CA, USA
A Draft Test Protocol for Detecting Possible Biohazards in Martian Samples Returned to Earth
Rummel, John D.; Race, Margaret S.; DeVinenzi, Donald L.; Schad, P. Jackson; Stabekis, Pericles D.; Viso, Michel; Acevedo, Sara E.; October 31, 2002; 123 pp.; In English
Contract(s)/Grant(s): NAG2-6044
Report No.(s): NASA/CP-2002-211842; NAS 1.26:211842; A-0208825; Copyright; Avail: CASI; A06, Hardcopy

This document presents the first complete draft of a protocol for detecting possible biohazards in Mars samples returned to Earth; it is the final product of the Mars Sample Handling Protocol Workshop Series, convened in 2000-2001 by NASA's Planetary Protection Officer. The goal of the five-workshop Series vas to develop a comprehensive protocol by which returned martian sample materials could be assessed for the presence of any biological hazard(s) while safeguarding the purity of the samples from possible terrestrial contamination The reference numbers for the proceedings from the five individual Workshops.
Author
Contamination; Detection; Mars Surface; Planetary Protection; Hazards; Biology

20030053065 NASA Ames Research Center, Moffett Field, CA, USA
The Galileo Probe: How it Has Changed Our Understanding of Jupiter
Young, Richard E.; [2003]; 1 pp.; In English; Copyright; Avail: Other Sources; Abstract Only

The Galileo Mission to Jupiter, which arrived in December of 1995, provided the first study by an orbiter, and the first in-situ sampling via an entry probe, of an outer planet atmosphere. The rationale for an entry probe is that, even from an orbiter, remote sensing of the jovian atmosphere could not adequately retrieve the information desired. This paper provides

a current summary of the most significant aspects of the data returned from the Galileo entry probe. As a result of the probe measurements, there has been a reassessment of our understanding of outer planet formation and evolution of the solar system. The primary scientific objective of the Galileo probe was to determine the composition of the jovian atmosphere, which from remote sensing remained either very uncertain, or completely unknown, with respect to several key elements. The probe found that the global He mass fraction is. significantly above the value reported from the Voyager Jupiter flybys but is slightly below the protosolar value, implying that there has been some settling of He to the deep jovian interior. The probe He measurements have also led to a reevaluation of the Voyager He mass fraction for Saturn, which is now determined to be much closer to that of Jupiter. The elements C, N, S, Ar, Kr, Xe were all found to have global abundances approximately 3 times their respective solar abundances. This result has raised a number of fundamental issues with regard to properties of planetesimals and the solar nebula at the time of giant planet formation. Ne, on the other hand, was found to be highly depleted, probably as the result of it being carried along with helium as helium settles towards the deep interior. The global abundance of O was not obtained by the probe because of the influence of local processes at the probe entry site (PES), processes which depleted condensible species, in this case H2O, well below condensation levels. Other condensible species, namely NH3 and H2S, were similarly affected but attained their deep equilibrium mixing ratios before the maximum depth sampled by the probe. Processes that might be capable of producing such effects on the condensibles are still under investigation. Measured isotopic ratios of noble gases and other heavy elements are solar, and (D + (Sup 3)He)/H is the same to within measurement uncertainties as in the local interstellar medium. No thick clouds were detected, and in particular no significant water cloud, but the PES location clearly affected the probe measurements of clouds. In fact, the probe data must be understood in the context of the location of the PES, which was within what is termed a 5 micron hot spot, a local clearing in the clouds that is bright near the 5 microns spectral region. The thermal structure at the PES was determined from approximately 1000 km above the 1 bar pressure level (10(exp -9 bars)) to 132 km 1 bar (22bars). The probe showed the atmosphere to have a generally sub-adiabatic temperature gradient (static stability) of = 0.1 K/km to as deep as the probe made measurements. In the upper atmosphere the probe derived a maximum positive vertical temperature gradient of approximately 5 K/km, and maximum temperature of = 900 K. The energy sources producing the warm upper atmosphere have yet to be completely identified. At first glance, Doppler tracking of the probe indicates that the long observed cloud level zonal winds extend to levels at least as deep as the probe made measurements. Zonal wind increases from = 80 m/s at pressures less than a bar to about 180 m/s near 5 bars, and remains approximately constant with depth thereafter. However, there is a question as to whether the winds measured from probe tracking are representative of the general wind field, or are considerably influenced by localized winds associated with the PES.

Author

Galileo Probe; Jupiter Atmosphere; Doppler Radar; Gas Giant Planets; Heavy Elements; Helium; Planetary Evolution

20030053066 NASA Ames Research Center, Moffett Field, CA, USA

Kepler Mission: A Mission to Find Earth-size Planets in the Habitable Zone

Borucki, W. J.; [2003]; 1 pp.; In English; Toward Other Earths, 22-25 Apr. 2003, Heidlberg, Germany; No Copyright; Avail: Other Sources; Abstract Only

The Kepler Mission is a Discovery-class mission designed to continuously monitor the brightness of 100,000 solar-like stars to detect the transits of Earth-size and larger planets. It is a wide field of view photometer Schmidt-type telescope with an array of 42 CCDs. It has a 0.95 m aperture and 1.4 m primary and is designed to attain a photometric precision of 2 parts in 10(exp 5) for 12th magnitude solar-like stars for a 6 hr transit duration. It will continuously observe 100,000 main-sequence stars from 9th to 14th magnitude in the Cygnus constellation for a period of four years with a cadence of 4/hour. An additional 250 stars can be monitored at a cadence of l/minute to do astro-seismology of stars brighter than 11.5 mv. The photometer is scheduled to be launched into heliocentric orbit in 2007. When combined with ground-based spectrometric observations of these stars, the positions of the planets relative to the habitable zone can be found. The spectra of the stars are also used to determine the relationships between the characteristics of terrestrial planets and the characteristics of the stars they orbit. In particular, the association of planet size and occurrence frequency with stellar mass and metallicity will be investigated. Based on the results of the current Doppler-velocity discoveries, over a thousand giant planets will also be found. Information on the albedos and densities of those giants showing transits will be obtained. At the end of the four year mission, hundreds of Earth-size planets should be discovered in and near the HZ of their stars if such planets are common. A null result would imply that terrestrial planets in the HZ are very rare and that life might also be quite rare.

Author

Terrestrial Planets; Brightness; Gas Giant Planets; Mission Planning

20030053067 NASA Ames Research Center, Moffett Field, CA, USA

Kepler Mission: A Technical Overview

Borucki, W. J.; [2003]; 1 pp.; In English; Eddington Workshop, 8-10 Apr. 2003, Palermo, Italy; No Copyright; Avail: Other Sources; Abstract Only

The Kepler Mission is a Discovery-class mission designed to continuously monitor the brightness of 100,000 solar-like stars to detect the transits of Earth-size and larger planets. It is a wide field of view photometer Schmidt-type telescope with an array of 42 CCDs. It has a 0.95 m aperture and 1.4 m primary and is designed to attain a photometric precision of 2 parts in 10(exp 5) for 12th magnitude solar-like stars for a 6 hr transit duration. It will continuously observe 100,000 main-sequence stars from 9th to 14th magnitude in the Cygnus constellation for a period of four years with a cadence of 4/hour. An additional 250 stars can be monitored at a cadence of l/minute to do astro-seismology of stars brighter than 11.5 mv. The photometer is scheduled to be launched into heliocentric orbit in 2007. A ground-based program to classify all 225,000 stars in the FOV and to do a detailed examination of a subset of the stars that show planetary companions is also planned.

Author

Apertures; Brightness; Photometers; Planets; Monitors

20030053085 NASA Goddard Space Flight Center, Greenbelt, MD, USA

The Extreme Ultraviolet Normal Incidence Spectrograph (EUNIS)

Oegerle, William, Technical Monitor; Rabin, D.; Davila, J.; Thomas, R. J.; Engler, C.; Irish, S.; Keski-Kuha, R.; Novello, J.; Nowak, M.; Payne, L.; Rodriguez, I.; June 20, 2003; 1 pp.; In English; 34th Meeting of the AAS Solar Physics Division 'Beyond SDO: Future Instrumentation for Space-Based Solar Physics', 16-20 Jun. 2003, Laurel, MD, USA; Copyright; Avail: Other Sources; Abstract Only

EUNIS (Extreme Ultraviolet Normal Incidence Spectrograph) is a high-efficiency extreme ultraviolet spectrometer that is expected to fly for the first time in 2004 as a sounding rocket payload. Using two independent optical systems, EUNIS will probe the structure and dynamics of the inner solar corona high spectral resolution in two wavelength regions: 17-21 nm with 3.5 pm resolution and 30-37 nm with 7 pm resolution. The long wavelength channel includes He II 30.4 nm and strong lines from Fe XI-XVI; the short wavelength channel includes strong lines of Fe IX-XIII. Angular resolution of 2 arcsec is maintained along a slit covering a full solar radius. EUNIS will have 100 times the throughput of the highly successful SERTS payloads that have preceded it. There are only two reflections in each optical channel, from the superpolished, off-axis paraboloidal primary and the toroidal grating. Each optical element is coated with a high-efficiency multilayer coating optimized for its spectral bandpass. The detector in each channel is a microchannel plate image intensifier fiber- coupled to three 1K x 1K active pixel sensors. EUNIS will obtain spectra with a cadence as short as 1 sec, allowing unprecedented studies of the physical properties of evolving and transient structures. Diagnostics of wave heating and reconnection wil be studied at heights above 2 solar radii, in the wind acceleration region. The broad spectral coverage and high spectral resolution will provide superior temperature and density diagnostics and will enable underflight calibration of several orbital instruments, including SOHO/CDS and EIT, TRACE, Solar-B/EIS, and STEREO/EUVI. EUNIS is supported by NASA through the Low Cost Access to Space Program in Solar and Heliospheric Physics.

Author

Ultraviolet Spectrometers; Spectrographs; Angular Resolution; Image Intensifiers; Solar Corona; Solar Diameter; Solar Physics

20030053087 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Kepler Mission to Detect Earth-like Planets

Kondo, Yoji; [2003]; 1 pp.; In English; No Copyright; Avail: Other Sources; Abstract Only

Kepler Mission to detect Earth-like planets in our Milky Way galaxy was approved by NASA in December 2001 for a 4-5 year mission. The launch is planned in about 5 years. The Kepler observatory will be placed in an Earth-trailing orbit. The unique feature of the Kepler Mission is its ability to detect Earth-like planets orbiting around solar-type stars at a distance similar to that of Earth (from our Sun); such an orbit could provide an environment suitable for supporting life as we know it. The Kepler observatory accomplishes this feat by looking for the transits of planetary object in front of their suns; Kepler has a photometric precision of 10E-5 (0.00001) to achieve such detections. Other ongoing planetary detection programs (based mostly on a technique that looks for the shifting of spectral lines of the primary star due to its planetary companions' motions around it) have detected massive planets (with masses in the range of Jupiter); such massive planets are not considered suitable for supporting life. If our current theories for the formation of planetary systems are valid, we expect to detect about 50 Earth-like planets during Kepler's 4-year mission (assuming a random distribution of the planetary orbital inclinations with

respect to the line of sight from Kepler). The number of detection will increase about 640 planets if the planets to be detected are Jupiter-sized.
Author
Planetary Systems; Extrasolar Planets; Planet Detection; Space Missions

20030064028 California Univ., Santa Barbara, CA, USA
Planetary System Physics
Peale, S. J.; [2002]; 13 pp.; In English
Contract(s)/Grant(s): NAG5-3646; No Copyright; Avail: CASI; A03, Hardcopy

Contents include a summary of publications followed by their abstracts titeled: 1. On microlensing rates and optical depth toward the Galactic center. 2. Newly discovered brown dwarfs not seen in microlensing timescale frequency distribution? 3. Origin and evolution of the natural satellites. 4. Probing the structure of the galaxy with microlensing. 5. Tides, Encyclopedia of Astronomy and Astrophysics. 6. The Puzzle of the Titan-Hyperion 4:3 Orbital Resonance. 7. On the Validity of the Coagulation Equation and the Nature of Runaway Growth. 8. Making Hyperion. 9. The MESSENGER mission to Mercury: Scientific objectives and implementation. 10. A Survey of Numerical Solutions to the Coagulation. 11. Probability of detecting a planetary companion during a microlensing event. 12. Dynamics and origin of the 2:l orbital resonances of the GJ876 planets. 13. Planetary Interior Structure Revealed by Spin Dynamics. 14. A primordial origin of the Laplace relation among the Galilean Satellites. 15. A procedure for determining the nature of Mercury's core. 16. Secular evolution of hierarchical planetary systems. 17. Tidally induced volcanism. 18. Extrasolar planets and mean motion resonances. 19. Comparison of a ground-based microlensing search for planets with a search from space.
CASI
Astrophysics; Galaxies; Numerical Analysis; Optical Thickness; Planetary Cores

20030064419 Lawrence Livermore National Lab., Livermore, CA
Progress in Horizontal and Slant-Path Imaging Using Speckle Imaging
Carrano, C. J.; Jan. 30, 2003; 16 pp.; In English
Report No.(s): DE2003-15003385; UCRL-JC-150217-REV-1; No Copyright; Avail: Department of Energy Information Bridge

This project involved images of Titan, Neptune, and Uranus obtained using the 10-meter W.M. Keck II Telescope and its adaptive optics system. An adaptive optics system corrects for turbulence in the Earths atmosphere by sampling the wavefront and applying a correction based on the distortion measured for a known source within the same isoplanatic patch as the science target (for example, a point source such as a star). Adaptive optics can achieve a 10-fold increase in resolution over that obtained by images without adaptive optics (for example, Saturns largest moon Titan is unresolved without adaptive optics but at least 10 resolution elements can be obtained across the disk in Keck adaptive optics images).
NTIS
Imaging Techniques; Space Perception; Adaptive Optics; Telescopes

20030064425 Lawrence Livermore National Lab., Livermore, CA, USA, California Univ., Berkeley, CA
Deconvolution of Adaptive Optics Images of Titan, Neptune, and Uranus
Gibbard, S.; Marchis, F.; Dec. 20, 2002; In English
Report No.(s): DE2003-15003348; UCRL-ID-151346; No Copyright; Avail: National Technical Information Service (NTIS)

This project involved images of Titan, Neptune, and Uranus obtained using the 10-meter W.M. Keck II Telescope and its adaptive optics system. An adaptive optics system corrects for turbulence in the Earths atmosphere by sampling the wavefront and applying a correction based on the distortion measured for a known source within the same isoplanatic patch as the science target (for example, a point source such as a star). Adaptive optics can achieve a 10-fold increase in resolution over that obtained by images without adaptive optics (for example, Saturns largest moon Titan is unresolved without adaptive optics but at least 10 resolution elements can be obtained across the disk in Keck adaptive optics images).
NTIS
Adaptive Optics; Neptune (Planet); Titan; Uranus (Planet); Telescopes; Images

20030064939 Ball Aerospace and Technologies Corp., Boulder, CO, USA
Final Report for the Advanced Camera for Surveys (ACS) from Ball Aerospace and Technologies Corporation
Volmer, Paul; Sullivan, Pam, Technical Monitor; [2003]; 7 pp.; In English
Contract(s)/Grant(s): NAS5-32864; No Copyright; Avail: CASI; A02, Hardcopy

The Advanced Camera for Surveys ACS was launched aboard the Space Shuttle Columbia just before dawn on March 1, 2002. After successfully docking with the Hubble Space Telescope (HST), several components were replaced. One of the components was the Advanced Camera for Surveys built by Ball Aerospace & Technologies Corp. (BATC) in Boulder, Colorado. Over the life of the HST contract at BATC hundreds of employees had the pleasure of working on the concept, design, fabrication, assembly and test of ACS. Those employees thank NASA - Goddard Space Flight Center and the science team at Johns Hopkins University (JHU) for the opportunity to participate in building a great science instrument for HST. After installation in HST a mini-functional test was performed and later a complete functional test. ACS performed well and has continued performing well since then. One of the greatest rewards for the BATC employees is a satisfied science team. Following is an excerpt from the JHU final report, 'The foremost promise of ACS was to increase Hubble's capability for surveys in the near infrared by a factor of 10. That promise was kept. '
Author
Hubble Space Telescope; Surveys; Optics; Cameras

20030065306 Mission Research Corp., Santa Barbara, CA
Celestial Background Scene Descriptor: Final Report
Noah, P. V.; Noah, M. A.; Feb. 2001; 89 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F19628-98-C-0028; Proj-S321
Report No.(s): AD-A413194; AFRL-VS-TR-2001-1584; No Copyright; Avail: CASI; A05, Hardcopy

This report summarizes the results of the Celestial Background Scene Descriptor (CBSD) program. The goal of the CBSD program is to design, build, and validate a suite of FORTRAN codes that simulates the flux from the celestial background, in support of DoD developed optical and infrared sensor systems, realistic scenario generation, and the development of clutter removal algorithms. Components of the CBSD suite are CBSKY4 - stellar point sources (both catalogs of bright stars and a statistical model of faint stars are included), CBAMP4 - solar system objects (planets and asteroids modeled to better than 2 arc-second accuracy), CBZODY6 - solar system, zodiacal, dust, and CBHIII - galactic HI regions. The CBSD codes have a 'dial-a-wavelength' capability between 0.2 and 35 micrometers which provides a predictive capability for new optical and infrared sensor systems. The suite can produce images, spectra, and catalogs of objects in units of radiance or irradiance (W/sq cm, W/sq cm/micrometers, W/sq cm/sr, W/sp cm/micrometers/sr, Jy, MJy, Jy/sr, and MJy/sr). Summaries of two validation reports for CBSKY4 and CBZODY6 are included as Appendices.
DTIC
Astronomy; Solar System; Infrared Detectors; Geodetic Satellites; Algorithms; Stellar Models

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ASTROPHYSICS

Includes cosmology; celestial mechanics; space plasmas; and interstellar and interplanetary gases and dust.

20030052733 NASA Goddard Space Flight Center, Greenbelt, MD, USA
The Low-Metallicity Galaxy, I Zw 18 (Z=1/50 Z(circle dot))
Heap, Sara R.; [2003]; 1 pp.; In English; The First Stars II Conference, 29-31 May 2003, State College, PA, USA; No Copyright; Avail: Other Sources; Abstract Only

Both observations and evolutionary models indicate that rotation becomes a more important factor at lower metallicities. Some important effects of rotation include: increasing the rate of mass-loss; lowering the effective gravity; altering the evolutionary track on the Hertzsprung-Russell Diagram (HRD); extending the main-sequence phase (both on the HR diagram and in time); and mixing of CNO-processed elements up to the stellar surface. We discuss these effects for massive stars in the low-metallicity galaxy, I Zw 18 (Z=1/50 Z(circle dot)) and their implications for the first stars.
Author
Metallicity; Galaxies; Rotation; Massive Stars

20030064015 California Univ., Los Angeles, CA, USA
KT Boundary Impact Debris from DSDP Site 577
Kyte, Frank T.; Vakulenko, Marta; Meteoritics and Planetary Science; 2001; Volume 36, pp. A64; In English
Contract(s)/Grant(s): NAG5-9441; Copyright; Avail: CASI; A01, Hardcopy

The KT boundary at DSDP Site 577 (Shatsky Rise, western North Pacific) is in a calcareous nannofossil ooze. It is bioturbated so Ir and impact debris are smeared across less than 15 cm of core. An absence of sulfides and chalcophile

enrichment and the presence of Mn-micronodules indicate that this boundary did not experience anoxic conditions typical of many other calcareous KT sites. Because of its shallow burial (109 m) ejecta is extremely well preserved and has been the subject of numerous studies. Three high-temperature minerals have been identified at this site. Clinopyroxene (cpx), found only at Site 577 may be precursor to diagenetic sanidine in some European sites. Magnesioferrite spinel has the highest Fe2O3/FeO of any locality and can have and trace inclusions of Ni-magnesiowustite, which is known at only one other site (Site 596). Other debris described includes shocked quartz grains less than 200 microns, hollow spherules possibly related to impact melt glasses found near Chicxulub, and irregular Ir-rich particles that may be derived directly from meteoritic materials. The latter may be related to the fossil meteorite found at Site 576, just 500 km to the east. A large-volume (approx. 10 cc) sample was taken to systematically characterize debris. The less than 60 microns fraction of the carbonate-free sediment contained 44 mg of impact debris. 2700 particles less than l00 microns were classified based on color, shape, and morphology. About 55\% are generally light colored, composed mostly of clays, and typically lack magnesioferrite spinel. Less than half of these are quite spherical; many have irregular shapes, possibly from fragmentation. Hollow spherules with smooth shiny surfaces are only 2\% of the total but many fragments in the 60 - 100 microns fraction suggest that they were more abundant and that some may have been quite large; 800 microns or more. Cpx-bearing spherules, easily identified by green crystals at the surface, constitute only 2.5\% of the total. Three cpx spherules are dumbbells. The other 40\% of the debris is a complex assemblage of dark-colored particles, most of which have magnesioferrite spinel. We have currently separated these into 6 groups based on color and morphology, but this hardly describes the diversity of this group. They range from smooth and spherical to rough and irregular in shape. Some have a planar cleavage, similar to some broken cosmic spherules. 220 particles were irradiated for trace element analysis, as groups and as individual particles. It appears that every spherule type as at least a few ng/g Ir. Several of the spinel-bearing particles have been identified with high Ir (200-1500 ng/g), Cr (2-5 mg/g), and Ni (2-10 mg/g), consistent with results. It is hoped that some of these will yield potential fragments of the KT bolide. Only five have been sectioned to date and they are characterized by high concentrations of spinel; two contained traces of magnesiowustite. This debris constitutes a complex assemblage of ejecta materials. The light-colored, spinel-free particles likely derive mainly from target materials. A significant fraction of these are probably alteration products of cpx-spherules. The dark-colored debris is more likely to have high siderophile concentrations, and thus a high extraterrestrial component. However, the majority don't. Most of the larger spinel-bearing spherules have modest Ir concentrations (5-30 ng/g).
Author

Boundaries; Impact Melts; Debris; Ejecta; Geochemistry; Meteorites; Trace Elements

20030064023 Smithsonian Astrophysical Observatory, Cambridge, MA, USA

Ground-Based Investigations with the Cryogenic Hydrogen Maser

Walsworth, Ronald L.; Mattison, Edward; Vessot, Robert F. C.; June 2003; 14 pp.; In English

Contract(s)/Grant(s): NAG8-1434; Copyright; Avail: CASI; A03, Hardcopy

The cryogenic hydrogen maser (CHM) developed at the Smithsonian Astrophysical Observatory (SAO) was designed to be functionally similar to SAO room temperature hydrogen masers with appropriate modifications made for operation at cryogenic temperatures. A schematic of the SAO CHM is shown in Figure 1, and a description of this device and its operation follows. A beam of molecular hydrogen is dissociated into atoms at room temperature. The resultant beam of atomic hydrogen is then cooled, magnetically state selected, and focused into a quartz storage bulb centered inside of a microwave cavity resonant with the hydrogen hyperfine transition at 1420 MHz. The quartz storage bulb is coated with a superfluid He-4 film, and both the bulb and cavity are maintained near 0.5 K. The maser signal is coupled out inductively and carried to room temperature via semi-rigid coaxial cable. After passing through a room temperature isolator and preamp, the maser signal is detected with a low-noise heterodyne receiver as used in the room temperature SAO hydrogen masers. The maser temperature is lowered to 0.5 K using a recirculating He-3 refrigerator. This refrigerator consists of several cooling stages: a liquid nitrogen stage at 77 K, a liquid 4He bath at 4.2 K, a pumped He-4 pot at approximately 1.7 K, and the pumped, recirculating He-3 stage at 0.5 K. The atomic hydrogen beam, state selector, storage bulb and cavity are all connected inside a single, maser vacuum chamber (MVC). This space is pumped out from below by a turbo pump. Above the MVC, an inlet to the space allows for the input of flowing superfluid 4He film. External to the MVC is a second, outer vacuum chamber (OVC), maintained for operation of the cryostat and also pumped by a turbo pump. Inside the OVC, there is radiation shielding at 77 K and 1.7 K.
Author

Cryogenic Temperature; Hydrogen Masers; Molecular Gases; Helium Isotopes

20030064035 California Univ., Santa Barbara, CA, USA

Dynamics and Origin of Extra-solar Planetary Systems and Microlensing Detection of Extra-solar Planets

Peale, S. J.; [2003]; 2 pp.; In English

Contract(s)/Grant(s): NAG5-12087; No Copyright; Avail: CASI; A01, Hardcopy

We compare a space-based microlensing search for planets, with a ground based microlensing search originally proposed by D. Tytler (Beichman, et al. 1996). Perturbations of microlensing light curves when the lens star has a planetary companion are sought by one wide angle survey telescope and an array of three or four followup narrow angle telescopes distributed in longitude that follow events with high precision, high time resolution photometry. Alternative ground based programs are considered briefly. With the four 2 meter telescopes distributed in longitude in the southern hemisphere in the Tytler proposal, observational constraints on a ground-based search for planets during microlensing events toward the center of the galaxy are severe. Probably less than 100 events could be monitored per year with high precision, high time resolution photometry with only about 42\% coverage on the average regardless of how many events were discovered by the survey telescope. Statistics for the occurrence and properties for Jupiter-mass planets would be meaningful but relatively meager four years after the program was started, and meaningful statistics for Earth-mass planets would be non existent. In contrast, the 14,500 events in a proposed 4 year space based program (GEST = Galactic Exoplanet Survey Telescope) would yield very sound statistics on the occurrence, masses and separations of Jupiter-mass planets, and significant constraints on similar properties for Earth-mass planets. The significance of the Jupiter statistics would be to establish the frequency of planetary systems like our own, where terrestrial planets could exist inside the orbits of the giants.
Author
Extrasolar Planets; Planetary Systems; Terrestrial Planets; Perturbation; Temporal Resolution

20030064050 Smithsonian Astrophysical Observatory, Cambridge, MA, USA
[Probing Planck-scale Physics with a Ne-21/He-3 Zeeman Maser]
June 2003; 2 pp.; In English
Contract(s)/Grant(s): NAG8-1784; No Copyright; Avail: CASI; A01, Hardcopy

The Ne-21/He-3 Zeeman maser is a recently developed device which employs co-located ensembles of Ne-21 and He-3 atoms to provide sensitive differential measurements of the noble gas nuclear Zeeman splittings as a function of time, thereby greatly attenuating common-mode systematic effects such as uniform magnetic field variations. The Ne-21 maser will serve as a precision magnetometer to stabilize the system's static magnetic field, while the He-3 maser is used as a sensitive probe for violations of CPT and Lorentz symmetry by searching for small variations in the 3He maser frequency as the spatial orientation of the apparatus changes due to the rotation of the Earth (or placement on a rotating table). In the context of a general extension of the Standard Model of particle physics, the Ne-21/He-3 maser will provide the most sensitive search to date for CPT and Lorentz violation of the neutron: better than 10(exp -32) GeV, an improvement of more than an order of magnitude over past experiments. This exceptional precision will offer a rare opportunity to probe physics at the Planck scale. A future space-based Ne-21/He-3 maser or related device could provide even greater sensitivity to violations of CPT and Lorentz symmetry, and hence to Planck-scale physics, because of isolation from dominant systematic effects associated with ground-based operation, and because of access to different positions in space-time.
Derived from text
Helium Isotopes; Neon Isotopes; Masers; Zeeman Effect; Magnetic Fields; Rare Gases; Magnetostatic Fields

20030064144 NASA Ames Research Center, Moffett Field, CA, USA
The Infrared Spectrum of Matrix Isolated Aminoacetonitrile: A Precursor to the Amino Acid Glycine
Bernstein, Max P.; Bauschlicher, Charles W., Jr.; Sandford, Scott A.; [2003]; 5 pp.; In English
Contract(s)/Grant(s): NCC2-1178; 344-00-00; 344-30-21-01; 344-37-00-07; Copyright; Avail: CASI; A01, Hardcopy

We present infrared (IR) spectral data from matrix isolation experiments and density functional theory calculations on the pre-biologically interesting molecule aminoacetonitrile, a precursor to glycine. We find that this nitrile has an unusually weak nitrile (C=N) stretch in the infrared, in contrast to expectations based on measurements and models of other nitriles under astrophysical conditions. The absence of an observable nitrile absorption feature in the infrared will make the IR search for this molecule considerably more difficult, and will raise estimates of upper limits on nitriles in interstellar and outer Solar System ices. This is also of relevance to assessing the formation routes of the amino acid glycine, since aminoacetonitrile is the putative precursor to glycine via the Strecker synthesis, the mechanism postulated to have produced the amino acids in meteorites.
Author
Infrared Spectra; Matrix Theory; Isolation; Amino Acids; Acetonitrile; Glycine

20030064380 Fermi National Accelerator Lab., Batavia, IL, USA
What Ignites Optical Jets
Jester, S.; 2000; 8 pp.; In English
Report No.(s): DE2003-806222; FERMILAB-CONF-02/338-A; No Copyright; Avail: Department of Energy Information Bridge

The properties of radio galaxies and quasars with and without optical or X-ray jets are compared. The majority of jets from which high-frequency emission has been detected so far (13 with optical emission, 11 with X-rays, 13 with both) are associated with the most powerful radio sources at any given redshift. It is found that optical/X-ray jet sources are more strongly beamed than the average population of extragalactic radio sources. This suggests that the detection or non-detection of optical emission from jets has so far been dominated by surface brightness selection effects, not by jet physics. It implies that optical jets are much more common than is currently appreciated.
NTIS
Radio Galaxies; Quasars; Optical Properties; X Rays

20030064427 Lawrence Livermore National Lab., Livermore, CA
Fe XXII I(11.92 A)/I(11.77 A) Density Diagnostic
Mauche, C. W.; Liedahl, D. A.; Fournier, K. B.; Jan. 24, 2003; 10 pp.; In English
Report No.(s): DE2003-15003345; UCRL-JC-151385; No Copyright; Avail: Department of Energy Information Bridge

The unique aspect of high-temperature plasma in the post-shock region of accretion flow of magnetic cataclysmic variables is its density, which is expected to be high because of the magnetic funneling of the mass lot by the secondary; the factor-of-four density jump across the accretion shock; and the settling nature of the post-shock flow, where the density scales inversely with the temperature.
NTIS
Cataclysmic Variables; High Temperature Plasmas; Electron Density Profiles; Astrophysics

20030064459 Lawrence Livermore National Lab., Livermore, CA, Exeter Univ., UK
Portent of Heine's Reciprocal Square Root Identity
Cohl, H. S.; Jan. 13, 2003; 12 pp.; In English
Report No.(s): DE2003-15003144; UCRL-JC-150467-REV-1; No Copyright; Avail: Department of Energy Information Bridge

Precise efforts in theoretical astrophysics are needed to fully understand the mechanisms that govern the structure, stability, dynamics, formation, and evolution of differentially rotating stars. Direct computation of the physical attributes of a star can be facilitated by the use of highly compact azimuthal and separation angle Fourier formulations of the Green's functions for the linear differential equations of mathematical physics.
NTIS
Astrophysics; Stellar Evolution; Theoretical Physics; Linear Equations

20030064462 Lawrence Livermore National Lab., Livermore, CA
Spin-Up Rate of the White Dwarf of GK Per
Mauche, C. W.; Jan. 24, 2003; 10 pp.; In English
Report No.(s): DE2003-15003148; UCRL-JC-151610; No Copyright; Avail: Department of Energy Information Bridge

GK Per is an extraordinary cataclysmic variable; the first nova of the last century. It contains a magnetic white dwarf, a large truncated accretion disk, and an evolved secondary. It is surrounded by a nova shell visible in the radio, optical, and X-ray wavebands.
NTIS
Accretion Disks; Cataclysmic Variables; White Dwarf Stars; Astrophysics

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*.

20030053084 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Coronagraphic Amplitude and Phase Correction for Detecting Planets
Woodgate, Bruce E.; Bowers, Charles W.; [2003]; 1 pp.; In English; AAS Conference, 26 May 2003, Nashville, TN, USA; No Copyright; Avail: Other Sources; Abstract Only

Detection of earth-like planets around other stars using coronagraphy requires the optical beam into the coronagraph to be extremely uniform in both phase and amplitude. Errors in phase can be corrected using a deformable mirror, and error in amplitude can be corrected using a spatial light modulator, both in the pupil plan,a. These corrections can be combined using a Michelson interferometer. If amplitude corrections of only a few percent range are needed, the required accuracy of 10 (circumflex) -4 can be obtained with spatial light modulators with the modest dynamic range of 8 bits.
Author
Coronagraphs; Amplitudes; Correction; Planet Detection; Phase Error

20030064013 California Univ., Los Angeles, CA, USA
The Meteoritic Component in Impact Deposits
Kyte, Frank T.; [2003]; 7 pp.; In English
Contract(s)/Grant(s): NAG5-9441; No Copyright; Avail: CASI; A02, Hardcopy

This proposal requested support for a broad-based research program designed to understand the chemical and mineralogical record of accretion of extraterrestrial matter to the Earth. The primary goal of this research is to study the accretion history of the Earth, to understand how this accretion history reflects the long-term flux of comets, asteroids, and dust in the inner solar system and how this flux is related to the geological and biological history of the Earth. This goal is approached by seeking out the most significant projects that can be attacked utilizing the expertise of the PI and potential collaborators. The greatest expertise of the PI is the analysis of meteoritic components in terrestrial sediments. This proposal identifies three primary areas of research, involving impact events in the early Archean (3.2 Ga), the late Eocene (35 Ma) and the late Pliocene (2 Ma). In the early Archean we investigate sediments that contain the oldest recorded impacts on Earth. These are thick spherule beds, three of which were deposited within 20 m.y. If these are impact deposits the flux of objects to Earth at this time was much greater than predicted by current models. Earlier work used Cr isotopes to prove that one of these contain extraterrestrial matter, from a projectile with Cr isotopes similar to CV chondrites. We planned to expand this work to other spherule beds and to search for additional evidence of other impact events. With samples from D. Lowe (Stanford Univ.) the PI proposed to screen samples for high Ir and Cr so that appropriate samples can be provided to A. Shukolyukov for Cr-isotopic analyses. This work was expected to provide evidence that at least one interval in the early Archean was a period of intense bombardment and to characterize the composition of objects accreted. The late Eocene is also a period of intense bombardment with multiple spherule deposits and two large craters. Farley et al. (1998) demonstrated an increased (3)He flux to marine sediments that was attributed to an increase in interplanetary dust due to a shower of comets invading the inner solar system. We planned to detect a change in the Cr-isotopic composition in the flux of fine-grained extraterrestrial matter to ocean sediments. This would provide evidence for the comet shower hypothesis. We planned attempt to locate late Eocene impact deposits in a new high resolution, hi-latitude site that had the potential for excellent preservation and new information of the sources and effects of these impacts. Although most impacts on Earth occur in deep-ocean basins, only one such event is known - the late Pliocene impact of the Eltanin asteroid. The ejecta from this impact includes Ir- rich impact melt, spherules, and actual meteorites from the km-sized mesosiderite asteroid. Through a study of the ejecta, we can learn about the formation, distribution, alteration and preservation of Ir-rich deposits. We can also learn about meteorite survival during hypervelocity impacts and we can study pieces of a km-sized object to learn more about the mesosiderite parent body. Analyses of sediment cores and geophysical exploration of the impact site can further our understanding of the processes involved in deep-ocean impacts and potential effects on the terrestrial climate and biosphere. We planned analyses of this ejecta, a search for ejecta 5000 km distant from the impact area, and a new oceanographic expedition to study and sample the impact site. In addition to these three specific areas of research, the PI planned to remain flexible and available to exploit new opportunities presented by new discoveries, and to engage in new collaborations if other researchers require his expertise to develop new projects that fit within the objectives of the overall research program.
Author
Meteoritic Composition; Deposition; Meteorite Collisions; Sediments; Spherules; Chromium Isotopes

20030064016 Washington Univ., Saint Louis, MO, USA
Solid State and Mass Spectrometric Measurements: Microanalytical Studies of Extraterrestrial Materials
[2002]; 5 pp.; In English
Contract(s)/Grant(s): NAG5-8336; No Copyright; Avail: CASI; A01, Hardcopy

This document is a bibliography of publications resulting from the grant, published during the reporting period.
CASI
Solid State; Mass Spectroscopy; Microanalysis; Extraterrestrial Matter; Bibliographies

20030064018 Alfred-Wegener-Inst. for Polar and Marine Research, Bremerhaven, Germany
Oceanic Impact: Mechanisms and Environmental Perturbations
Gersonde, Rainer, Editor; Deutsch, Alex, Editor; Ivanov, Boris A., Editor; Kyte, Frank T., Editor; Deep-Sea Research Part II; 2002; Volume 49, No. 6, pp. 952-1169; In English; Oceanic Impact: Mechanisms and Environmental Perturbations, 15-17 Apr. 1999, Bremerhaven, Germany
Contract(s)/Grant(s): NAG5-9441; Copyright; Avail: Other Sources

The contents include the following: Oceanic impacts-a growing field of fundamental geoscience. Shock metamorphism on the ocean floor (numerical simulations). Numerical modeling of impact-induced modifications of the deep-sea floor. Computer modelling of the water resurge at a marine impact: the Lockne crater, Sweden. Experimental investigation of the role of water in impact vaporization chemistry. Calcareous plankton stratigraphy around the Pliocene Eltanin asteroid impact area (SE Pacific): documentation and application for geological and paleoceanographic reconstruction. Composition of impact melt debris from the Eltanin impact strewn field, Bellingshausen Sea. Iridium concentrations and abundances of meteoritic ejecta from the Eltanin impact in sediment cores from Polarstern expedition ANT XII/4. Unmelted meteoritic debris collected from Eltanin ejecta in Polarstern cores from expedition ANT XII/4. Impact tsunami-Eltanin. Ancient impact structures on modern continental shelves: The Chesapeake Bay, Montagnais, and Toms Canyon craters, Atlantic margin of North America. The Mjolnir marine impact crater porosity anomaly. Kardla (Hiiu-maa Island, Estonia) - the buried and well-preserved Ordovician marine impact structure. Long-term effect of the Kardla crater (Hiiu-maa, Estonia) on Late Ordovician carbonate sedimentation. The middle Devonian Kaluga impact crater (Russia): new interpretation of marine setting.
CASI
Impact Melts; Ocean Bottom; Mathematical Models; Plankton; Computerized Simulation

20030064019 California Univ., Los Angeles, CA, USA
Early Archean Spherule Beds: Chromium Isotopes Confirm Origin Through Multiple Impacts of Projectiles of Carbonaceous Chondrite Type
Kyte, Frank T.; Shukolyukov, Alex; Lugmair, Guenter W.; Lowe, Donald R.; Byerly, Gary R.; Geology; March 2003; Volume 31, No. 3, pp. 283-286; In English
Contract(s)/Grant(s): NCA2-721; NAG5-4145; NAG5-9411; NGT9-136; NAG5-9842; NSF EAR-99-09684; Copyright; Avail: Other Sources

Three Early Archean spherule beds from Barberton, South Africa, have anomalous Cr isotope compositions in addition to large Ir anomalies, confirming the presence of meteoritic material with a composition similar to that in carbonaceous chondrites. The extra-terrestrial components in beds S2, S3, and S4 are estimated to be approx. 1%, 50\% - 60\%, and 15\% - 30\%, respectively. These beds are probably the distal, and possibly global, ejecta from major large-body impacts. These impacts were probably much larger than the Cretaceous-Tertiary event, and all occurred over an interval of approx. 20 m.y., implying an impactor flux at 3.2 Ga that was more than an order of magnitude greater than the present flux.
Author
Meteoritic Composition; Carbonaceous Chondrites; Chromium Isotopes

20030064078 California Univ., Los Angeles, CA, USA
Exploration of the Eltanin Impact Area (Bellingshausen Sea): Expedition ANT XVIII5a
Gersonde, Rainer; Kyte, Frank T.; Meteoritics and Planetary Science; 2001; Volume 36, pp. A109; In English
Contract(s)/Grant(s): NAG5-9441; Copyright; Avail: Other Sources

The impact of the Eltanin asteroid into the Bellingshausen Sea (2.15 Ma) is the only known impact in a deep-ocean (approx. 5 km) basin. On 26 March 2001, the FS Polarstern returned to the impact area during expedition ANT XVIII/5a. Over a period of 14 days, this region was explored by detailed bathymetric mapping, acoustic profiling of sediment deposits, and direct sampling with 18 piston cores and four gravity cores. Preliminary shipboard examination of microfossils showed that

sixteen of the piston cores and three gravity cores contained sediments at least as old as the impact event and have a high probability of containing a record of the disturbances caused by the impact. During the expedition, portions of eleven piston cores were opened for preliminary examination of the impact deposits. Visual examination of cores and microscopic identification of suspect impact melt particles were were used to identify ejecta and X-ray radiographs of the opened core segments permitted analysis of sediment structures. Impact deposits were found in nine of the eleven opened cores, and a similar success rate is anticipated in the seven cores remaining to be opened. These preliminary observations indicate that the highest concentrations of meteoritic ejecta and the largest particle sizes appear to occur in the region north of the San Martin seamounts. Recovered debris includes cm-sized melt rocks and a 2.5 cm meteorite. This expedition has confirmed the presence of high concentrations of meteoritic ejecta across a region at least as large as 10(exp 5) sq km. Quantitative analyses of ejecta distribution within this region will require further study, but previous estimates of 1 km for the minimum diameter of the Eltanin asteroid, appear safe.
Author
Meteorite Collisions; Ocean Bottom; Bathymeters; Acoustic Sounding; Sediments; Core Sampling

20030064112 California Univ., Los Angeles, CA, USA
Ejecta from Ocean Impacts
Kyte, Frank T.; [2003]; 2 pp.; In English; Conference on Submarine Craters and Ejecta-Crater Correlation, 29 Aug. - 3 Sep. 2001, Svalbard, Norway
Contract(s)/Grant(s): NAG5-9441; No Copyright; Avail: CASI; A01, Hardcopy

Numerical simulations of deep-ocean impact provide some limits on the size of a projectile that will not mix with the ocean floor during a deep-ocean impact. For a vertical impact at asteroidal velocities (approx. 20 km/s), mixing is only likely when the projectile diameter is greater than 112 of the water depth. For oblique impacts, even larger projectiles will not mix with ocean floor silicates. Given the typical water depths of 4 to 5 km in deep-ocean basins, asteroidal projectiles with diameters as large as 2 or 3 km may commonly produce silicate ejecta that is composed only of meteoritic materials and seawater salts. However, the compressed water column beneath the projectile can still disrupt and shock metamorphose the ocean floor. Therefore, production of a separate, terrestrial ejecta component is not ruled out in the most extreme case. With increasing projectile size (or energy) relative to water depths, there must be a gradation between oceanic impacts and more conventional continental impacts. Given that 60\% of the Earth's surface is covered by oceanic lithosphere and 500 m projectiles impact the Earth on 10(exp 5) y timescales, there must be hundreds of oceanic impact deposits in the sediment record awaiting discovery.
Derived from text
Ejecta; Meteorite Collisions; Ocean Bottom

20030064910 California Inst. of Tech., Pasadena, CA, USA
Participation of D. O. Muhleman as a Co-Investigator on the Mars Observer Laser Altimeter (MOLA) Team
Muhleman, Duane O.; [2003]; 2 pp.; In English
Contract(s)/Grant(s): NAG5-4437
Report No.(s): DOM.64317-1-NASA.643170; No Copyright; Avail: Other Sources; Abstract Only

This report briefly describes the efforts in which Professor Duane 0. Muhleman (PI) has been a member of on the MOLA team since the beginning of the Mars Surveyor Project, continuing on through the Mars Observer program. Throughout this participation he supported a single Caltech graduate student, Anton Ivanov, who has been at JPL since receiving his Ph.D. from Caltech in 2000. Muhleman remained (and remains) active at essentially all team meetings throughout these programs. The PI S efforts primarily included three areas of research involving the data from the MOLA instrument.
Author
Mars Observer; Opacity; Mars Surface; Altimeters

20030065159 NASA Ames Research Center, Moffett Field, CA, USA
Protoplanetary Nebula Evolution using the Beta Viscosity Model
Davis, Sanford S.; [2003]; 1 pp.; In English; DPS Meeting, 2-6 Sep. 2002, Monterey, CA, USA
Contract(s)/Grant(s): RTOP 274-00-02-44; No Copyright; Avail: Other Sources; Abstract Only

The evolutionary dynamics of a protoplanetary disk is an important component of the planet formation process. In particular, the dynamic and thermodynamic field plays a critical role in chemical evolution, the migration of dust particles in the nebula, and the radial transport of meteoritic components. The dynamic evolution is investigated using analytical solutions

of the surface density transport equations using a turbulence model based on hydrodynamic generation of turbulence. It captures the major properties of the disk including region of separation between radial inflow and-outflow and the evolution of the central plane temperature. The analytical formulas are compared with available numerical solutions based on the alpha viscosity model. The beta viscosity model, heretofore used for steady-state disks, is shown to be a useful approximation for unsteady problems.
Author
Planetary Evolution; Nebulae; Protoplanetary Disks; Chemical Evolution; Numerical Analysis

20030065170 NASA Langley Research Center, Hampton, VA, USA
Mars Exploration Rover Six-Degree-Of-Freedom Entry Trajectory Analysis
Desai, Prasun N.; Schoenenberger, Mark; Cheatwood, F. M.; [2003]; 16 pp.; In English; AAS/AIAA Astrodynamics Specalits Conference, 3-7 Aug. 2003, Big Sky, MT, USA
Report No.(s): AAS Paper 03-642; Copyright; Avail: CASI; A03, Hardcopy

The Mars Exploration Rover mission will be the next opportunity for surface exploration of Mars in January 2004. Two rovers will be delivered to the surface of Mars using the same entry, descent, and landing scenario that was developed and successfully implemented by Mars Pathfinder. This investigation describes the trajectory analysis that was performed for the hypersonic portion of the MER entry. In this analysis, a six-degree-of-freedom trajectory simulation of the entry is performed to determine the entry characteristics of the capsules. In addition, a Monte Carlo analysis is also performed to statistically assess the robustness of the entry design to off-nominal conditions to assure that all entry requirements are satisfied. The results show that the attitude at peak heating and parachute deployment are well within entry limits. In addition, the parachute deployment dynamics pressure and Mach number are also well within the design requirements.
Author
Degrees Of Freedom; Trajectory Analysis; Atmospheric Entry; Mars Roving Vehicles; Mars Exploration; NASA Space Programs

92
SOLAR PHYSICS

Includes solar activity, solar flares, solar radiation and sunspots. For related information see *93 Space Radiation*.

20030063904 Smithsonian Astrophysical Observatory, Cambridge, MA, USA
Boundary Conditions of the Heliosphere
Frisch, Priscilla C.; Slavin, Jonathan D.; Wagner, William, Technical Monitor; July 2003; 4 pp.; In English
Contract(s)/Grant(s): NAG5-12571; No Copyright; Avail: CASI; A01, Hardcopy

As described in the Revised Task Statement for this grant (submitted following the award at a reduced budget), my role in these investigations is to focus on the theoretical calculations relevant to the ionization state and dust content of the Local Cloud that surrounds the Solar System. An important motivation for our investigations is to aid in the interpretation of pick-up ion (PUI) and anomalous cosmic ray (ACR) observations which depends on knowledge of the flux of neutral atoms of various elements into the heliosphere. This flux depends on the ionization and elemental abundances of the gas of the Local Cloud. We have made substantial progress in our program to understand the ionization of the Local Cloud. Our steady state photoionization models are remarkably successful in accounting for the ionization observed both by line of sight (column density) observations towards nearby stars and in situ measurements. By lifting some of the simplifying assumptions in our earlier modeling we hope to make further progress in this understanding. In future work on this project we will continue our exploration of photoionization models, focusing on making sense of the differences between the LIC and the BC. In addition we will explore the effects of altered abundances in the hot gas on the ionization and thermal balance in the LIC.
Author
Boundary Conditions; Heliosphere; Photoionization; Gas Ionization; Neutral Atoms; Mathematical Models; Particle Flux Density

20030063908 NASA Marshall Space Flight Center, Huntsville, AL, USA
Evidence that a Deep Meridional Flow Sets the Sunspot Cycle Period
Hathaway, David H.; Nandy, D.; Wilson, R. M.; Reichmann, E. J.; [2003]; 1 pp.; In English; Solar Physics Division/American Astronomical Society, 16-20 Jun. 2003, Laurel, MD, USA; No Copyright; Avail: Other Sources; Abstract Only

Sunspots appear on the Sun in two bands on either side of the equator that drift toward lower latitudes as each sunspot

cycle progresses. We examine the equatorward drift of the centroid of the sunspot area in each hemisphere from 1874 to 2002 and find that the drift rate slows as the centroid approaches the equator. We compare the drift rate at sunspot cycle maximum to the cycle-period for each hemisphere and find a highly significant anti-correlation: hemispheres with faster drift rates have shorter periods. These observations are. consistent with an equatorward meridional counterflow, deep within the Sun, as the primary driver of the equatorward migration and the period associated with the sunspot cycle. We also find that the drift rate at maximum is significantly correlated with the amplitude of the following cycle, a prediction of dynamo models that employ a deep equatorward meridional flow. Our results indicate an amplitude of about 1.2 m/s for the meridional flow velocity at the base of the solar convection zone.
Author
Sunspots; Sunspot Cycle; Equators; Solar Interior; Stellar Structure; Meridional Flow; Flow Velocity

20030064909 Smithsonian Astrophysical Observatory, Cambridge, MA, USA
SOHO Ultraviolet Coronagraph Spectrometer (UVCS) Mission Operations and Data Analysis
Kohl, John L.; Gurman, Joseph, Technical Monitor; 2003; 12 pp.; In English
Contract(s)/Grant(s): NAG5-11420; No Copyright; Avail: CASI; A03, Hardcopy

The scientific goal of UVCS is to obtain detailed empirical descriptions of the extended solar corona as it evolves over the solar cycle and to use these descriptions to identify and understand the physical processes responsible for coronal heating, solar wind acceleration, coronal mass ejections (CMEs), and the phenomena that establish the plasma properties of the solar wind as measured by 'in situ' solar wind instruments. This report covers the period from 01 February 2002 to 15 February 2003. During that time, UVCS observations have consisted of three types: 1) standard synoptic observations comprising, primarily, the H I Ly alpha line profile and the O VI 103.2 and 103.7 nm intensity over a range of heights from 1.5 to about 3.0 solar radii and covering 360 degrees about the sun, 2) sit and stare watches for CMEs, and 3) special observations designed by the UVCS Lead Observer of the Week for a specific scientific purpose. The special observations are often coordinated with those of other space-based and ground-based instruments and they often are part of SOHO joint observation programs and campaigns. Lead observers have included UVCS Co-Investigators, scientists from the solar physics community and several graduate and undergraduate level students. UVCS has continued to achieve its purpose of using powerful spectroscopic diagnostic techniques to obtain a much more detailed description of coronal structures and dynamic phenomena than existed before the SOHO mission. The new descriptions of coronal mass ejections (CMEs) and coronal structures from UVCS have inspired a large number of theoretical studies aimed at identifying the physical processes responsible for CMEs and solar wind acceleration in coronal holes and streamers. UVCS has proven to be a very stable instrument. Stellar observations have demonstrated its stability. UVCS has required no flight software modifications and all mechanisms are operational. The UVCS O VI Channel with its redundant optical path for wavelengths near H I Ly alpha is capable of observing the entire UVCS wavelength range. Since December 1998, the O VI Channel has been used for all UVCS observations. Although the H I Ly alpha Channel and detector are still operational, increases in the dark count up to about 5 x 10(exp -4) counts/sec/pixel and an increase in high voltage current to within a factor of two of the maximum used in the laboratory before flight led to the decision to not use that detector at the present time. There is no significant decrease in the scientific capability of UVCS owing to the O VI channel redundant optical path. UVCS data, data analysis software, calibration files and the mission log are available from the SOHO archive and SAO. All UVCS data is now available to scientists and the general public via the SOHO Data Archive and SAO within three months of the observations. UVCS has resulted in 46 scientific papers in 2002. There were numerous presentations at scientific meetings. All requests for observation time by qualified outside users have been granted.
Author
Soho Mission; Coronagraphs; Ultraviolet Spectrometers; Solar Corona; Coronal Mass Ejection

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.

20030064055 NASA Johnson Space Center, Houston, TX, USA

National Aeronautics and Space Administration (NASA)/American Society of Engineering Education (ASEE) Summer Faculty Fellowship Program - 2000

Bannerot, Richard B., Editor; Sickorez, Donn G., Editor; March 2003; 268 pp.; In English; See also 20030064056 - 20030064075; Original contains black and white illustrations

Contract(s)/Grant(s): NAG9-867

Report No.(s): NASA/CR-2003-208934; NAS 1.26:208934; No Copyright; Avail: CASI; A12, Hardcopy

The 2000 Johnson Space Center (JSC) National Aeronautics and Space Administration (NASA)/American Society for Engineering Education (ASEE) Summer Faculty Fellowship Program was conducted by the University of Houston and JSC. The 10-week program was operated under the auspices of the ASEE. The program at JSC, as well as the programs at other NASA Centers, was funded by the Office of University Affairs, NASA Headquarters, Washington, D.C. The objectives of the program, which began in 1965 at JSC and 1964 nationally, are to (1) further the professional knowledge of qualified engineering and science faculty, (2) stimulate an exchange of ideas between participants and NASA, (3) enrich and refresh the research and teaching activities of participants' institutions, and (4) contribute to the research objectives of the NASA Centers. Each faculty fellow spent at least 10 weeks at JSC engaged in a research project commensurate with her/his interests and background, and worked in collabroation with a NASA/JSC colleague. This document is a compilation of the final reports on the research projects done by the faculty fellows during the summer of 2000.

Author

NASA Programs; University Program; Engineering; Instructors; Education; Science; Research

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