National Aeronautics and
Space Administration
Langley Research Center

Scientific and Technical
Information Program Office

Scientific and Technical Aerospace Reports

STAR

Volume 45 Number 20

October 15, 2007

WHAT'S INSIDE

NASA STI Program ... in Profile

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- NASA-owned patents and patent applications
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The U.S. Patent and Trademark Office (USPTO)

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

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Subject Divisions/Categories

Document citations are grouped by division and then by category, according to the *NASA Scope and Subject Category Guide.*

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Astronautics

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Mathematical and Computer Sciences

Physics

Social and Information Sciences

Space Sciences

Indexes

Two indexes are available. You may use the find command under the tools menu while viewing the PDF file for direct match searching on any text string. You may also select either of the two indexes provided for linking to the corresponding document citation from *NASA Thesaurus* terms and personal author names.

SCIENTIFIC AND TECHNICAL AEROSPACE REPORTS

A Biweekly Publication of the National Aeronautics and Space Administration

VOLUME 45, NUMBER 20 OCTOBER 15, 2007

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.

20070031035 NASA Dryden Flight Research Center, Edwards, CA, USA
2006 Engineering Annual Report
Bowers, Albion; Stoliker, Patrick; Cruciani, Everlyn; August 2007; 61 pp.; In English; See also 20070031036 - 20070031058; Original contains color and black and white illustrations
Report No.(s): NASA/TM-2007-214622; H-2715; No Copyright; Avail.: CASI: A04, Hardcopy
ONLINE: http://hdl.handle.net/2060/20070031035

Selected research and technology activities at Dryden Flight Research Center are summarized. These activities exemplify the Center's varied and productive research efforts.
Author
Aerodynamics; Research and Development; Aeronautical Engineering; Aircraft Structures; Test Stands; Flight Tests

20070031036 NASA Dryden Flight Research Center, Edwards, CA, USA
Stability, Control, and Handling Qualities Analysis of the F-15B Quiet Spike(TradeMark) Airplane
Cox, Timothy H.; McWherter, Shaun C.; Moua, Cheng; 2006 Engineering Annual Report; August 2007, pp. 39-41; In English; See also 20070031035; Original contains color and black and white illustrations; No Copyright; Avail.: CASI: A01, Hardcopy
ONLINE: http://hdl.handle.net/2060/20070031036

The primary objective of the Quiet Spike(TradeMark) (Gulfstream Aerospace, Savannah, Georgia) (QS) flight research program, figure 1, was the aerodynamic and structural proof-of-concept of a telescoping, half-scale, sonic-boom suppressing nose boom on a F-15B (McDonnell Douglas Corporation, St. Louis, Missouri, now The Boeing Company, Chicago, Illinois) airplane. The program goal was to collect flight data for these disciplines to 1.8 Mach. In the area of stability and controls, the primary objective was to assess the effect of the spike on the stability, controllability, and handling qualities of the airplane. The primary goal of this test philosophy was maintaining safety of flight. Flight-validated simulator predictions were used for envelope clearance to sequentially higher dynamic pressure, Mach number, angle of attack or sideslip.
Derived from text
Stability Tests; Controllability; Angle of Attack; Proving; Stability

20070031037 NASA Dryden Flight Research Center, Edwards, CA, USA
Quiet Spike(TradeMark) Flight-Testing
Hodge, Mark; 2006 Engineering Annual Report; August 2007, pp. 37-38; In English; See also 20070031035; Original contains black and white illustrations; No Copyright; Avail.: CASI: A01, Hardcopy
ONLINE: http://hdl.handle.net/2060/20070031037

The Gulfstream Aerospace Corporation (GAC) (Savannah, Georgia) partnered with the NASA Dryden Flight Research Center (DFRC) to execute the Quiet Spike(TradeMark) (QS) project. Following a survey of potential test platforms, the NASA F-15B (McDonnell Douglas Corporation, St. Louis, Missouri, now The Boeing Company, Chicago, Illinois) airplane, tail number 836, was selected as the target test vehicle primarily because of its unique ability to carry a large-scale test apparatus

to relevant supersonic flight speeds. The airplane radome was removed and a long, composite boom (spike) with a stationary extension and two moveable extensions were attached to the radar bulkhead so that the boom could be extended and retracted in flight.
Derived from text
Flight Tests; Supersonic Flight; Test Vehicles

20070031038 NASA Dryden Flight Research Center, Edwards, CA, USA
Real-Time Stability Margin Estimation for the X-48B Blended-Wing Body
Regan, Chris; 2006 Engineering Annual Report; August 2007, pp. 16-17; In English; See also 20070031035; No Copyright; Avail.: CASI: A01, Hardcopy
ONLINE: http://hdl.handle.net/2060/20070031038

A real-time stability margin (RTSM) estimation tool has been developed for in-flight robustness analysis of the X-48B (Boeing Phantom Works, St. Louis, Missouri) blended-wing body. The tool incorporates methods for generating excitation signals and the ability to analyze the open-loop frequency response during flight-testing. The excitation signals are mutually orthogonal and minimize the peak factors to provide multi-input excitation while avoiding excursions in flight condition. For in-flight analysis, an emphasis has been placed on comparison between flight data and simulation data in addition to estimated stability margins.
Derived from text
Body-Wing Configurations; Real Time Operation; Flight Tests; Stability Tests; Data Simulation; Stability

20070031039 NASA Dryden Flight Research Center, Edwards, CA, USA
The C-20A/G-III Platform Precision Autopilot Development
Lee, James; Baumann, Ethan; Strovers, Brian; Lin, Victor; Redifer, Matt; 2006 Engineering Annual Report; August 2007, pp. 13-15; In English; See also 20070031035; Original contains color and black and white illustrations; No Copyright; Avail.: CASI: A01, Hardcopy
ONLINE: http://hdl.handle.net/2060/20070031039

The NASA Unmanned Aerial Vehicle Synthetic Aperture Radar (UAVSAR) program is developing a Synthetic Aperture Radar (SAR) for ground measurements. A key element for the success of this program is a Platform Precision Autopilot (PPA). An interim vehicle, the NASA C-20A Gulfstream III (C-20A/G-III) (Gulfstream Aerospace Corporation, Savannah, Georgia) airplane, shown in figure 1, was selected to carry the radar pod and develop the PPA. The PPA interfaces with the C-20A/G-III airplane, making the onboard computer think it is flying an Instrument Landing System (ILS) approach. This technique retains the safeguards in the airplane autopilot. The PPA will enter initial flight-testing in early 2007.
Derived from text
Pilotless Aircraft; Automatic Pilots; Instrument Landing Systems; Synthetic Aperture Radar; Flight Tests; Airborne/Spaceborne Computers

20070031040 NASA Dryden Flight Research Center, Edwards, CA, USA
Ikhana, The First 'Intelligent' Unmanned Research Testbed
Lin, Yohan; 2006 Engineering Annual Report; August 2007, pp. 22-24; In English; See also 20070031035; Original contains black and white illustrations; No Copyright; Avail.: CASI: A01, Hardcopy
ONLINE: http://hdl.handle.net/2060/20070031040

The NASA Dryden Flight Research Center (DFRC) has acquired an MQ-9 Predator B unmanned aircraft system (UAS), seen in figure 1, to be used as a research testbed. The vehicle is manufactured by General Atomics Aeronautical Systems, Inc. (GA-ASI) (San Diego, California), and was procured through the assistance of the Air Force Flight Test Center at Edwards, California. A flight research computer will be integrated into the vehicle to conduct autonomous flight research experiments, such as collision avoidance, intelligent mission planning, or precision autopilot control. Modifications to the aircraft and ground control station (GCS) software are in development. The vehicle will then be able to provide duo role capability, conducting science mission flights in addition to research experiment flights. This is the first time that a large, high-altitude, long endurance UAS has been used in this manner.
Derived from text
Pilotless Aircraft; Ground Based Control; Flight Tests; Automatic Pilots; Aircraft Control

20070031041 NASA Dryden Flight Research Center, Edwards, CA, USA

Gordon's Unmanned Aerial Vehicle Trainer: A Flight-Training Tool for Remotely- Piloted Vehicle Pilots

Jacobson, Steve; Frackowiack, Tony; Fullerton, Gordon; 2006 Engineering Annual Report; August 2007, pp. 19-21; In English; See also 20070031035; Original contains black and white illustrations; No Copyright; Avail.: CASI: A01, Hardcopy

ONLINE: http://hdl.handle.net/2060/20070031041

In 2007, the NASA Dryden Flight Research Center (DFRC) will be flying the Ikhana Predator B (General Atomics Aeronautical Systems, Inc., San Diego, California) unmanned aerial vehicle (UAV) (fig. 1), and the X-48B (The Boeing Company, Chicago, Illinois) Blended-Wing Body (BWB) aircraft (fig. 2). These high-value UAVs require a remote pilot to fly the vehicle while looking through a forward-looking camera located in the vehicle nose during take off, pattern operations, and landing. These operations are high-risk to the vehicle because of the poor field of view, lack of peripheral vision and external cues, lack of sensory feedback, and system time delays for uplink command and video downlink. Recently, DFRC pilots have flown only piloted vehicles and were concerned with the lack of familiarity with operating a remotely-piloted vehicle (RPV) through a video camera.

Derived from text

Pilotless Aircraft; Remotely Piloted Vehicles; Flight Training; Blended-Wing-Body Configurations; Field of View

20070031042 NASA Dryden Flight Research Center, Edwards, CA, USA

F-15 Intelligent Flight Control System Neural Network Flight Systems Summary

Larson, Richard; 2006 Engineering Annual Report; August 2007, pp. 33-34; In English; See also 20070031035; Original contains black and white illustrations; No Copyright; Avail.: CASI: A01, Hardcopy

ONLINE: http://hdl.handle.net/2060/20070031042

The NASA F-15 (McDonnell Douglas Corporation, St. Louis, Missouri, now The Boeing Company, Chicago, Illinois) airplane was used as a testbed to flight-test a neural network controller algorithm called 'Sigma Pi.' Two types of failures were included to demonstrate the effectiveness of the neural network controller. A simulated change in aircraft stability was achieved by changing the gain on the angle-of-attack feedback to the symmetric canard. With fixed canards, the aircraft is both statically and dynamically unstable. Angle-of-attack feedback to the canards is required for longitudinal stability. A change in control effectiveness was simulated by biasing and freezing one of the stabilator control surfaces. The flight test was performed at Mach 0.75 at an altitude of 20,000 ft with maneuvering at 3 g tracking and formation tasks. Results from flight tests show that the canard multiplier failures were less severe than predicted by the nonlinear simulation. The adaptive system seemed to provide some improvement with these failures; however, the change was less dramatic than was predicted. The stabilator failures provided a good example of an asymmetric vehicle. The neural networks provided some relief from the coupled behavior, however, with the neural networks engaged, the system tended to be much more PIO-prone in the pitch axis. Pilot control stick motions revealed that pilot compensation was adequate to deal with most of the cross coupling when accomplishing a pitch task. For task accomplishment requiring motions in the lateral axis, however, pilot compensation was less successful.

Derived from text

Flight Control; Longitudinal Stability; Neural Nets; Flight Tests; Tracking (Position); Angle of Attack; Cross Coupling; F-15 Aircraft

20070031043 NASA Dryden Flight Research Center, Edwards, CA, USA

F-15 Intelligent Flight Controls

Bosworth, John T.; Burken, John J.; Williams-Hayes, Peggy S.; 2006 Engineering Annual Report; August 2007, pp. 31-32; In English; See also 20070031035; Original contains color illustrations; No Copyright; Avail.: CASI: A01, Hardcopy

ONLINE: http://hdl.handle.net/2060/20070031043

Eighteen flights were flown in early 2006 providing evaluation of a direct adaptive neural-network-based flight control concept. A highly modified NF-15B (McDonnell Douglas Corporation, St. Louis, Missouri, now The Boeing Company, Chicago, Illinois) airplane, tail number 837 was used as the demonstration vehicle. It was shown that in some cases improved handling qualities were observed as a result of the adaptive system. The use of neural networks and similar adaptive technologies in the design of highly fault- and damage-tolerant flight control systems shows promise in making future aircraft far more survivable than current technology allows. During the flight evaluations in 2006, the neural network was engaged and allowed to learn in real time to dynamically alter the aircraft handling qualities characteristics in the presence of simulated

failure conditions. The objective was to demonstrate an improvement of one Cooper-Harper rating level when the adaptation system is engaged.
Author
Flight Control; Real Time Operation; Neural Nets; Flight Tests; Fault Tolerance; F-15 Aircraft

20070031044 NASA Dryden Flight Research Center, Edwards, CA, USA
Altair Western States Fire Mission
Willhite, Jamie; Navarro, Robert; Cobleigh, Brent; 2006 Engineering Annual Report; August 2007, pp. 45-47; In English; See also 20070031035; Original contains color and black and white illustrations; No Copyright; Avail.: CASI: A01, Hardcopy
ONLINE: http://hdl.handle.net/2060/20070031044

The Altair Western States Fire Mission teamed NASA Dryden Flight Research Center (DFRC) (Edwards, California), NASA Ames Research Center (ARC) (Moffett Field, California) and General Atomics Aeronautical Systems Inc. (GA-ASI) (San Diego, California) with the USDA Forest Service to demonstrate the capability to use an Unmanned Air Vehicle (UAV) as a wildfire remote sensing platform. The experiment demonstrated the combined use of a NASA ARC-designed thermal multispectral scanner integrated on a large payload capacity UAV, a satellite image data telemetry system, near-real-time image georectification, and rapid Internet data dissemination to fire center and disaster managers. The flight demonstrations were conducted in September and October of 2006, as seen in figure 1. Two days after the research effort had been completed, the Governor of California requested emergency support for remote sensing over the Esperanza fire south of Beaumont, California. The entire team responded to the request to execute an extremely effective operational fire mission. This required completely reinstalling the fire pod and rewiring the Altair aircraft, planning the mission and requesting and receiving an emergency Certificate of Authorization (COA) from the Federal Aviation Administration (FAA) to operate in the National Airspace System (NAS.)
Derived from text
Remote Sensing; Forest Fires; Satellite Imagery; National Airspace System; Disasters

20070031045 NASA Dryden Flight Research Center, Edwards, CA, USA
Project Orion - Abort Flight Test
Clarke, Robet; Reed, Don; 2006 Engineering Annual Report; August 2007, pp. 3; In English; See also 20070031035; No Copyright; Avail.: CASI: A01, Hardcopy
ONLINE: http://hdl.handle.net/2060/20070031045

The Project Orion-Abort Flight Test (AFT) project involves the NASA Johnson Space Center (JSC) (Houston, Texas), the Dryden Flight Research Center (DFRC) (Edwards, California), the Langley Research Center (LaRC) (Langley, Virginia), the Kennedy Space Center (KSC) (Kennedy Space Center, Florida), the Glenn Research Center (GRC) (Cleveland, Ohio), the Project Orion prime contractor, Lockheed Martin Corporation (Bethesda, Maryland), and subcontractors. This project will flight-test the new Orion systems that are responsible for safely removing astronauts from potentially fatal launch and boost phase situations. Proposed tests include pad abort, seen in figure 1, as well as booster-launched flight tests. The AFT flight tests are important to the design effort and timely launch of manned Orion. The goals of the AFT project are to: 1. Provide characterization of emerging design of the critical Launch Abort System (LAS), as well as recovery, power, and avionics systems to improve and perfect the Orion final design. 2. Flight-demonstrate and characterize the performance of the same systems.
Derived from text
Flight Tests; Launching; Avionics; Flight Characteristics; Acceleration (Physics)

20070031046 NASA Dryden Flight Research Center, Edwards, CA, USA
Further Development of Ko Displacement Theories for Deformed Shape Predictions of Complex Structures
Ko, William L.; Richards, W. Lance; 2006 Engineering Annual Report; August 2007, pp. 6-7; In English; See also 20070031035; No Copyright; Avail.: CASI: A01, Hardcopy
ONLINE: http://hdl.handle.net/2060/20070031046

Formulated Ko displacement theories are further developed for nonuniform cantilever beams, seen in figure 1, under bending, torsion, and combined bending and torsion loading. The displacement equations are expressed in terms of strains measured at multiple equally spaced strain-sensing stations on the lower (or upper) surface of the beam. The bending and distortion strain data can be input to the displacement equations for the calculations of slopes, deflections, and cross-sectional twist angles of the beam for generation of the deformed shapes of the entire beam. The displacement equations developed were

successfully validated for their accuracy by the finite-element analysis. The displacement theories developed could also be applied to calculate the deformed shapes of simple beams, plates, aircraft wings, and fuselages. The displacement equations with the associated strain sensing system using fiber-optic sensors form a powerful tool for in-flight deformed shape monitoring of the flexible aircraft wings. The calculated displacement data could ultimately be visually displayed before the eyes of a groundbased pilot to monitor the in-flight deformed shape of unmanned aircraft wings.
Derived from text
Cantilever Beams; Flexible Wings; Deflection; Displacement; Finite Element Method; Bending; Torsion; In-Flight Monitoring

20070031047 NASA Dryden Flight Research Center, Edwards, CA, USA
Reentry Thermal Analysis of a Generic Crew Exploration Vehicle Windward Wall Structures
Ko, William L.; Tran, Van T.; 2006 Engineering Annual Report; August 2007, pp. 4-5; In English; See also 20070031035; No Copyright; Avail.: CASI: A01, Hardcopy
ONLINE: http://hdl.handle.net/2060/20070031047

Reentry heat transfer analysis was performed on the windward wall structures of a generic composite Crew Exploration Vehicle (CEV) capsule, seen in figure 1, protected by the Apollo thermal protection system (TPS) (ablative material). The Apollo low Earth orbit reentry trajectory was used to calculate the input reentry heating rates. In the thermal analysis computer program used, the TPS ablation effect was not included; however, the results from the non-ablation heat transfer analyses were used to develop an approximate virtual ablation method to estimate the ablation heat loads and the TPS secession thicknesses. Depending on the severity of the heating-rate time history, the virtual ablation period was found to last for 93-117 s, and the ablation heat load was estimated to be in the range of 85-87 percent of the total heat load for the ablation period. The TPS recession thickness was estimated to be in the range of 0.08-0.11 in. The TPS thickness range of 0.717-0.733 in was found to be adequate to keep the composite sub-structural temperatures at the limit of 300 F.
Derived from text
Thermal Analysis; Reentry Effects; Spacecrews; Spacecraft Modules; Aerodynamic Heat Transfer; Thermal Protection; Aerodynamic Heating

20070031048 NASA Dryden Flight Research Center, Edwards, CA, USA
Optimal Use of Vertical Gusts
Allen, Michael; 2006 Engineering Annual Report; August 2007, pp. 48-49; In English; See also 20070031035; Original contains color illustrations; No Copyright; Avail.: CASI: A01, Hardcopy
ONLINE: http://hdl.handle.net/2060/20070031048

Equations for determining vertical wind velocity and vertical wind shear were developed for the purpose of atmospheric energy harvesting. The vertical wind state was calculated from surface positions, body axis accelerations and rates, Euler angles, and GPS position. The estimated velocity was used to determine optimal pitching maneuvers for one of three objectives during straight-line flight in the presence of headwind or tailwind. The selected objectives are: minimal energy consumption, minimal energy consumption while maintaining arrival time, and maximum cross-country speed. The equations used for cross-country pitching maneuvers were taken from sailplane cross-country racing theory. This approach has been tested in simulation with good results.
Derived from text
Gusts; Wind Shear; Wind Velocity; Gliders; Energy Consumption; Euler Equations of Motion; Global Positioning System

20070031049 NASA Dryden Flight Research Center, Edwards, CA, USA
Aeroelastic Model Structure Computation for Envelope Expansion
Kukreja, Sunil L.; 2006 Engineering Annual Report; August 2007, pp. 28-30; In English; See also 20070031035; No Copyright; Avail.: CASI: A01, Hardcopy
ONLINE: http://hdl.handle.net/2060/20070031049

Structure detection is a procedure for selecting a subset of candidate terms, from a full model description, that best describes the observed output. This is a necessary procedure to compute an efficient system description that may afford greater insight into the functionality of the system or a simpler controller design. Structure computation as a tool for black-box modeling may be of critical importance in the development of robust, parsimonious models for the flight-test community. Moreover, this approach may lead to efficient strategies for rapid envelope expansion, which may save significant development time and costs. In this study, a least absolute shrinkage and selection operator (LASSO) technique is investigated for

computing efficient model descriptions of nonlinear aeroelastic systems. The LASSO minimizes the residual sum of squares by the addition of an l(sub 2) penalty term on the parameter vector of the traditional l(sub 2) minimisation problem. The use of LASSO for structure detection is a natural extension of this constrained minimisation approach to pseudolinear regression problems which produces some model parameters that are exactly zero and, therefore, yields a parsimonious system description. Applicability of LASSO for model structure computation for the NASA F/A-18 (McDonnell Douglas Corporation, St. Louis, Missouri, and Northrop Corporation, Newbury Park, California) airplane Active Aeroelastic Wing (AAW) using flight-test data is shown for several flight conditions (Mach numbers) by identifying a parsimonious system description with a high-percent fit for cross-validated data.
Derived from text
Aeroelasticity; Flight Tests; Nonlinear Systems; Computation; Controllers; Electronic Equipment; Flight Conditions; Optimization

20070031050 NASA Dryden Flight Research Center, Edwards, CA, USA
Design of the Phoenix Missile Hypersonic Testbed (PMHT)
Jones, Thomas P.; 2006 Engineering Annual Report; August 2007, pp. 52-54; In English; See also 20070031035; Original contains black and white illustrations; No Copyright; Avail.: CASI: A01, Hardcopy
ONLINE: http://hdl.handle.net/2060/20070031050

Following the success of the Hyper-X project, conclusion of the X-43 Program, and the retirement of the NASA B-52 (The Boeing Company, Chicago, Illinois) airplane, tail number 008, researchers at the NASA Dryden Flight Research Center began to look for another research test vehicle, or testbed, for the hypersonic flight regime. A new hypersonic testbed would have to be low cost to survive in the financial environment of shrinking aeronautics funding within NASA. A low-cost approach to develop a hypersonic testbed was found in a surplus of U.S. Navy Phoenix (Raytheon Company, Waltham, Massachusetts) air-to-air missiles in combination with the NASA F-15B (McDonnell Douglas Corporation, St. Louis, Missouri) airplane, tail number 836. Currently, the only other option for hypersonic flight-testing is through the use of sounding rockets that are unguided and limited in their trajectory variability. Also, sounding rockets cannot be used to verify control system algorithms because they lack a guidance system. As shown in figure 1, the F-15B airplane will be used to carry the missiles to supersonic conditions for launch. The missiles would then be launched, carrying experimental research payloads to their test conditions at speeds in excess of Mach 5. This effort is being performed with the assistance of the Naval Air Warfare Center Weapons Division (NAWC-WD) at China Lake, California.
Derived from text
Hypersonic Speed; Flight Tests; Air to Air Missiles; Research Vehicles; Hypersonic Flight; Test Vehicles

20070031051 NASA Dryden Flight Research Center, Edwards, CA, USA
Fiber Optic Wing Shape Sensing on the Ikhana Vehicle
Richards, W. Lance; Cobleigh, Brent; 2006 Engineering Annual Report; August 2007, pp. 25-27; In English; See also 20070031035; Original contains color and black and white illustrations; No Copyright; Avail.: CASI: A01, Hardcopy
ONLINE: http://hdl.handle.net/2060/20070031051

In June 2003, the Helios (AeroVironment, Inc., Monrovia, California) prototype unpiloted aerial vehicle (UAV) experienced significant pitch instability during low-altitude flight that lead to a catastrophic structural failure and in-flight breakup. One of the most significant lessons learned from the mishap investigation was the requirement to provide real-time measurement of wing shape. This measurement could ultimately be used as feedback into the flight control system for aeroelastic motion control. Wing shape sensing (WSS) is, therefore, an essential first step towards achieving the ultimate goal of actively controlling the wing shape during flight, reducing aerostructural loads and avoiding such failures in the future. Calculating real-time wing shape is particularly challenging especially for lightweight, highly-flexible structures because of the stringent weight and volume requirements, both for structural sensors and supporting systems. A recent study assessed the viability of using conventional strain gage instrumentation and demonstrated that the wire weight alone represented a prohibitive weight penalty and was impractical to implement for many aerospace vehicles. Alternatively, lightweight and low-profile fiber optic wing shape sensors (FOWSS), in conjunction with computationally efficient algorithms, were viewed as a promising approach to providing very accurate wing measurement calculations for eventual input to the flight control system for aeroelastic motion control. Both inhabited and uninhabited aircraft will benefit from this technology.
Derived from text
Pilotless Aircraft; Fiber Optics; Wings; Structural Failure; Aerodynamic Loads; Aeroelasticity; Flight Control

20070031052 NASA Dryden Flight Research Center, Edwards, CA, USA

High-Temperature Sensor Applications For Ground Testing of C-17 Engine

Piazza, Anthony; 2006 Engineering Annual Report; August 2007, pp. 1-2; In English; See also 20070031035; Original contains black and white illustrations; No Copyright; Avail.: CASI: A01, Hardcopy

ONLINE: http://hdl.handle.net/2060/20070031052

The Flight Loads Laboratory (FLL) at the NASA Dryden Flight Research Center (DFRC) is attempting to acquire high-temperature dynamic strain measurements by using optical-strain sensors as a secondary experiment on the C-17 (The Boeing Company, Chicago, Illinois) engine '17th Stage Bleed-Air Duct Redesign Verification' tests. The Extrinsic Fabry-Perot Interferometer (EFPI) optical sensors have been used successfully during ground tests to measure static strains to temperatures as high as 1850 F, but no measurement attempt has been made in a combined high-temperature/vibration environment. In addition to optical strain measurements, valuable application experience and data will be generated from thermal-sprayed, free-filament, wire resistive strain gages in this hostile environment.

Derived from text

Aerodynamic Loads; Strain Gages; Optical Measuring Instruments; High Temperature Environments; Ground Tests; Optical Measurement

20070031053 NASA Dryden Flight Research Center, Edwards, CA, USA

Autopilot Interface Computer for Platform Precision Autopilot

Redifer, Matt; Baumann, Ethan; Lee, James; Hanson, Jason; 2006 Engineering Annual Report; August 2007, pp. 11-12; In English; See also 20070031035; Original contains black and white illustrations; No Copyright; Avail.: CASI: A01, Hardcopy

ONLINE: http://hdl.handle.net/2060/20070031053

The NASA Unmanned Aerial Vehicle Synthetic Aperture Radar (UAVSAR) program is developing a Synthetic Aperture Radar (SAR) for ground measurements. The C-20A Gulfstream III (C-20A/GIII) (Gulfstream Aerospace, Savannah, Georgia) airplane is being used as an interim platform for the SAR prior to integration onto an Unmanned Aerial Vehicle (UAV). The Platform Precision Autopilot (PPA) is used to fly precision trajectories required by the SAR on the C-20A/GIII airplane. The embedded computer component of the PPA is referred to as the Autopilot Interface Computer (AIC). Design criteria for the AIC include low cost, high-performance, simple programming interface, environmental qualification, plus small size and low power for possible transfer to the UAV platform.

Derived from text

Pilotless Aircraft; Automatic Pilots; Embedded Computer Systems; Synthetic Aperture Radar; Radar Measurement; Design Analysis

20070031054 NASA Dryden Flight Research Center, Edwards, CA, USA

Autonomous Airborne Refueling Demonstration Phase 1 Testing

Dibley, Ryan; Allen, Michael; 2006 Engineering Annual Report; August 2007, pp. 42-44; In English; See also 20070031035; Original contains black and white illustrations; No Copyright; Avail.: CASI: A01, Hardcopy

ONLINE: http://hdl.handle.net/2060/20070031054

An autonomous system for hose-and-drogue air-to-air refueling was developed and flight-tested between May 2005 and August 2006. Ten flights were flown, culminating with the successful autonomous refueling engagement on the final flight on August 30, 2006. The goal of the project was to develop and flight-test an autonomous airborne refueling demonstration (AARD) engagement using the Navy style hose-and-drogue air-to-air refueling method.

Derived from text

Refueling; Air to Air Refueling; Flight Tests; Autonomy

20070031055 NASA Dryden Flight Research Center, Edwards, CA, USA

F-15B Quiet Spike(TradeMark) Structural Mode Interaction Ground Test and Aeroservoelastic Flight Test

Brenner, Marty; 2006 Engineering Annual Report; August 2007, pp. 35-36; In English; See also 20070031035; No Copyright; Avail.: CASI: A01, Hardcopy

ONLINE: http://hdl.handle.net/2060/20070031055

In preparation for the F-15B airplane (McDonnell Douglas Corporation, St. Louis, Missouri, now The Boeing Company, Chicago, Illinois) Quiet Spike(TradeMark) (Gulfstream Aerospace, Savannah, Georgia) (QS) flight test, baseline F-15B airplane and modified F-15B QS Structural Mode Interaction (SMI) ground tests were performed to compare with military

specification requirements for safety-of-flight. Ground-test results were unsatisfactory, so there was some concern about aeroservoelastic (ASE) stability margins in flight. The baseline F-15B airplane was cleared through extensive previous flight-testing and a dedicated ASE flight (testing low dynamic pressure, the worst case). Unfortunately, the modified F-15B-QS configuration had significantly lower margins from both the ground SMI tests, and from an ASE analysis with coupled aerostructural control dynamics, especially with the spike-boom retracted at higher angle of attack (AOA) with less fuel weight. This resulted in an extensive ASE flight clearance based on the SMI and ASE results.
Derived from text
Flight Tests; Aeroservoelasticity; Dynamic Pressure; Angle of Attack; Specifications; Ground Tests

20070031056 NASA Dryden Flight Research Center, Edwards, CA, USA
Mass Property Verification of the Unmanned Aerial Vehicle Synthetic Aperture Radar
Davidson, Kia; Voelker, Leonard; Herrera, Claudia; 2006 Engineering Annual Report; August 2007, pp. 8-10; In English; See also 20070031035; Original contains black and white illustrations; No Copyright; Avail.: CASI: A01, Hardcopy
ONLINE: http://hdl.handle.net/2060/20070031056

The NASA Unmanned Aerial Vehicle Synthetic Aperture Radar (UAVSAR) program has developed an external store flight-test article for repeat pass interferometry missions aboard an unmanned aerial vehicle (UAV). Most of the UAVSAR pod flight instrumentation, structure, and outer shell were developed and designed from scratch in collaboration with Total Aircraft Services (TAS) (Van Nuys, California), Jet Propulsion Laboratory (JPL) (Pasadena, California), and NASA Dryden Flight Research Center giving the uncommon opportunity to compare the computer aided design (CAD) model mass properties with the results of a final product measurement.
Derived from text
Synthetic Aperture Radar; Pilotless Aircraft; Flight Tests; Interferometry; Pods (External Stores)

20070031057 NASA Dryden Flight Research Center, Edwards, CA, USA
Aeronautics Research Mission Directorate Hypersonics Material and Structures: Carbon-Silicon Carbide Rudderva-tor Subcomponent Test and Analysis Task
Hudson, Larry; Stephens, Craig; 2006 Engineering Annual Report; August 2007, pp. 50-51; In English; See also 20070031035; Original contains black and white illustrations; No Copyright; Avail.: CASI: A01, Hardcopy
ONLINE: http://hdl.handle.net/2060/20070031057

In fiscal year 2006, planning was initiated for the NASA Aeronautics Research Mission Directorate (ARMD) Fundamental Aeronautics Program. As part of the ARMD planning efforts, NASA personnel proposed using the Carbon-Silicon Carbide (C/SiC) Ruddervator Subcomponent Test Article (RSTA) as a test structure to support research objectives within the Hypersonics Materials & Structures (M&S) program. By the end of fiscal year 2006, the RSTA test effort was established and incorporated into the Hypersonic M&S program. The C/SiC RSTA is a hot-structure control surface that was designed, fabricated, but never tested under the X-37 long-duration orbital vehicle technology development program, seen in figure 1. The RSTA was designed by Materials Research & Design, Inc. (MR&D) of Wayne, Pennsylvania, and manufactured by GE Power System Composites (GE PSC) of Newark, Delaware. The RSTA is a truncated version of the full-scale X-37 control surface but it incorporates all of the major full-scale features, including the metallic spindle, five major C/SiC quasi isotropic lay-up components fastened together with mostly C/SiC fasteners, and face-sheets which serve as access panels for assembly of the RSTA.
Derived from text
Control Surfaces; Carbides; X-37 Vehicle; Hypersonics; Fabrication

20070031058 NASA Dryden Flight Research Center, Edwards, CA, USA
SOFIA to Fly
Hodge, Mark; 2006 Engineering Annual Report; August 2007, pp. 18; In English; See also 20070031035; No Copyright; Avail.: CASI: A01, Hardcopy
ONLINE: http://hdl.handle.net/2060/20070031058

The Stratospheric Observatory For Infrared Astronomy (SOFIA) is a 2.5 m, optical, infrared, submillimeter telescope mounted in a Boeing (Chicago, Illinois) 747 airplane, to be used for many basic astronomical observations performed at stratospheric altitudes. A ground mission facility will be created to support the aircraft and science missions. The observatory will accommodate installation of different focal plane instruments with in-flight accessibility provided by investigators

selected from the international science community. The observatory objective is expected to have an operational lifetime in excess of 20 years.
Derived from text
SOFIA (Airborne Observatory); Infrared Telescopes; Focal Plane Devices; Submillimeter Waves; Stratosphere; Boeing 747 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.

20070030823 NASA Langley Research Center, Hampton, VA, USA
Static Extended Trailing Edge for Lift Enhancement: Experimental and Computational Studies
Liu, Tianshu; Montefort; Liou, William W.; Pantula, Srinivasa R.; Shams, Qamar A.; June 20, 2007; 16 pp.; In English; 3rd International Symposium on Integrating CFD and Experiments in Aerodynamics, 20-21 Jun. 2007, Colorado SPrings, CO, USA; Original contains color and black and white illustrations
Contract(s)/Grant(s): WBS 659877.02.07.05; Copyright; Avail.: CASI: A03, Hardcopy

A static extended trailing edge attached to a NACA0012 airfoil section is studied for achieving lift enhancement at a small drag penalty. It is indicated that the thin extended trailing edge can enhance the lift while the zero-lift drag is not significantly increased. Experiments and calculations are conducted to compare the aerodynamic characteristics of the extended trailing edge with those of Gurney flap and conventional flap. The extended trailing edge, as a simple mechanical device added on a wing without altering the basic configuration, has a good potential to improve the cruise flight efficiency.
Author
Trailing Edges; Airfoil Profiles; Zero Lift; Aerodynamic Drag; Aerodynamic Characteristics

20070030946 NASA Langley Research Center, Hampton, VA USA
Flow Over Blunt Body at M equals 20 in 2-Inch Helium Tunnel
July 22, 1960; In English; Originally recorded in 16mm, Silent, Black & White, 37ft., 1min.; DVD produced from the original 16mm recording
Report No.(s): L-562; No Copyright; Avail.: CASI: C01, DVD; Movie/Video (High Res)
ONLINE: View Movie/Video (Low Res); View Movie/Video (Medium Res)

The film shows flow over blunt body alone, with internal spike, and with external spikes.
CASI
Blunt Bodies; Wind Tunnel Tests; Flow Characteristics; Spikes (Aerodynamic Configurations)

20070030947 NASA Langley Research Center, Hampton, VA USA
Tests of Vortex-Ring Parachute at Supersonic Speed in the Langley Unitary Plan Wind Tunnel
July 18, 1960; In English; Originally recorded in 16mm, Silent, Black & White, 306ft., 8.5min.; DVD produced from the original 16mm recording
Report No.(s): L-560; No Copyright; Avail.: CASI: C01, DVD; Movie/Video (High Res)
ONLINE: View Movie/Video (Low Res); View Movie/Video (Medium Res)

For the test, the 12-inch-diameter 'Vortex-Ring' parachute was towed behind a conical-nosed cylindrical body 2.25 inches in diameter. The tow-cable length was 24 inches, and was attached to the cylindrical body through a large swivel and to the parachute through a smaller swivel. The attachment between the large swivel an the cylindrical body failed after about 1 minute's operation. Mach number was approximately 2.2, dynamic pressure was approximately 150 pounds per square foot, and camera speed was approximately 3000 frames per second.
Derived from text
Parachutes; Wind Tunnel Tests; Supersonic Speed; Vortex Rings; Swivels

20070030948 NASA Langley Research Center, Hampton, VA USA
High-Speed Schlieren Movies of the Flow About Reefed Parachute Models Towed at Supersonic Speeds Behind a Conical Body (4.875 Inches in Diameter). Drag Values Based on the Unreefed Diameter of 1.73 F. Porosity of Unreefed Parachute is 28 Percent.
June 28, 1960; In English; Originally recorded in 16mm, Silent, Black & White, 550ft., 15.5min.; DVD produced from the original 16mm recording
Report No.(s): L-556; No Copyright; Avail.: CASI: C01, DVD; Movie/Video (High Res)
ONLINE: View Movie/Video (Low Res); View Movie/Video (Medium Res)

Flexible parachute models reefed to one-eighth, one-fourth, one-third, and four tenths of its diameter were towed at speeds of Mach 1.80, 2.00, 2.20 and 2.87. Towline lengths tested were 23.40, 24.38, 26.81, and 29.25 inches. High-speed Schlieren movies of the flow are shown.
Derived from text
Parachutes; Supersonic Speed; Aerodynamic Drag; Flow Visualization; Wind Tunnel Tests; Supersonic Flow

20070030956 National Advisory Committee for Aeronautics. Langley Aeronautical Lab., Langley Field, VA USA
Schlieren Movies of the 8-Inch Diameter Rigid Parachute Model of the Cook Research Laboratory Taken During the Fourth Phase of Testing in the Langley Unitary Plan Wind Tunnel
September 29, 1958; In English; Originally recorded in 16mm, Silent, Black & White, 845ft., 23min.; DVD produced from the original 16mm recording
Report No.(s): L-396; No Copyright; Avail.: CASI: C01, DVD; Movie/Video (High Res)
ONLINE: View Movie/Video (Low Res); View Movie/Video (Medium Res)

Canopy Model IV was tested in four different configuration series. Shroud lines were used in the first three series of tests; none were used in the fourth series. Other variables were Mach number (1.77, 2.17, 2.76), dynamic pressure (290, 250, 155 lb per sq ft), camera speed, and attitude.
Derived from text
Wind Tunnel Tests; Parachutes; Rigid Structures; Schlieren Photography

20070030958 National Advisory Committee for Aeronautics. Langley Aeronautical Lab., Langley Field, VA USA
Aerodynamic Heating of Blunt Nose Shapes at Mach Numbers up to 14
April 23, 1958; In English; See also 19710065515; See also NACA-RM-L58E05a; Originally Recorded in 16mm, Silent, Black & White 330ft., 2min.; DVD produced from the original 16mm recording
Report No.(s): L-316; No Copyright; Avail.: CASI: C01, DVD; Movie/Video (High Res)
ONLINE: View Movie/Video (Low Res); View Movie/Video (Medium Res)

Results are presented from investigations of the aerodynamic heating rates of blunt nose shapes at Mach numbers up to 14. The wind-tunnel tests examined flat-faced cylinder stagnation-point heating rates over the Mach number range. The tests also examined heat transfer and angle of attack.
Author (revised)
Aerodynamic Heating; Wind Tunnel Tests; Hypersonic Speed; Supersonic Speed; Blunt Bodies; Noses (Forebodies)

20070030960 NASA Langley Research Center, Hampton, VA USA
Unitary Plan Wind Tunnel Tests of Cook Technological Center Parachutes in the Wake of a Conical-Nosed Cylindrical Body Having a Base Diameter of 2.375-Inches (Part 5 of 6)
May 09, 1962; In English; Originally recorded in 16mm, Silent, Black & White, 17.5 min.; DVD produced from the original 16mm recording
Report No.(s): L-729; No Copyright; Avail.: CASI: C01, DVD; Movie/Video (High Res)
ONLINE: View Movie/Video (Low Res); View Movie/Video (Medium Res)

The film depicts two tests of a flat roof, conical inlet canopy parachute. The first test is a series of wind tunnel trials with a flat circular ribbon roof of 22 percent porosity. The second test is a single series of wind tunnel trials with a flat circular ribbon roof of 25 percent porosity. Variables for both trials include Mach number, dynamic pressure, longitudinal separation distances (x/d), and drag coefficient C(sub d).
Derived from text
Wind Tunnel Tests; Parachutes; Supersonic Wakes; Cylindrical Bodies

20070030962 NASA Langley Research Center, Hampton, VA USA; NASA Ames Research Center, Moffett Field, CA, USA
Aerodynamic Heating and Deceleration During Entry into Planetary Atmospheres
Chapman, Dean R.; April 10, 1962; In English; Originally recorded in 16mm, Sound, Black & White, 1100ft., 29min.; DVD produced from the original 16mm recording
Report No.(s): L-713; HQ-5; No Copyright; Avail.: CASI: C01, DVD; Movie/Video (High Res)
ONLINE: View Movie/Video (Low Res); View Movie/Video (Medium Res)

Dr. Chapman's lecture examines the physics behind spacecraft entry into planetary atmospheres. He explains how scientists determine if a planet has an atmosphere and how scientists can compute deceleration when the atmospheric conditions are unknown. Symbols and equations used for calculations for aerodynamic heating and deceleration are provided. He also explains heat transfer in bodies approaching an atmosphere, deceleration, and the use of ablation in protecting spacecraft from high temperatures during atmospheric entry.
CASI
Aerodynamic Heating; Atmospheric Entry; Deceleration

20070030965 NASA Langley Research Center, Hampton, VA USA
Unitary Wind Tunnel Tests of 30-Degree Conical Ribbon Parachute and a Rotofoil Parachute Towed in the Wake of a Conical Nosed Cylindrical Body
March 02, 1962; In English; Originally recorded in 16mm, Silent, Black & White, 880ft., 24.5min.; DVD produced from the original 16mm recording
Report No.(s): L-683; No Copyright; Avail.: CASI: C01, DVD; Movie/Video (High Res)
ONLINE: View Movie/Video (Low Res); View Movie/Video (Medium Res)

Multiple wind tunnel test trials were conducted on a 30 degree conical ribbon parachute with porosities of 30, 27, and 24 percent. Variables were Mach number, dynamic pressure, towline length, and coefficient of drag. A Rotofoil parachute having a porosity of approximately 24 percent was tested, but failed after about 30 seconds of operation at a Mach number of 1.8 All of the parachutes had a nominal diameter and shroud line length of 10 inches. Drag coefficients were based on the area of a circle having a diameter two-thirds of the nominal parachute diameter.
Derived from text
Wind Tunnel Tests; Ribbon Parachutes; Aerodynamic Drag; Conical Bodies; Nose Cones

20070030967 NASA Langley Research Center, Hampton, VA USA
Wind Tunnel Investigation of a Balloon as Decelerator at Mach Numbers from 1.47 to 2.50
McShera, John T.; Keyes, J. Wayne; August 1961; In English; See also 19980227793; See also NASA-TN-D-919; Originally recorded in 16mm, Silent, Black & White, 190ft., 5.5min.; DVD produced from the original 16mm recording
Report No.(s): L-628; No Copyright; Avail.: CASI: C01, DVD; Movie/Video (High Res)
ONLINE: View Movie/Video (Low Res); View Movie/Video (Medium Res)

A wind-tunnel investigation was conducted to study the characteristics of a towed spherical balloon as a drag device at Mach numbers from 1.47 to 2.50, Reynolds numbers from 0.36 x 10(exp 6) to 1.0 x 10(exp 6) , and angles of attack from -15 to 15 degrees. Tow-cable length was approximately 24 inches from asymmetric body to cone on the upstream side of the balloon. As the tow cable was lengthened the balloon reached a point in the test section where wall-reflected shocks intersected the balloon and caused severe oscillations. As a result, the tow cable broke and the inflatable balloon model was destroyed. Further tests used a model rigid plastic sphere 6.75 inches in diameter. Tow cable length was approximately 24 inches from asymmetric body to the upstream side of the sphere.
Author (revised)
Tethered Balloons; Wind Tunnel Tests; Supersonic Speed; Drag Devices; Brakes (For Arresting Motion)

20070030970 NASA Langley Research Center, Hampton, VA USA
Aerodynamic Characteristics of Parachutes at Mach Numbers from 1.6 to 3
Maynard, J. D.; February 1961; In English; See also 20010024158; See also NASA-TN-D-752; Originally recorded in 16mm, Silent, Black & White, 1000ft., 31min.; DVD produced from the original 16mm recording
Report No.(s): L-598; No Copyright; Avail.: CASI: C01, DVD; Movie/Video (High Res)
ONLINE: View Movie/Video (Low Res); View Movie/Video (Medium Res)

A wind-tunnel investigation was conducted to determine the parameters affecting the aerodynamic performance of drogue parachutes in the Mach number range from 1.6 to 3. Flow studies of both rigid and flexible-parachute models were made by

means of high-speed schlieren motion pictures and drag coefficients of the flexible-parachute models were measured at simulated altitudes from about 50,000 to 120,000 feet.
Author (revised)
Supersonic Speed; Wind Tunnel Tests; Aerodynamic Drag; Drag Chutes; Aerodynamic Coefficients

20070030972 NASA Langley Research Center, Hampton, VA USA
High Speed Schlieren Studies of Flow Over Mercury Atlas Vehicle in the Langley 2-Foot Transonic Aeroplasticity Tunnel
December 02, 1960; In English; Originally recorded in 16mm, Silent, Black & White, 535ft., 15min.; DVD produced from the original 16mm recording
Report No.(s): L-583; No Copyright; Avail.: CASI: C01, DVD; Movie/Video (High Res)
ONLINE: View Movie/Video (Low Res); View Movie/Video (Medium Res)

Test conditions for the studies are: Mach number varying continuously from approximately 0.8 to 1.1 and Reynolds number (based on maximum diameter of Atlas) approximately 0.451 x 10(exp 6). Camera speed is 2000 frames per second.
Derived from text
Transonic Wind Tunnels; Mercury Spacecraft; Atlas Launch Vehicles; Transonic Speed; Schlieren Photography

20070030973 NASA Langley Research Center, Hampton, VA USA
High-Speed Schlieren Movies of Decelerators at Supersonic Speeds
August 10, 1960; In English; Originally recorded in 16mm, Silent, Black & White, 245ft., 7min.; DVD produced from the original 16mm recording
Report No.(s): L-569; No Copyright; Avail.: CASI: C01, DVD; Movie/Video (High Res)
ONLINE: View Movie/Video (Low Res); View Movie/Video (Medium Res)

Tests were conducted on several types of porous parachutes, a paraglider, and a simulated retrorocket. Mach numbers ranged from 1.8-3.0, porosity from 20-80 percent, and camera speeds from 1680-3000 feet per second (fps) in trials with porous parachutes. Trials of reefed parachutes were conducted at Mach number 2.0 and reefing of 12-33 percent at camera speeds of 600 fps. A flexible parachute with an inflatable ring in the periphery of the canopy was tested at Reynolds number 750,000 per foot, Mach number 2.85, porosity of 28 percent, and camera speed of 36oo fps. A vortex-ring parachute was tested at Mach number 2.2 and camera speed of 3000 fps. The paraglider, with a sweepback of 45 degrees at an angle of attack of 45 degrees was tested at Mach number 2.65, drag coefficient of 0.200, and lift coefficient of 0.278 at a camera speed of 600 fps. A cold air jet exhausting upstream from the center of a bluff body was used to simulate a retrorocket. The free-stream Mach number was 2.0, free-stream dynamic pressure was 620 lb/sq ft, jet-exit static pressure ratio was 10.9, and camera speed was 600 fps.
Derived from text
Schlieren Photography; Brakes (For Arresting Motion); Supersonic Speed; Parachutes; Retrorocket Engines; Vortex Rings; Paragliders; Aerodynamic Characteristics

20070030995 NASA Langley Research Center, Hampton, VA USA
Performance of a 16.6 Meter Diameter Cross Parachute in a Simulated Martian Environment
Lundstrom, Reginald R.; Darnell, Wayne L.; Coltrane, Lucille C.; February 1968; In English; See also 19680012364; See also NASA-TM-X-1543; Originally recorded in 16mm, Silent, Color, 112ft., 3min.; DVD produced from the original 16mm recording
Report No.(s): L-985; No Copyright; Avail.: CASI: C01, DVD; Movie/Video (High Res)
ONLINE: View Movie/Video (Low Res); View Movie/Video (Medium Res)

Inflation and drag characteristics of a 54.4-foot (16.6 meter) nominal-diameter cross parachute, deployed at a Mach number of 1.65 and a dynamic pressure of 12.68 lb/sq f t (607.1 N/m(exp2)), were obtained from the fourth balloon-launched flight test of the Planetary Entry Parachute Program (PEPP). After deployment, the parachute quickly inflated to a full condition, partially collapsed, and then gradually reinflated while undergoing rapid oscillations between over-inflation and under-inflation. The oscillations began while the parachute was still at supersonic speeds and continued to low subsonic speeds well below an altitude of 90,000 feet (27.4 km). These canopy instabilities produced large cyclic variations in the parachute's drag coefficient. The average value of drag coefficient was about 0.8 to 0.9 at subsonic speeds and slightly lower at supersonic speeds. These drag coefficient values were based on the actual fabric surface area of the parachute canopy. The parachute

sustained minor damage consisting of two canopy tears and abrasions and tears on the riser line. It is believed that this damage did not produce a significant change in the performance of the parachute.
Author
Aerodynamic Drag; Atmospheric Entry Simulation; Inflating; Parachutes; Supersonic Speed; Subsonic Speed

20070030996 NASA Langley Research Center, Hampton, VA USA
Performance of a 16.6 Meter Diameter Modified Ringsail Parachute in a Simulated Martian Environment
Whitlock, Charles H.; Henning, Allen B.; Coltrane, Lucille C.; January 1968; In English; See also 19680004623; See also NASA-TM-X-1500; Originally recorded in 16mm, Silent, Color, 150ft., 4.2min. DVD produced from the original 16mm recording
Report No.(s): L-984; No Copyright; Avail.: CASI: C01, DVD; Movie/Video (High Res)
ONLINE: View Movie/Video (Low Res); View Movie/Video (Medium Res)

Inflation, drag, and stability characteristics of a 54.5 -foot nominal-diameter (16.6-meter) modified ringsail parachute deployed in the wake of a 15-foot-diameter (4.6-meter) spacecraft traveling at a Mach number of 1.6 and a dynamic pressure equal to 11.6 psf (555 N/m(exp 2)) were obtained from the third balloon-launched flight test of the Planetary Entry Parachute Program. After deployment, the parachute inflated rapidly to a full condition, partially collapsed, and reinflated to a stable configuration. After reinflation, an average drag coefficient near 0.6 based on nominal surface area was obtained. During descent, an aerodynamic trim angle was observed in a plane near several torn sails. Amplitude of the trim was approximately 15 degrees and oscillation about trim was less than 11 degrees.
Author
Aerodynamic Drag; Atmospheric Entry; Parachute Descent; Aerodynamic Stability; Inflating

20070030997 NASA Langley Research Center, Hampton, VA USA
Performance of a 19.7 Meter Diameter Disk-Gap-Band Parachute in a Simulated Martian Environment
Bendura, Richard J.; Coltrane, Lucille C.; Huckins III, Earle K.; January 1968; In English; See also 19680004328; See also NASA-TM-X-1499; Originally recorded in 16mm, Silent, Color, 150ft., 4.25min.; DVD produced from the original 16mm recording
Report No.(s): L-983; No Copyright; Avail.: CASI: C01, DVD; Movie/Video (High Res)
ONLINE: View Movie/Video (Low Res); View Movie/Video (Medium Res)

Inflation and drag characteristics of a 64.7-foot (19.7-meter) nominal-diameter disk-gap-band parachute deployed at a Mach number of 1.59 and a dynamic pressure of 11.6 psf (555 newtons per m(exp 2)) were obtained from the second balloon-launched flight test of the Planetary Entry Parachute Program. In addition, parachute stability characteristics during the subsonic descent portion of the test are presented. After deployment, the parachute rapidly inflated to a full condition, partially collapsed, and then reinflated to a stable configuration. After reinflation, an average drag coefficient of about 0.55 based on nominal surface area was obtained. The parachute exhibited good stability characteristics during descent. The only major damage to the parachute during the test was the tearing of two canopy panels; a loss of less than 0.5 percent of nominal surface area resulted.
Author
Aerodynamic Drag; Aerodynamic Coefficients; Atmospheric Entry; Parachutes; Aerodynamic Stability

20070030998 NASA Langley Research Center, Hampton, VA USA
Flight Tests of a 40-Foot Nominal Diameter Modified Ringsail Parachute Deployed at Mach 1.64 and Dynamic Pressure of 9.1 Pounds Per Square Foot
Eckstrom, Clinton V.; Murrow, Harold N.; Preisser, John S.; December 1967; In English; See also 19680002451; See also NASA-TM-X-1484; Originally recorded in 16mm, Silent, Color, 120ft., 3.3min.; DVD produced from the original 16mm recording
Report No.(s): L-981; No Copyright; Avail.: CASI: C01, DVD; Movie/Video (High Res)
ONLINE: View Movie/Video (Low Res); View Movie/Video (Medium Res)

A ringsail parachute, which had a nominal diameter of 40 feet (12.2 meters) and reference area of 1256 square feet (117 m(exp 2)) and was modified to provide a total geometric porosity of 15 percent of the reference area, was flight tested as part of the rocket launch portion of the NASA Planetary Entry Parachute Program. The payload for the flight test was an instrumented capsule from which the test parachute was ejected by a deployment mortar when the system was at a Mach number of 1.64 and a dynamic pressure of 9.1 pounds per square foot (43.6 newtons per m(exp 2)). The parachute deployed

to suspension line stretch in 0.45 second with a resulting snatch force of 1620 pounds (7200 newtons). Canopy inflation began 0.07 second later and the parachute projected area increased slowly to a maximum of 20 percent of that expected for full inflation. During this test, the suspension lines twisted, primarily because the partially inflated canopy could not restrict the twisting to the attachment bridle and risers. This twisting of the suspension lines hampered canopy inflation at a time when velocity and dynamic-pressure conditions were more favorable.
Author
Atmospheric Entry; Parachutes; Inflating

20070030999 NASA Langley Research Center, Hampton, VA USA
Flight Test of a 30-Foot Nominal-Diameter Disk-Gap-Band Parachute Deployed at Mach 1.56 and Dynamic Pressure of 11.4 Pounds per Square Foot
Eckstrom, Clinton V.; Preisser, John S.; September 05, 1967; In English; See also 19670026287; See also NASA-TM-X-1451; Originally recorded in16mm, Silent, Color 100ft., 3min.; DVD produced from the original 16mm recording
Report No.(s): L-968; No Copyright; Avail.: CASI: C01, DVD; Movie/Video (High Res)
ONLINE: View Movie/Video (Low Res); View Movie/Video (Medium Res)

A 30-foot (9.1 meter) nominal-diameter disk-gap-band parachute (reference area 707 sq ft (65.7 m(exp 2)) was flight tested with a 200-pound (90.7 kg) instrumented payload as part of the NASA Planetary Entry Parachute Program. A deployment mortar ejected the test parachute when the payload was at a Mach number of 1.56 and a dynamic pressure of 11.4 lb/sq ft (546 newtons per m 2) at an altitude of 127,500 feet (38.86 km). The parachute reached suspension line stretch in 0.37 second resulting in a snatch force loading of 1270 pounds (5650 N). Canopy inflation began 0.10 second after line stretch. A delay in the opening process occurred and was apparently due to a momentary interference of the glass-fiber shroud used in packing the parachute bag in the mortar. Continuous canopy inflation began 0.73 second after initiation of deployment and 0.21 second later full inflation was attained for a total elapsed time from mortar fire of 0.94 second. The maximum opening load of 3915 pounds (17,400 newtons) occurred at the time the canopy was first fully opened. The parachute exhibited an average drag coefficient of 0.52 during the deceleration period and pitch-yaw oscillations of the canopy were less than 5 degrees. During the steady-state descent portion of the test period, the average effective drag coefficient was about 0.47 (based on vertical descent velocity and total system weight).
Author
Parachutes; Aerodynamic Drag; Atmospheric Entry; Inflating; Descent

20070031000 NASA Langley Research Center, Hampton, VA USA
Flight Test of 31.2 Diameter Modified Ringsail Parachute Deployed at Mach 1.39, Dynamic Pressure 11 Pounds per Square Foot
Preisser, John S.; Eckstrom, Clinton V.; Murrow, Harold N.; April 25, 1967; In English; See also 19670022936; See also NASA-TM-X-1414; Originally recorded in 16mm, Silent, Color, 120ft., 3.5min.; DVD produced from the original 16mm recording
Report No.(s): L-966; No Copyright; Avail.: CASI: C01, DVD; Movie/Video (High Res)
ONLINE: View Movie/Video (Low Res); View Movie/Video (Medium Res)

A 31.2-foot (9.51 meter) nominal diameter (reference area 764 ft(exp 2) (71.0 m(exp 2)) ringsail parachute modified to provide 15-percent geometric porosity was flight tested while attached to a 201-pound mass (91.2 kilogram) instrumented payload as part of the rocket launch portion of the NASA Planetary Entry Parachute Program (PEPP). The parachute deployment was initiated by the firing of a mortar at a Mach number of 1.39 and a dynamic pressure of 11.0 lb/ft(exp 2) (527 newtons/m(exp 2)) at an altitude of 122,500 feet (37.3 kilometers). The parachute deployed to suspension-line stretch (snatch force) in 0.35 second, and 0.12 second later the drag force increase associated with parachute inflation began. The parachute inflated in 0.24 second to the full-open condition for a total elapsed opening time of 0.71 second. The maximum opening load of 3970 pounds (17,700 newtons) came at the time the parachute was just fully opened. During the deceleration period, the parachute exhibited an average drag coefficient of 0.52 and oscillations of the parachute canopy were less than 5 degrees. During the steady-state terminal descent portion of the test period, the average effective drag coefficient (based on vertical descent velocity) was 0.52.
Author
Atmospheric Entry; Parachutes; Parachute Descent; Aerodynamic Characteristics

20070031003 NASA Langley Research Center, Hampton, VA USA

Performance of 26 Meter Diameter Ringsail Parachute in a Simulated Martian Environment

Whitlock, Charles H.; Bendura, Richard J.; Cotrane, Lucille C.; February 1967; In English; See also 19670009951; See also NASA-TM-X-1356; 16mm, Silent, Color, 80ft., 2.5min.; DVD produced from the original 16mm recording

Report No.(s): L-946; No Copyright; Avail.: CASI: C01, DVD; Movie/Video (High Res)

ONLINE: View Movie/Video (Low Res); View Movie/Video (Medium Res)

Inflation, drag, and stability characteristics of an 85.3-foot (26-meter) nominal diameter ringsail parachute deployed at a Mach number of 1.15 and at an altitude of 132,600 feet (40.42 kilometers) were obtained from the first flight test of the Planetary Entry Parachute Program. After deployment, the parachute inflated to the reefed condition. However, the canopy was unstable and produced low drag in the reefed condition. Upon disreefing and opening to full inflation, a slight instability in the canopy mouth was observed initially. After a short time, the fluctuations diminished and a stable configuration was attained. Results indicate a loss in drag during the fluctuation period prior to stable inflation. During descent, stability characteristics of the system were such that the average pitch-yaw angle from the local vertical was less than 10 degrees. Rolling motion between the payload and parachute canopy quickly damped to small amplitude.

Author

Aerodynamic Drag; Parachutes; Atmospheric Entry; Descent; Aerodynamic Stability; Inflating

20070031005 NASA Langley Research Center, Hampton, VA USA

High Altitude Flight Test of a 40-Foot Diameter (12.2 meter) Ringsail Parachute at Deployment Mach Number of 2.95

Eckstrom, Clinton V.; May 1970; In English; See also 19700022313; See also NASA-TN-D-5796; Originally recorded in 16mm, Silent, Color, 115ft., 3.2min

Report No.(s): L-1077; No Copyright; Avail.: CASI: C01, DVD; Movie/Video (High Res)

ONLINE: View Movie/Video (Low Res); View Movie/Video (Medium Res)

A 40-foot-nominal-diameter (12.2-meter) modified ringsail parachute was flight tested as part of the NASA Supersonic High Altitude Parachute Experiment (SHAPE) program. The 41-pound (18.6-kg) test parachute system was deployed from a 239.5-pound (108.6-kg) instrumented payload by means of a deployment mortar when the payload was at an altitude of 171,400 feet (52.3 km), a Mach number of 2.95, and a free-stream dynamic pressure of 9.2 lb/sq ft (440 N/m(exp 2)). The parachute deployed properly, suspension line stretch occurring 0.54 second after mortar firing with a resulting snatch-force loading of 932 pounds (4146 newtons). The maximum loading due to parachute opening was 5162 pounds (22 962 newtons) at 1.29 seconds after mortar firing. The first near full inflation of the canopy at 1.25 seconds after mortar firing was followed immediately by a partial collapse and subsequent oscillations of frontal area until the system had decelerated to a Mach number of about 1.5. The parachute then attained a shape that provided full drag area. During the supersonic part of the test, the average axial-force coefficient varied from a minimum of about 0.24 at a Mach number of 2.7 to a maximum of 0.54 at a Mach number of 1.1. During descent under subsonic conditions, the average effective drag coefficient was 0.62 and parachute-payload oscillation angles averaged about &loo with excursions to +/-20 degrees. The recovered parachute was found to have slight damage in the vent area caused by the attached deployment bag and mortar lid.

Author

Aerodynamic Drag; Parachutes; Supersonic Speed; Subsonic Speed

20070031007 NASA Langley Research Center, Hampton, VA USA

High Altitude Flight Test of a Reefed 12.2 Meter Diameter Disk-Gap-Band Parachute with Deployment at Mach Number of 2.58

Grow, R. Bruce; Preisser, John S.; August 1971; In English; See also 19710024550; See also NASA-TN-D-6469; Originally recorded in 16mm, Silent, Color, 180ft., 5min.; DVD produced from the original 16mm recording

Report No.(s): L-1106; No Copyright; Avail.: CASI: C01, DVD; Movie/Video (High Res)

ONLINE: View Movie/Video (Low Res); View Movie/Video (Medium Res)

A reefed 12.2-meter nominal-diameter (40-ft) disk-gap-band parachute was flight tested as part of the NASA Supersonic High Altitude Parachute Experiment (SHAPE) program. A three-stage rocket was used to drive the instrumented payload to an altitude of 43.6 km (143,000 ft), a Mach number of 2.58, and a dynamic pressure of 972 N/m(exp 2) (20.3 lb/ft(exp 2)) where the parachute was deployed by means of a mortar. The parachute deployed satisfactorily and reached a partially inflated condition characterized by irregular variations in parachute projected area. A full, stable reefed inflation was achieved when the system had decelerated to a Mach number of about 1.5. The steady, reefed projected area was 49 percent of the steady, unreefed area and the average drag coefficient was 0.30. Disreefing occurred at a Mach number of 0.99 and a dynamic pressure of 81 N/m(exp 2) (1.7 lb/ft(exp 2)). The parachute maintained a steady inflated shape for the remainder of the deceleration

portion of the flight and throughout descent. During descent, the average effective drag coefficient was 0.57. There was little, if any, coning motion, and the amplitude of planar oscillations was generally less than 10 degrees. The film also shows a wind tunnel test of a 1.7-meter-diameter parachute inflating at Mach number 2.0.
Author (revised)
Parachutes; Wind Tunnel Tests; Supersonic Speed; Subsonic Speed; Inflating; Flight Tests; Aerodynamic Drag

20070031009 NASA Langley Research Center, Hampton, VA USA
Flight Test of a 40-Foot Nominal Diameter Disk-Gap-Band Parachute Deployed at a Mach Number of 2.72 and a Dynamic Pressure of 9.7 Pounds per Square Foot
Eckstrom, Clinton V.; Preisser, John S.; November 1968; In English; See also 19680020521; See also NASA-TM-X-1623; Originally recorded in 16mm, Silent, Color, 111ft., 3min.; DVD produced from the original 16mm recording
Report No.(s): L-1006; No Copyright; Avail.: CASI: C01, DVD; Movie/Video (High Res)
ONLINE: View Movie/Video (Low Res); View Movie/Video (Medium Res)

A 40-foot-nominal-diameter (12.2 meter) disk-gap-band parachute was flight tested as part of the NASA Supersonic Planetary Entry Decelerator (SPED-I) Program. The test parachute was deployed from an instrumented payload by means of a deployment mortar when the payload was at an altitude of 158,500 feet (48.2 kilometers), a Mach number of 2.72, and a free-stream dynamic pressure of 9.7 pounds per foot(exp 2) (465 newtons per meter(exp 2)). Suspension line stretch occurred 0.46 second after mortar firing and the resulting snatch force loading was -8.lg. The maximum acceleration experienced by the payload due to parachute opening was -27.2g at 0.50 second after the snatch force peak for a total elapsed time from mortar firing of 0.96 second. Canopy-shape variations occurred during the higher Mach number portion of the flight test (M greater than 1.4) and the payload was subjected to large amplitude oscillatory loads. A calculated average nominal axial-force coefficient ranged from about 0.25 immediately after the first canopy opening to about 0.50 as the canopy attained a steady inflated shape. One gore of the test parachute was damaged when the deployment bag with mortar lid passed through it from behind approximately 2 seconds after deployment was initiated. Although the canopy damage caused by the deployment bag penetration had no apparent effect on the functional capability of the test parachute, it may have affected parachute performance since the average effective drag coefficient of 0.48 was 9 percent less than that of a previously tested parachute of the same configuration.
Author
Parachutes; Flight Tests; Supersonic Speed; Loads (Forces); Aerodynamic Characteristics

20070031013 NASA Langley Research Center, Hampton, VA USA
Drag Characteristics of Several Towed Decelerator Models at Mach 3
Miserentino, Robert; Bohon, Herman L.; February 1970; In English; See also 19700017623; See also NASA-TN-D-5750; Originally recorded in 16mm, Silent, Black & White, 70ft., 1.75min.; DVD produced from the original 16mm recording
Report No.(s): L-1075; No Copyright; Avail.: CASI: C01, DVD; Movie/Video (High Res)
ONLINE: View Movie/Video (Low Res); View Movie/Video (Medium Res)

An investigation has been made to determine the possibility of using toroid-membrane and wide-angle conical shapes as towed decelerators. Parameter variations were investigated which might render toroid-membrane models and wide-angle-cone models stable without loss of the high drag coefficients obtainable with sting-mounted models. The parameters varied included location of center of gravity, location of the pivot between the towline and the model, and configuration modifications of the aft end as the addition of a corner radius and the addition of a skirt. The toroid membrane can be made into a stable towed decelerator with a suitable configuration modification of the aft end.
Author
Aerodynamic Brakes; Conical Shells; Towed Bodies; Wind Tunnel Tests; Toroids

20070031059 NASA Langley Research Center, Hampton, VA, USA
Proceedings of the 2004 Workshop on CFD Validation of Synthetic Jets and Turbulent Separation Control
Rumsey, Christopher L., Compiler; April 2007; 206 pp.; In English; 2004 Workshop on Computational Fluid Dynamics (CFD) Validation of Synthetic Jets and Turbulent Separation Control, 29-31 Mar. 2004, Williamsburg, VA, USA; See also 20070031060 - 20070031090; Original contains color and black and white illustrations
Contract(s)/Grant(s): WBS 561581.02.08
Report No.(s): NASA/CP-2007-214874; L-19333; Copyright; Avail.: CASI: A10, Hardcopy

The papers presented here are from the Langley Research Center Workshop on Computational Fluid Dynamics (CFD)

Validation of Synthetic Jets and Turbulent Separation Control (nicknamed 'CFDVAL2004'), held March 2004 in Williamsburg, Virginia. The goal of the workshop was to bring together an international group of CFD practitioners to assess the current capabilities of different classes of turbulent flow solution methodologies to predict flow fields induced by synthetic jets and separation control geometries. The workshop consisted of three flow-control test cases of varying complexity, and participants could contribute to any number of the cases. Along with their workshop submissions, each participant included a short write-up describing their method for computing the particular case(s). These write-ups are presented as received from the authors with no editing. Descriptions of each of the test cases and experiments are also included.
Author
Computational Fluid Dynamics; Conferences; Turbulent Flow; Separated Flow; Jet Flow; Mathematical Models; Active Control

20070031061 Warwick Univ., Coventry, UK
Cubic and EASM Modelling of Synthetic Jets
Preece, a. K.; Tucker, P. G.; Liu, Y.; Proceedings of the 2004 Workshop on CFD Validation of Synthetic Jets and Turbulent Separation Control; April 2007, pp. 1.6.1 - 1.6.3; In English; See also 20070031059; Copyright; Avail.: CASI: A01, Hardcopy

Computations were carried out using a modified version of the NEAT finite volume code [1]. The convection terms are discretized using the essentially second order central difference based CONDIF [2] scheme. For the diffusion terms, central differences are used. To integrate the equations through time, the Crank-Nicolson scheme is used. Compatible with our future intention to model the jet with LES staggered grids are used. To provide a pressure field the SIMPLE algorithm [3] was used. For Unsteady Reynolds Averaged Navier-Stokes (URANS) solutions, the use of various solution adaptive time step methods is also being explored.
Derived from text
Reynolds Averaging; Navier-Stokes Equation; Pressure Distribution; Algorithms; Convection

20070031062 George Washington Univ., Washington, DC, USA
Lumped Element Modeling
Mittal, Rajat; Sheplak, Mark; Cattafesta, Louis; Gallas, Quentin; Proceedings of the 2004 Workshop on CFD Validation of Synthetic Jets and Turbulent Separation Control; April 2007, pp. 1.11-1 - 1.11.5; In English; See also 20070031059; Original contains color illustrations; Copyright; Avail.: CASI: A01, Hardcopy

The approach described here is to model the response of a synthetic jet using lumped element modeling to complement more rigorous and expensive numerical simulations. The approach used is to model the actuator orifice impedance without a grazing boundary layer and is based on a lumped element modeling (LEM) technique, following the recent paper by Gallas et al. [1].
Derived from text
Boundary Layers; Actuators; Numerical Analysis; Impedance; Grazing

20070031064 Arizona Univ., Tucson, AZ, USA
Flow Simulation Methodology for Simulation of Active Flow Control
Israel, Daniel M.; Fasel, Hermann F.; Proceedings of the 2004 Workshop on CFD Validation of Synthetic Jets and Turbulent Separation Control; April 2007, pp. 3.6.1 - 3.6.5; In English; See also 20070031059; Original contains color and black and white illustrations
Contract(s)/Grant(s): F49620-02-1-0122; Copyright; Avail.: CASI: A01, Hardcopy

The Flow Simulation Methodology (FSM) is applied to the proposed experimental geometry. In this approach only the largest scales of motion need to be resolved, while in regions where there are no large coherent turbulent structures a state of the art RANS model is recovered. This allows us to obtain good results with fewer than three million grid points for a 3-D calculation. The simulations performed for this workshop build on our extensive previous work with this geometry, as well as our simulations of the experiments of Seifert and Pack [1, 2, 3, 4]. We have performed both laminar [5] and turbulent [6] simulations for the Seifert and Pack geometry. Lower Reynolds number (Re = 10(exp 5)) turbulent cases have been computed in both 2-D and 3-D. Additionally, 2-D simulations were performed at Re = 10(exp 6). The same geometry was also used to test closed loop control strategies [7]. For these earlier investigations a high order (fourth-order in time and space) explicit finite difference code was employed. This code was a curvilinear coordinate extension of previous codes developed for transition research, and consequently was designed to accurately predict the growth rates of disturbances. For this CFD

challenge the computational cost of using an explicit code, especially in 3-D, was unacceptably high. For this reason we have implemented our FSM approach [8, 9] in the CFL3D code developed at NASA Langley. This is a second order implicit thin-layer Navier-Stokes code. All the results submitted for this workshop were performed using this code, with the viscous terms activated in all three coordinate directions.
Derived from text
Computational Fluid Dynamics; Turbulent Flow; Flow Distribution; Control Simulation; Computational Grids; Active Control; Navier-Stokes Equation; Finite Difference Theory

20070031065 Utah State Univ., Logan, UT, USA
Separated Flows-An Assessment of the Predictive Capability of Five Common Turbulence Models
Spall, R. E.; Phillips. W. F.; Alley, N. R.; Proceedings of the 2004 Workshop on CFD Validation of Synthetic Jets and Turbulent Separation Control; April 2007, pp. 3.11.1 - 3.11.5; In English; See also 20070031059; Original contains black and white illustrations; Copyright; Avail.: CASI: A01, Hardcopy

The results presented herein were generated using the commercial CFD solver Fluent, which makes available to the user a relatively large number of turbulence model options. Fluent is widely used in both industry and academia, and it was of interest to the authors to assess the applicability of the available models in predicting separated flows. Our interest is also derived, in part, from our use of the code in the design of high lift, unmanned aerial vehicles (UAV s) in which the ability to predict flow separation is crucial.
Derived from text
Turbulence Models; Separated Flow; Computational Fluid Dynamics; Boundary Layer Separation; Prediction Analysis Techniques

20070031067 NASA Langley Research Center, Hampton, VA, USA
Simulation of a Periodic Jet in a Crossflow with a RANS Solver Using an Unstructured Grid
Atkins, H. L.; Proceedings of the 2004 Workshop on CFD Validation of Synthetic Jets and Turbulent Separation Control; April 2007, pp. 2.6.1 - 2.6.5; In English; See also 20070031059; Original contains black and white illustrations; Copyright; Avail.: CASI: A01, Hardcopy

A second-order unstructured-grid code, developed and used primarily for steady aerodynamic simulations, is applied to the synthetic jet in a cross flow. The code, FUN3D, is a vertex-centered finite-volume method originally developed by Anderson[1, 2], and is currently supported by members of the Fast Adaptive Aerospace Tools team at NASA Langley. Used primarily for design[3] and analysis[4] of steady aerodynamic configurations, FUN3D incorporates a discrete adjoint capability, and supports parallel computations using MPI. A detailed description of the FUN3D code can be found in the references given above. The code is under continuous development and contains a variety of flux splitting algorithms for the inviscid terms, two methods for computing gradients, several turbulence models, and several solution methodologies; all in varying states of development. Only the most robust and reliable components, based on experiences with steady aerodynamic simulations, were employed in this work. As applied in this work, FUN3D solves the Reynolds averaged Navier-Stokes equations using the one equation turbulence model of Spalart and Allmaras[5]. The spatial discretization is formed on unstructured meshes using a vertex-centered approach. The inviscid terms are evaluated by a flux-difference splitting formulation using least-squares reconstruction and Roe-type approximate Riemann fluxes. Green-Gauss gradient evaluations are used for viscous and turbulence modeling terms. The discrete spatial operator is combined with a backward time operator which is then solved iteratively using point or line Gauss-Seidel and local time stepping in a pseudo time. For steady flows, the physical time step is set to infinity and the pseudo time step is ramped up with the iteration count. A second-order backward in time operator is used for time accurate flows with 20 to 50 steps in the pseudo time applied at each physical time step. For this effort, FUN3D was modified to support spatially varying boundary and initial conditions, and unsteady boundary conditions. Also, a specialized in/out flow boundary condition was implemented to model the action of the diaphragm. This boundary condition is described below in more detail. The grids were generated using the internally developed codes GridEX[6] for meshing the surfaces and inviscid regions of the domain, and for CAD access; and MesherX[7] for meshing the viscous regions. Grid spacing in on the surfaces and in the inviscid regions are indirectly controlled by specifying sources. The viscous layers are generated using an advancing layer technique. MeshersX allows the user to control the spatial variation of the first step off the surface, growth rates, and the termination criterion by providing small problem dependent subroutines.
Derived from text
Unstructured Grids (Mathematics); Jet Flow; Cross Flow; Turbulence Models; Navier-Stokes Equation; Reynolds Averaging

20070031068 NASA Langley Research Center, Hampton, VA, USA

Simulation of a Synthetic Jet in Quiescent Air Using TLNS3D Flow Code

Vatsa, Veer N.; Turkel, Eli; Proceedings of the 2004 Workshop on CFD Validation of Synthetic Jets and Turbulent Separation Control; April 2007, pp. 1.4.1 - 1.4.5; In English; See also 20070031059; Original contains color illustrations; Copyright; Avail.: CASI: A01, Hardcopy

Although the actuator geometry is highly three-dimensional, the outer flowfield is nominally two-dimensional because of the high aspect ratio of the rectangular slot. For the present study, this configuration is modeled as a two-dimensional problem. A multi-block structured grid available at the CFDVAL2004 website is used as a baseline grid. The periodic motion of the diaphragm is simulated by specifying a sinusoidal velocity at the diaphragm surface with a frequency of 450 Hz, corresponding to the experimental setup. The amplitude is chosen so that the maximum Mach number at the jet exit is approximately 0.1, to replicate the experimental conditions. At the solid walls zero slip, zero injection, adiabatic temperature and zero pressure gradient conditions are imposed. In the external region, symmetry conditions are imposed on the side (vertical) boundaries and far-field conditions are imposed on the top boundary. A nominal free-stream Mach number of 0.001 is imposed in the free stream to simulate incompressible flow conditions in the TLNS3D code, which solves compressible flow equations. The code was run in unsteady (URANS) mode until the periodicity was established. The time-mean quantities were obtained by running the code for at least another 15 periods and averaging the flow quantities over these periods. The phase-locked average of flow quantities were assumed to be coincident with their values during the last full time period.

Derived from text

Compressible Flow; Actuators; Structured Grids (Mathematics); Incompressible Flow; Flow Distribution; Temperature Gradients; Flow Equations

20070031069 Arizona State Univ., Tempe, AZ, USA

Prediction Using RANS and DES

Krishnan, Vivek; Squires, Kyle D.; Forsythe, James R.; Proceedings of the 2004 Workshop on CFD Validation of Synthetic Jets and Turbulent Separation Control; April 2007, pp. 3.4.1 - 3.4.5; In English; See also 20070031059; Original contains color illustrations

Contract(s)/Grant(s): F49620-02-1-0117; Copyright; Avail.: CASI: A01, Hardcopy

The development of computational tools that can be used to guide technologies for flow control applications at realistic Reynolds numbers and in complicated configurations is a topic of significant interest. Computational Fluid Dynamics (CFD) offers a useful tool in understanding flow characteristics and studying the performance gains that can be achieved through flow control, though advances in several areas are needed to improve the robustness of CFD predictions for applications. Most of the flow fields for which control would be advantageous are often very complex the flows are far from equilibrium, e.g., separated or on the verge of separation, and distorted by effects such strong pressure gradients and streamline curvature. Application Reynolds numbers are sufficiently high that empirical input to any simulation strategy appears unavoidable. In addition, it would be desirable in many flow control applications to exert a 'microscopic' (e.g., small-scale) input and observe a desired 'macroscopic' (large-scale) output. This implies a wide range in the geometric scales to be simulated, which in turn places significant burdens on issues such as grid design and construction, possibly more so than in most conventional CFD applications. Thus, the opportunity for a thorough assessment of simulation strategies against measurements and other simulation approaches represents a valuable undertaking. Summarized in this report are predictions of Case 3 using solutions of the Reynolds-averaged Navier-Stokes (RANS) equations and Detached-Eddy Simulation (DES).

Derived from text

Computational Fluid Dynamics; Reynolds Averaging; Navier-Stokes Equation; Flow Characteristics

20070031070 Florida Univ., Gainesville, FL, USA

Lumped Element Modeling of a Zero-Net Mass Flux Actuator Interacting with a Grazing Boundary Layer

Gallas, Quentin; Mittal, Rajat; Cattafesta, Louis; Proceedings of the 2004 Workshop on CFD Validation of Synthetic Jets and Turbulent Separation Control; April 2007, pp. 2.8.1 - 2.8.5; In English; See also 20070031059; Original contains color illustrations; Copyright; Avail.: CASI: A01, Hardcopy

The approach described here is to model the response of a synthetic jet to a grazing boundary layer using lumped element modeling. This effort complements more rigorous and expensive numerical simulations. The approach used is to model the actuator orifice impedance with a grazing boundary layer and is based on a lumped element modeling (LEM) technique, following the recent paper by Gallas et al. [1].

Derived from text

Jet Boundaries; Boundary Layers; Actuators; Impedance; Grazing

20070031071 Kentucky Univ., Lexington, KY, USA

Two-Dimensional Simulation of Flow over a Hump Model with Menter's SST Model

Katam, V.; Chen, H.; Huang, L.; Parimi, V.; LeBeau, R. P.; Huang, P. G.; Proceedings of the 2004 Workshop on CFD Validation of Synthetic Jets and Turbulent Separation Control; April 2007, pp. 3.9.1 - 3.9.3; In English; See also 20070031059; Copyright; Avail.: CASI: A01, Hardcopy

Flow control of separation is an ongoing topic of investigation. This investigation of the phenomenon is based on our CFD experience working on flow control approaches such as morphing wings[1] and blowing and suction jets [2,3]. The latter studies were performed with the CFD code GHOST. It is this code and its techniques that we have applied to solve the current flow control problem.

Derived from text

Two Dimensional Models; Separated Flow; Boundary Layer Separation; Computational Fluid Dynamics; Electric Current

20070031072 NASA Langley Research Center, Hampton, VA, USA

Two-Dimensional Flow Control Analysis on the Hump Model

Viken, Sally A.; Proceedings of the 2004 Workshop on CFD Validation of Synthetic Jets and Turbulent Separation Control; April 2007, pp. 3.10.1 - 3.10.5; In English; See also 20070031059; Copyright; Avail.: CASI: A01, Hardcopy

Computational analyses have been conducted on the Wall-mounted Glauert-Goldschmied type body ('hump' model) with the Full Unstructured Navier-Stokes 2-D (FUN2D) flow solver developed at NASA LaRC. This investigation uses the time-accurate Reynolds-averaged Navier- Stokes (RANS) approach to predict aerodynamic performance of the active flow control experimental database for the hump model. The workshop is designed to assess the current capabilities of different classes of turbulent flow solution methodologies, such as RANS, to predict flow fields induced by synthetic jets and separation control geometries. The hump model being studied is geometrically similar to that previously tested both experimentally and computationally at NASA LaRC [ref. 1 and 2, respectively].

Derived from text

Active Control; Two Dimensional Flow; Turbulent Flow; Flow Distribution; Navier-Stokes Equation; Analysis (Mathematics); Aerodynamic Characteristics

20070031073 NASA Langley Research Center, Hampton, VA, USA

Computations of Flow Over the Hump Model Using Higher-Order Method With Turbulence Modeling

Balakumar, P.; Proceedings of the 2004 Workshop on CFD Validation of Synthetic Jets and Turbulent Separation Control; April 2007, pp. 3.15.1 - 3.15.5; In English; See also 20070031059; Original contains black and white illustrations; Copyright; Avail.: CASI: A01, Hardcopy

The flow over the two-dimensional hump model is computed by solving the RANS equations with kappa-omega (SST) model. The governing equations, the flow equations and the turbulent equations, are solved using the 5th order accurate weighted essentially non-oscillatory (WENO) scheme for space discretization and using explicit third order total-variation-diminishing (TVD) Runge-Kutta scheme for time integration. The WENO and the TVD methods and the formulas are explained in [1] and the application of ENO method to N-S equations is given in [2]. The solution method implemented in this computation is described in detail in [3].

Derived from text

Computation; Essentially Non-Oscillatory Schemes; Flow Equations; Two Dimensional Models; Turbulence Models; Tvd Schemes

20070031074 Office National d'Etudes et de Recherches Aeronautiques, Paris, France

Synthetic Jet in a Crossflow

Dandois, Julien; Garnier, Eric; Sagaut, Pierre; Proceedings of the 2004 Workshop on CFD Validation of Synthetic Jets and Turbulent Separation Control; April 2007, pp. 2.3.1 - 2.3.5; In English; See also 20070031059; Original contains color and black and white illustrations; Copyright; Avail.: CASI: A01, Hardcopy

Three-dimensional, compressible simulations of the interaction between a synthetic jet and a turbulent boundary layer have been performed using Large Eddy Simulation. A modeled boundary condition has been used for the actuator. A study of the effects of the time step, number of sub-iterations in the time integration process, actuator boundary condition has been investigated.

Derived from text

Compressible Flow; Turbulent Boundary Layer; Jet Boundaries; Large Eddy Simulation; Three Dimensional Models; Actuators

20070031075 Ohio Aerospace Inst., Wright-Patterson AFB, OH, USA

High-Order Hybrid and RANS Simulations of a Wall-Mounted Hump

Morgan, P. E.; Rizzetta, D. P.; Visbal, M. R.; Proceedings of the 2004 Workshop on CFD Validation of Synthetic Jets and Turbulent Separation Control; April 2007, pp. 3.5.1 - 3.5.5; In English; See also 20070031059; Copyright; Avail.: CASI: A01, Hardcopy

The primary purpose of this study is to compare a high-order compact scheme with standard second-order methodologies for flow over a hump. The secondary purpose is to explore predictive capabilities of high-order hybrid techniques with those of standard Reynolds-Averaged Navier-Stokes (RANS) approaches.

Derived from text

Navier-Stokes Equation; Reynolds Averaging; Predictions; Simulation

20070031077 NASA Langley Research Center, Hampton, VA, USA

Separation Control Over A Wall-Mounted Hump

Greenblatt, D.; Paschal, K. B.; Schaeffler, N. W.; Washburn, A. E.; Harris, J.; Yao, C. S.; Proceedings of the 2004 Workshop on CFD Validation of Synthetic Jets and Turbulent Separation Control; April 2007, pp. 3.1.1 - 3.1.5; In English; See also 20070031059; Original contains black and white illustrations; Copyright; Avail.: CASI: A01, Hardcopy

Separation control by means of steady suction or zero efflux oscillatory jets is known to be effective in a wide variety of flows under different flow conditions. Control is effective when applied in a nominally two-dimensional manner, for example, at the leading-edge of a wing or at the shoulder of a deflected flap. Despite intuitive understanding of the flow, at present there is no accepted theoretical model that can adequately explain or describe the observed effects of the leading parameters such as reduced suction-rate, or frequency and momentum input. This difficulty stems partly from the turbulent nature of the flows combined with superimposed coherent structures, which are usually driven by at least one instability mechanism. The ever increasing technological importance of these flows has spurned an urgent need to develop turbulence models with a predictive capability. Present attempts to develop such models are hampered in one way or another by incomplete data sets, uncertain or undocumented inflow and boundary conditions, or inadequate flow-field measurements. This paper attempts to address these issues by conducting an experimental investigation of a lowspeed separated flow over a wall-mounted hump model. The model geometry was designed by Seifert & Pack, who measured static and dynamic pressures on the model for a wide range of Reynolds and Mach numbers and control conditions. This paper describes the present experimental setup, as well as the types and range of data acquired. Sample data is presented and future work is discussed.

Derived from text

Separated Flow; Low Speed; Flow Distribution; Wind Tunnel Models; End Plates; Mounting; Wall Flow

20070031078 George Washington Univ., Washington, DC, USA

Time-Accurate Numerical Simulations of Synthetic Jet Quiescent Air

Rupesh, K-A. B.; Ravi, B. R.; Mittal, R.; Raju, R.; Gallas, Q.; Cattafesta, L.; Proceedings of the 2004 Workshop on CFD Validation of Synthetic Jets and Turbulent Separation Control; April 2007, pp. 1.9.1 - 1.9.5; In English; See also 20070031059; Original contains color and black and white illustrations

Contract(s)/Grant(s): NAG1-01024; F49620-03-1-0146; F49620-03-1-0135; Copyright; Avail.: CASI: A01, Hardcopy

The unsteady evolution of three-dimensional synthetic jet into quiescent air is studied by time-accurate numerical simulations using a second-order accurate mixed explicit-implicit fractional step scheme on Cartesian grids. Both two-dimensional and three-dimensional calculations of synthetic jet are carried out at a Reynolds number (based on average velocity during the discharge phase of the cycle V(sub j), and jet width d) of 750 and Stokes number of 17.02. The results obtained are assessed against PIV and hotwire measurements provided for the NASA LaRC workshop on CFD validation of synthetic jets.

Derived from text

Computational Fluid Dynamics; Cartesian Coordinates; Numerical Analysis

20070031079 Maryland Univ., College Park, MD, USA

CFD Validation of Baseline and Controlled Flow Over a Smooth Hump Profile

Duraisamy, Karthikeyan; Baeder, James D.; Proceedings of the 2004 Workshop on CFD Validation of Synthetic Jets and Turbulent Separation Control; April 2007, pp. 3.7.1 - 3.7.5; In English; See also 20070031059; Original contains color and black and white illustrations; Copyright; Avail.: CASI: A01, Hardcopy

Separated boundary layer flows with subsequent downstream re-attachment are very common in engineering applications.

Over the past decade there has been extensive research on control of flow separation using microjet actuators. Accurate numerical solution of such flows continues to be a challenging problem mainly because of their non-equilibrium nature. The present work involves the use of Reynolds Averaged Navier Stokes (RANS) and Detached Eddy Simulation (DES) tools in the numerical validation of the Case 3 problem, which involves high Reynolds number flow over a two dimensional bump. In this paper, the RANS results will be presented and the DES is expected to be completed by the time of the workshop.
Derived from text

Computational Fluid Dynamics; Separated Flow; Boundary Layer Flow; Boundary Layer Separation; Actuators; Computerized Simulation

20070031080 NASA Langley Research Center, Hampton, VA, USA

Experimental Evaluation of an Isolated Synthetic Jet IN Crossflow

Schaeffler, Norman W.; Jenkins, Luther N.; Hepner, Timothy E.; Proceedings of the 2004 Workshop on CFD Validation of Synthetic Jets and Turbulent Separation Control; April 2007, pp. 2.1.1 - 2.1.8; In English; See also 20070031059; Original contains color and black and white illustrations; Copyright; Avail.: CASI: A02, Hardcopy

The second case for this workshop builds upon the isolated synthetic jet of Case 1 by adding a crossflow, with no streamwise pressure gradient, for the developing jet to interact with. Formally, Case 2 examines the interaction of a single, isolated, synthetic jet and a fully turbulent zero-pressure gradient boundary layer. The resulting flow has many of the characteristics that need to be modeled with fidelity if the results of the calculations are to serve as the basis for research and design with active flow control devices. These include the turbulence in the boundary layer, the time-evolution of the large vortical structure emanating from the jet orifice and its subsequent interaction with and distortion by the boundary layer turbulence, and the effect of the suction cycle on the boundary layer flow. In a synthetic jet, the flow through the orifice and out into the outer flowfield alternates between an exhaust and a suction cycle, driven by the contraction and expansion of a cavity internal to the actuator. In the present experiment, the volume changes in the internal cavity are accomplished by replacing one of the rigid walls of the cavity, the wall opposite the orifice exit, with a deformable wall. This flexible wall is driven by a bottom-mounted moveable piston. The piston is driven electro-mechanically. The synthetic jet issues into the external flow through a circular orifice. In the present experiment, this orifice has a diameter of 0.250 inches (6.35 mm). The flow is conceptually similar to that documented in Schaeffler [1]. To document the flow, several measurement techniques were utilized. The upstream boundary conditions (in-flow conditions), and several key phase-averaged velocity profiles were measured with a 3-component laser-Doppler velocimetry system. Phase-averaged velocity field measurements were made with both stereo digital particle image velocimetry and 2-D digital particle image velocimetry as the primary measurement system. Surface pressure measurements were made utilizing an electronically scanned pressure system.
Derived from text

Cross Flow; Pressure Gradients; Jet Flow; Velocity Distribution; Turbulence Effects; Flow Distribution; Turbulent Boundary Layer

20070031081 Italian Aerospace Research Center, Capua, Italy

Investigation of a Boundary Condition Model for the Simulation of Controlled Flows

Marongiu, C.; Iaccarino, G.; Catalano, P.; Amato, M.; Proceedings of the 2004 Workshop on CFD Validation of Synthetic Jets and Turbulent Separation Control; April 2007, pp. 3.13.1 - 3.13.5; In English; See also 20070031059; Original contains color illustrations; Copyright; Avail.: CASI: A01, Hardcopy

The aim of this work is to investigate the use of a boundary condition for the simulation of flows controlled by steady-unsteady mass injection/suction devices. These actuators usually consist of a deforming membrane oscillating inside a cavity. The simulation of the whole cavity would require a very complicated and time-consuming moving-mesh calculation. Therefore the use of a boundary condition applied at the cavity exit, the interface between the external and the internal domain, is an attractive strategy. This work is a first step towards investigating the limits and the benefits of the approach. Results obtained by two unsteady RANS codes, the CIRA U-ZEN code, and FLUENT, a commercial CFD code, are reported for the flow around a two-dimensional bump. Several turbulence models are employed including one-, two- and four-equation models. The flow control is obtained via suction and it has been computed using two boundary conditions, corresponding to a top-hat distribution on the wall and to an inclined jet. The results have been compared with the experimental data and numerical computations including the whole cavity.
Derived from text

Boundary Conditions; Computational Fluid Dynamics; Injection; Turbulence Models; Simulation; Computational Grids

20070031082 Kentucky Univ., Lexington, KY, USA

Numerical Simulation of a Synthetic Jet into a Quiescent Air Using a Structured and an Unstructured Grid Flow Solver

Huang, L.; Chen, H.; Katam, V.; Parimi, V.; LeBeau, R. P.; Huang, P. G.; Proceedings of the 2004 Workshop on CFD Validation of Synthetic Jets and Turbulent Separation Control; April 2007, pp. 1.7.1 - 1.7.5; In English; See also 20070031059; Original contains color illustrations; Copyright; Avail.: CASI: A01, Hardcopy

Active flow control technologies is growing area of aerodynamic research in the early 21st century. The goal is to prevent boundary layer separation and as such it is often applied to designs of high-lift airfoils. Forced oscillations superimposed on a mean flow which is on the verge of separation point is an effective means to delay boundary-layer separation, such as blowing or suction techniques. However, the progress in active flow control technologies has often been paced by the development of actuator capabilities. A popular current actuator is the synthetic jet, which has demonstrated capabilities regarding separation control and thrust vectoring. Our approach to this problem has been to employ two different computational fluid dynamics (CFD) codes, a two-dimensional structured grid solver and a three-dimensional unstructured grid solver. Both codes are in-house codes in use at the University of Kentucky. The structured code, GHOST, uses overlapping Chimera-style grids to model more complicated flows and geometries, the advantages and disadvantages of this type of approach are well-established, although with proper diligence excellent results can be obtained using these methods. However, the continual advances in both computational fluid dynamics (CFD) algorithms and computer technologies have made unstructured grids more attractive with their ability to smoothly conform to varying flow conditions and complicated boundaries with a single grid. Remaining challenges for this type of approach including grid generation for a computational domain with complex geometries, well-balanced grid decomposition on distributed system, and efficient parallel performance. For the three-dimensional simulation of this case, we use a three-dimensional unstructured grid code called UNCLE. While one is structured and one is unstructured, GHOST and UNCLE share some common numerical techniques and as such are quite complementary

Derived from text

Unstructured Grids (Mathematics); Structured Grids (Mathematics); Three Dimensional Models; Actuators; Grid Generation (Mathematics); Computational Fluid Dynamics; Active Control; Airfoils; Thrust Vector Control

20070031085 Arizona Univ., Tucson, AZ, USA

Direct Numerical Simulation on the CRAY X1

Postl, D.; Wernz, S.; Fasel, H. F.; Proceedings of the 2004 Workshop on CFD Validation of Synthetic Jets and Turbulent Separation Control; April 2007, pp. 3.3.1 - 3.3.5; In English; See also 20070031059; Original contains black and white illustrations

Contract(s)/Grant(s): F49620-02-1-0122; Copyright; Avail.: CASI: A01, Hardcopy

In the present approach, we assess the feasibility of simulating complex flows at high Reynolds numbers without the use of turbulence models. With the ever-increasing availability of computational resources on supercomputers such as the Cray X1, it has become possible to perform three-dimensional computations using hundreds of millions of grid points. Despite the fact that such high Reynolds number simulations may not be fully resolved all the way down to the smallest scales, they are considered to be useful for studying the development and the dynamics of large coherent structures in complex turbulent flows as well as for aiding in our interpretation of results obtained from turbulence models.

Derived from text

Direct Numerical Simulation; Computational Grids; Turbulence Models; Turbulent Flow; Simulation; Dynamic Structural Analysis

20070031087 Poitiers Univ., France

Synthetic Jet Into Quiescent Air. URANS Simulations with Eddy-Viscosity and Reynolds-Stress Models

Carpy, Sabrina; Manceau, Remi; Proceedings of the 2004 Workshop on CFD Validation of Synthetic Jets and Turbulent Separation Control; April 2007, pp. 1.5.1 - 1.5.3; In English; See also 20070031059; Original contains black and white illustrations; Copyright; Avail.: CASI: A01, Hardcopy

Computations of a synthetic jet (Case 1) are performed with Code_Saturne, a finite-volume solver on unstructured grids developed at EDF [1]. The purpose of the present work is to investigate the ability of standard turbulence models (eddy-viscosity and Reynolds-stress models) to close the phase-averaged Navier- Stokes equations. Therefore, this unsteady flow was run with usual RANS-equations solved in time-accurate mode (URANS), using the standard kappa-epsilon model [4] and the Rotta+IP second moment closure [3, 2]. Wall functions were used at all solid boundaries. All the computations are 2-dimensional. In order to investigate the influence of the grid and the time step, three runs were performed with the standard kappa-epsilon model and one with the second moment closure. A summary of the characteristics of these computations is

given in the table below. Note that the time steps are given in degrees, i.e., the value corresponds to 360f(Delta)t, where f is the frequency of the jet.
Derived from text
K-Epsilon Turbulence Model; Unstructured Grids (Mathematics); Unsteady Flow; Finite Volume Method; Stress Analysis; Turbulence Models

20070031089 Boeing Co., Huntington Beach, CA, USA
Active Control for Separated Flows
Shmilovich, A.; Yadlin, Y.; Clark, R. W.; Proceedings of the 2004 Workshop on CFD Validation of Synthetic Jets and Turbulent Separation Control; April 2007, pp. 3.12.1 - 3.12.2; In English; See also 20070031059; Copyright; Avail.:
CASI: A01, Hardcopy

A numerical procedure has been developed for the analysis of unsteady flows within the framework of active control. Computations have been performed for flows past airfoils, wings and engines, ranging from nearly static ambient conditions and up to transonic freestream velocities. The analysis tool has been extensively used to develop new and practical flow control approaches. Some of these applications include vortex control (by reducing core strength or by introduction of perturbations to destabilize the vortex) and separation control to enhance high lift performance over a wide range of flow conditions. The numerical tool is a modified OVERFLOW code originally developed by NASA [1]. Overflow uses the Reynolds Averaged Navier Stokes formulation in conjunction with field turbulence models. A special module has been used for applying the time-varying boundary conditions. Various signal shapes can be used in conjunction with arbitrary stagnation properties for the general description of the jet.
Derived from text
Active Control; Separated Flow; Boundary Layer Control; Unsteady Flow; Airfoils; Reynolds Averaging

20070031090 NASA Langley Research Center, Hampton, VA, USA
Synthetic Jets in Quiescent Air
Yao, C. S.; Chen, F. J.; Neuhart, D.; Harris, J.; Proceedings of the 2004 Workshop on CFD Validation of Synthetic Jets and Turbulent Separation Control; April 2007, pp. 1.1.1 - 1.1.5; In English; See also 20070031059; Original contains black and white illustrations; Copyright; Avail.: CASI: A01, Hardcopy

An oscillatory jet with zero net mass flow is generated by a cavity-pumping actuator. Among the three test cases selected for the Langley CFD validation workshop to assess the current CFD capabilities to predict unsteady flow fields, this basic oscillating jet flow field is the least complex and is selected as the first test case. Increasing in complexity, two more cases studied include jet in cross flow boundary layer and unsteady flow induced by suction and oscillatory blowing with separation control geometries. In this experiment, velocity measurements from three different techniques, hot-wire anemometry, Laser Doppler Velocimetry (LDV) and Particle Image Velocimetry (PIV), documented the synthetic jet flow field. To provide boundary conditions for computations, the experiment also monitored the actuator operating parameters including diaphragm displacement, internal cavity pressure, and internal cavity temperature.
Derived from text
Air Jets; Unsteady Flow; Jet Flow; Computational Fluid Dynamics; Boundary Layer Flow; Actuators; Mass Flow; Boundary Conditions

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.

20070030080 NASA Langley Research Center, Hampton, VA, USA
Runway Incursion Prevention: A Technology Solution
Young, Steven D.; Jones, Denise R.; November 05, 2001; 22 pp.; In English; Joint Meeting of the Flight Safety Foundation 54th Annual International Air Safety Seminar, 5-8 Nov. 2001, Athens, Greece; Original contains color and black and white illustrations
Contract(s)/Grant(s): 728-60-30-01; No Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20070030080

A runway incursion occurs any time an airplane, vehicle, person or object on the ground creates a collision hazard with

an airplane that is taking off or landing at an airport under the supervision of Air Traffic Control (ATC). Despite the best efforts of the Federal Aviation Administration (FAA), runway incursions continue to occur more frequently. The number of incursions reported in the U.S. rose from 186 in 1993 to 431 in 2000, an increase of 132 percent. Recently, the National Transportation Safety Board (NTSB) has made specific recommendations for reducing runway incursions including a recommendation that the FAA require, at all airports with scheduled passenger service, a ground movement safety system that will prevent runway incursions; the system should provide a direct warning capability to flight crews. To this end, NASA and its industry partners have developed an advanced surface movement guidance and control system (A-SMGCS) architecture and operational concept that are designed to prevent runway incursions while also improving operational capability. This operational concept and system design have been tested in both full-mission simulation and operational flight test experiments at major airport facilities. Anecdotal, qualitative, and specific quantitative results will be presented along with an assessment of technology readiness with respect to equipage.

Author

Runway Incursions; Systems Engineering; Technology Assessment; Air Traffic Control; Air Transportation

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.

20070030193 NASA Glenn Research Center, Cleveland, OH, USA

Modular, Cost-Effective, Extensible Avionics Architecture for Secure, Mobile Communications

Ivancic, William D.; August 2007; 17 pp.; In English; IEEE 2006 Aerospace Conference, 4-11 Mar. 2006, Big Sky MT, USA; Original contains color illustrations

Contract(s)/Grant(s): WBS 411931.02.07.03

Report No.(s): NASA/TM-2007-214836; E-16050; No Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: http://hdl.handle.net/2060/20070030193

Current onboard communication architectures are based upon an all-in-one communications management unit. This unit and associated radio systems has regularly been designed as a one-off, proprietary system. As such, it lacks flexibility and cannot adapt easily to new technology, new communication protocols, and new communication links. This paper describes the current avionics communication architecture and provides a historical perspective of the evolution of this system. A new onboard architecture is proposed that allows full use of commercial-off-the-shelf technologies to be integrated in a modular approach thereby enabling a flexible, cost-effective and fully deployable design that can take advantage of ongoing advances in the computer, cryptography, and telecommunications industries.

Author

Communication Networks; Telecommunication; Communication Equipment; Commercial Off-the-Shelf Products; Avionics

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.

20070030259 NASA Langley Research Center, Hampton, VA, USA

Interference Path Loss Prediction in A319/320 Airplanes Using Modulated Fuzzy Logic and Neural Networks

Jafri, Madiha J.; Ely, Jay J.; Vahala, Linda L.; June 24, 2007; 6 pp.; In English; NAFIPS 2007: North American Fuzzy Information Processing Society, 24-27 Jun. 2007, San Diego, CA, USA; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 732759.07.19; Copyright; Avail.: CASI: A02, Hardcopy

In this paper, neural network (NN) modeling is combined with fuzzy logic to estimate Interference Path Loss measurements on Airbus 319 and 320 airplanes. Interference patterns inside the aircraft are classified and predicted based on the locations of the doors, windows, aircraft structures and the communication/navigation system-of-concern. Modeled results are compared with measured data. Combining fuzzy logic and NN modeling is shown to improve estimates of measured data

over estimates obtained with NN alone. A plan is proposed to enhance the modeling for better prediction of electromagnetic coupling problems inside aircraft.
Author
Fuzzy Systems; Neural Nets; A-320 Aircraft; Logic Circuits; Commercial Aircraft; Mathematical Models

20070030306 NASA Langley Research Center, Hampton, VA, USA
On Problems Associated with Modeling Wing-Tail Configurations from Wind Tunnel Data
Murphy, Patrick C.; Klein, Vladislav; August 20, 2007; 18 pp.; In English; AIAA Atmospheric Flight Mechanics Conference and Exhibit, 20-23 Aug. 2007, Hilton Head, SC, USA; Original contains color illustrations
Contract(s)/Grant(s): WBS 561581.02; Copyright; Avail.: CASI: A03, Hardcopy

This paper considers factors that contribute to poor identification of unsteady aerodynamics from wind tunnel data for an airliner configuration. One approach to modeling a wing-tail configuration is considered and applied to both steady and large-amplitude forced pitch oscillation wind tunnel data taken over a wide range of angles of attack but a limited range of amplitude and frequencies. The identified models fit the measured data well but in some cases with inaccurate parameters. Only limited conclusions can be drawn from analysis of the current data set until further experiments can be performed to resolve the identification issues. The analysis of measured and simulated data provides some insights and guidance on how an effective experiment may be designed for wing-tail configurations with nonlinear unsteady aerodynamics.
Author
Unsteady Aerodynamics; Wind Tunnel Tests; Mathematical Models; Data Acquisition; Body-Wing and Tail Configurations

20070030307 NASA Langley Research Center, Hampton, VA, USA
General Equations of Motion for a Damaged Asymmetric Aircraft
Bacon, Barton J.; Gregory, Irene M.; August 20, 2007; 13 pp.; In English; AIAA Atmospheric Flight Mechanics Conference and Exhibit, 20-23 Aug. 2007, Hilton Head, SC, USA; Original contains color illustrations
Contract(s)/Grant(s): WBS 457280.02; No Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20070030307

There is a renewed interest in dynamic characteristics of damaged aircraft both in order to assess survivability and to develop control laws to enhance survivability. This paper presents a set of flight dynamics equations of motion for a rigid body not necessarily referenced to the body's center of mass. Such equations can be used when the body loses a portion of its mass and it is desired to track the motion of the body s previous center of mass/reference frame now that the mass center has moved to a new position. Furthermore, results for equations presented in this paper and equations in standard aircraft simulations are compared for a scenario involving a generic transport aircraft configuration subject to wing damage.
Author
Asymmetry; Damage; Equations of Motion; Aircraft Design; Aircraft Control; Rigid Structures

20070031030 NASA Langley Research Center, Hampton, VA, USA
Automated Simulation Updates based on Flight Data
Morelli, Eugene A.; Ward, David G.; August 20, 2007; 17 pp.; In English; AIAA Atmospheric Flight Mechanics Conference and Exhibit, 20-23 Aug. 2007, Hilton Head, SC, USA; Original contains color and black and white illustrations
Contract(s)/Grant(s): AF99-330; WBS 457280.02; No Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20070031030

A statistically-based method for using flight data to update aerodynamic data tables used in flight simulators is explained and demonstrated. A simplified wind-tunnel aerodynamic database for the F/A-18 aircraft is used as a starting point. Flight data from the NASA F-18 High Alpha Research Vehicle (HARV) is then used to update the data tables so that the resulting aerodynamic model characterizes the aerodynamics of the F-18 HARV. Prediction cases are used to show the effectiveness of the automated method, which requires no ad hoc adjustments by the analyst.
Author
Flight Simulators; F-18 Aircraft; Automatic Control; Mathematical Models; Wind Tunnel Models; Flight Tests; Research Vehicles

20070031031 NASA Langley Research Center, Hampton, VA, USA

CMG-Augmented Control of a Hovering VTOL Platform

Lim, K. B.; Moerder, D. D.; August 20, 2007; 27 pp.; In English; AIAA Guidance, Navigation, and Control Conference and Exhibit, 20-23 Aug. 2007, Hilton Head, SC, USA; Original contains color illustrations

Contract(s)/Grant(s): WBS 561581.02

Report No.(s): AIAA Paper 2007-6458; No Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: http://hdl.handle.net/2060/20070031031

This paper describes how Control Moment Gyroscopes (CMGs) can be used for stability augmentation to a thrust vectoring system for a generic Vertical Take-Off and Landing platform. The response characteristics of the platform which uses only thrust vectoring and a second configuration which includes a single-gimbal CMG array are simulated and compared for hovering flight while subject to severe air turbulence. Simulation results demonstrate the effectiveness of a CMG array in its ability to significantly reduce the agility requirement on the thrust vectoring system. Albeit simplifying physical assumptions on a generic CMG configuration, the numerical results also suggest that reasonably sized CMGs will likely be sufficient for a small hovering vehicle.

Author

Control Moment Gyroscopes; Hovering; Vertical Takeoff Aircraft; Mathematical Models; Stability Augmentation; Aircraft Landing

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.

20070030301 NASA Glenn Research Center, Cleveland, OH, USA

Experimental Investigation of Rotating Stall in a Research Multistage Axial Compressor

Lepicovsky, Jan; Braunscheidel, Edward P.; Welch, Gerard E.; August 2007; 17 pp.; In English; 18th ISABE Conference, 2-7 Sep. 2007, Beijing, China; Original contains color illustrations

Contract(s)/Grant(s): WBS 561581.02.08.03.21.02

Report No.(s): NASA/TM-2007-214978; ARL-TR-4126; E-16134; No Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: http://hdl.handle.net/2060/20070030301

A collection of experimental data acquired in the NASA low-speed multistage axial compressor while operated in rotating stall is presented in this paper. The compressor was instrumented with high-response wall pressure modules and a static pressure disc probe for in-flow measurement, and a split-fiber probe for simultaneous measurements of velocity magnitude and flow direction. The data acquired to-date have indicated that a single fully developed stall cell rotates about the flow annulus at 50.6% of the rotor speed. The stall phenomenon is substantially periodic at a fixed frequency of 8.29 Hz. It was determined that the rotating stall cell extends throughout the entire compressor, primarily in the axial direction. Spanwise distributions of the instantaneous absolute flow angle, axial and tangential velocity components, and static pressure acquired behind the first rotor are presented in the form of contour plots to visualize different patterns in the outer (midspan to casing) and inner (hub to mid-span) flow annuli during rotating stall. In most of the cases observed, the rotating stall started with a single cell. On occasion, rotating stall started with two emerging stall cells. The root cause of the variable stall cell count is unknown, but is not attributed to operating procedures.

Author

Data Acquisition; Flow Measurement; Rotating Stalls; High Pressure; Rotor Speed

20070030849 NASA Glenn Research Center, Cleveland, OH, USA

Effects of Unsteadiness Due to Wake Passing on Rotor Blade Heat Transfer

Ameri, Ali A.; Rigby, David L.; Heidmann, James; Steinthorsson, Erlendur; Fabian, John C.; August 2007; 16 pp.; In English; 9th AIAA/ASME Joint Thermophysics and Het Transfer Conference, 5-8 Jun. 2006, San Francisco, CA, USA; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 984754.02.07.03.16.06

Report No.(s): NASA/TM-2007-214908;; AIAA Paper 2006-3263; E-16070; Copyright; Avail.: CASI: A03, Hardcopy

In a gas turbine engine, the turbine rotor blades are buffeted by the wakes of the vanes located upstream. There is a

transient effect from the passing of wakes on the blade heat transfer. This transient effect has been computed for a representative rotor by introducing a wake upstream via an unsteady inlet flow boundary condition, or 'gust' condition. Two cases of turbulent flow and laminar flow with Reynolds numbers of 385,000 and 385 respectively were considered. For the turbulent flow case a quasi-steady calculation was also performed. The variation in the unsteady heat transfer coefficient was found to be as high as 120 percent of the mean. For the turbulent flow case a quasisteady calculation was also performed. The time mean of the unsteady heat transfer, the mean of the quasi-steady variations and the steady results agree reasonably well on all blade locations except for the turbulent results which differ near the leading edge. The quasi-steady heat transfer results do not agree with the instantaneous unsteady results, although the time-mean values are similar.
Author
Unsteady Flow; Heat Transfer; Heat Transfer Coefficients; Turbine Blades; Turbulent Heat Transfer; Gas Turbine Engines; Turbulent Flow; Rotors; Inlet Flow

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.

20070030941 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
A Convex Guidance Algorithm for Formation Reconfiguration
Acikmese, A. Behcet; Schar, Daniel P.; Murray, Emmanuell A.; Hadaeghs, Fred Y.; August 21, 2006; 17 pp.; In English; AIAA Guidance, Navigation and Control Conference, 21-24 Aug. 2006, Keystone, CO, USA; Original contains black and white illustrations; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/40138

In this paper, a reconfiguration guidance algorithm for formation flying spacecraft is presented. The formation reconfiguration guidance problem is first formulated as a continuous-time minimum-fuel or minimum-energy optimal control problem with collision avoidance and control constraints. The optimal control problem is then discretized to obtain a finite dimensional parameter optimization problem. In this formulation, the collision avoidance constraints are imposed via separating planes between each pair of spacecraft. A heuristic is introduced to choose these separating planes that leads to the convexification of the collision avoidance constraints. Additionally, convex constraints are imposed to guarantee that no collisions occur between discrete time samples. The resulting finite dimensional optimization problem is a second order cone program, for which standard algorithms can compute the global optimum with deterministic convergence and a prescribed level of accuracy. Consequently, the formation reconfiguration algorithm can be implemented onboard a spacecraft for real-time operations.
Author
Collision Avoidance; Formation Flying; Spacecraft Guidance; Algorithms; Real Time Operation; Optimal Control

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*.

20070030988 National Advisory Committee for Aeronautics. Langley Aeronautical Lab., Langley Field, VA USA
Apollo-Lunar Orbital Rendezvous Technique
January 1963; In English; Originally recorded in 16mm, Sound, Color, 219ft., 5.5min.; DVD produced from the original 16mm recording
Report No.(s): L-762; No Copyright; Avail.: CASI: C01, DVD; Movie/Video (High Res)
ONLINE: View Movie/Video (Low Res); View Movie/Video (Medium Res)

The film shows artists rendition of the spacecrafts, boosters, and flight of the Apollo lunar missions. The Apollo spacecraft will consist of three modules: the manned Command Module; the Service Module, which contains propulsion systems; and the Lunar Excursion Module (LEM) to carry astronauts to the moon and back to the Command and Service Modules. The spacecraft will be launched via a three-stage Saturn booster. The first stage will provide 7.5 million pounds of thrust from five

F-1 engines for liftoff and initial powered flight. The second stage will develop 1 million pounds of thrust from five J-2 engines to boost the spacecraft almost into Earth orbit. Immediately after ignition of the second stage, the Launch Escape System will be jettisoned. A single J-2 engine in the S4B stage will provide 200,000 pounds of thrust to place the spacecraft in an earth parking orbit. It also will be used to propel the spacecraft into a translunar trajectory, then it will separate from the Apollo Modules. Onboard propulsion systems will be used to insert the spacecraft into lunar orbit. Two astronauts will enter the LEM, which will separate from the command and service modules. The LEM will go into elliptical orbit and prepare for landing. The LEM will lift off of the Moon's surface to return to the Command and Service Modules, and most likely be left in lunar orbit. After leaving the Moon's orbit, and shortly before entering Earth's orbit, the Service Module will be ejected. The Command Module will be oriented for reentry into the Earth's atmosphere. A drogue parachute will deploy at approximately 50,000 feet, followed by the main parachute system for touchdown.
Derived from text
Apollo Spacecraft; Lunar Orbits; Earth Orbits; Spacecraft Modules; Lunar Landing; Saturn Launch Vehicles; Spacecraft Reentry

13
ASTRODYNAMICS

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

20070030976 NASA Langley Research Center, Hampton, VA USA
Simulator Study of Lunar Orbit Establishment
June 1965; In English; 16mm, Silent, Black & White, 250ft., 6.75min.; DVD produced from the original 16mm recording
Report No.(s): L-876; No Copyright; Avail.: CASI: C01, DVD; Movie/Video (High Res)
ONLINE: View Movie/Video (Low Res); View Movie/Video (Medium Res)

The film was made using the Lunar Orbit and Landing Approach Simulator (LOLA). It represents the view an astronaut would see if he were looking toward the lunar horizon just prior to and during retrofire for orbit establishment. During this period the astronaut is essentially flying backward, therefore the lunar surface features appear to be moving away during the flight.
Derived from text
Lunar Orbits; Lunar Surface; Lunar Orbit and Landing Simulators; Lunar Landing

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*.

20070030309 NASA Langley Research Center, Hampton, VA, USA
An Orion/Ares I Launch and Ascent Simulation: One Segment of the Distributed Space Exploration Simulation (DSES)
Chung, Victoria I.; Crues, Edwin Z.; Blum, Mike G.; Alofs, Cathy; Busto, Juan; August 20, 2007; 12 pp.; In English; AIAA Modeling and Simulation Technologies Conference and Exhibit, 20-23 Aug. 2007, Hilton Head, SC, USA; Original contains color illustrations
Contract(s)/Grant(s): WBS 160961.01.01.01
Report No.(s): AIAA Paper 2007-6625; Copyright; Avail.: CASI: A03, Hardcopy

This paper describes the architecture and implementation of a distributed launch and ascent simulation of NASA's Orion spacecraft and Ares I launch vehicle. This simulation is one segment of the Distributed Space Exploration Simulation (DSES) Project. The DSES project is a research and development collaboration between NASA centers which investigates technologies and processes for distributed simulation of complex space systems in support of NASA's Exploration Initiative.

DSES is developing an integrated end-to-end simulation capability to support NASA development and deployment of new exploration spacecraft and missions. This paper describes the first in a collection of simulation capabilities that DSES will support.
Author
Ares 1 Launch Vehicle; Ascent; Simulation; Space Exploration; Aerospace Systems; Crew Exploration Vehicle; Spacecraft Launching; Local Area Networks

20070030936 NASA Langley Research Center, Hampton, VA, USA
Simulation Environment for Orion Launch Abort System Control Design Studies
McMinn, J. Dana; Jackson, E. Bruce; Christhilf, David M.; August 20, 2007; 10 pp.; In English; AIAA Modeling and Simulation Technologies Conference, 20-23 August 2007, Hilton Head, SC, USA; Original contains color and black and white illustrations; Copyright; Avail.: CASI: A02, Hardcopy

The development and use of an interactive environment to perform control system design and analysis of the proposed Crew Exploration Vehicle Launch Abort System is described. The environment, built using a commercial dynamic systems design package, includes use of an open-source configuration control software tool and a collaborative wiki to coordinate between the simulation developers, control law developers and users. A method for switching between multiple candidate control laws and vehicle configurations is described. Aerodynamic models, especially in a development program, change rapidly, so a means for automating the implementation of new aerodynamic models is described.
Author
Control Systems Design; Abort Trajectories; Simulation; Spacecraft Launching; Crew Exploration Vehicle

20070030963 NASA Langley Research Center, Hampton, VA USA
USA Space Explorations 1958
April 03, 1962; In English; Originally recorded in 16mm, Sound, Color, 690ft., 19min.; DVD produced from the original 16mm recording
Report No.(s): L-703; HQ-8; No Copyright; Avail.: CASI: C01, DVD; Movie/Video (High Res)
ONLINE: View Movie/Video (Low Res); View Movie/Video (Medium Res)

The film describes preparation and launch of five satellites and two space probes during 1958. On January 31, a Jupiter vehicle launched Explorer I into space. Data from this satellite was used to identify the van Allen radiation belts. On March 17, a Vanguard I rocket launched an Earth satellite with solar batteries. Data from the mission was used to determine that the Earth is slightly pear-shaped. On March 26, Explorer III was launched to further study the van Allen belts, micrometeoroid impacts, and internal and external temperatures. Explorer IV, launched on July 26, was intended to study radiation and temperature data. A lunar probe, ABLE I, was intended to measure radiation, magnetic fields of Earth and the Moon, density of micrometeoric matter, and internal temperatures. A four-stage rocket was used in the launch. However, a turbo-pump failed and the liquid oxygen pump stopped, resulting in a failed mission. On October 10, Pioneer I was launched by an ABLE vehicle. First and second stage velocity was less than desired and the probe did not leave Earth orbit. Attempts to attain escape velocity were unsuccessful. On December, a Jupiter boost vehicle was used to launch Juno II, with Pioneer III as the payload. Escape velocity was reached and Pioneer III left Earth's atmosphere. Failed launches, such as those of Vanguard boost vehicles and several Explorer satellites, also added to scientific knowledge.
CASI
United States; Rocket Launching; Launch Vehicles; NASA Space Programs; Space Exploration

20070030984 NASA Langley Research Center, Hampton, VA USA
Launch Vehicle Dynamics Demonstrator Model
June 1963; In English; Originally recorded in 16mm, Silent, Color, 125ft., 3min.; DVD produced from the original 16mm recording
Report No.(s): L-789; No Copyright; Avail.: CASI: C01, DVD; Movie/Video (High Res)
ONLINE: View Movie/Video (Low Res); View Movie/Video (Medium Res)

The effect of vibration on launch vehicle dynamics was studied. Conditions included three modes of instability. The film includes close up views of the simulator fuel tank with and without stability control.
Derived from text
Launch Vehicles; Stability Tests; Vibration Effects; Rocket Launching

16
SPACE TRANSPORTATION AND SAFETY

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

20070030090 NASA Johnson Space Center, Houston, TX, USA

Orbital Debris: A Policy Perspective

Johnson, Nicholas L.; [2007]; 26 pp.; In English; Original contains color and black and white illustrations; No Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: http://hdl.handle.net/2060/20070030090

A viewgraph presentation describing orbital debris from a policy perspective is shown. The contents include: 1) Voyage through near-Earth Space-animation; 2) What is Orbital Debris?; 3) Orbital Debris Detectors and Damage Potential; 4) Hubble Space Telescope; 5) Mir Space Station Solar Array; 6) International Space Station; 7) Space Shuttle; 8) Satellite Explosions; 9) Satellite Collisions; 10) NASA Orbital Debris Mitigation Guidelines; 11) International Space Station Jettison Policy; 12) Controlled/Uncontrolled Satellite Reentries; 13) Return of Space Objects; 14) Orbital Debris and U.S. National Space Policy; 15) U.S Government Policy Strategy; 16) Bankruptcy of the Iridium Satellite System; 17) Inter-Agency Space Debris Coordination Committee (IADC); 18) Orbital Debris at the United Nations; 19) Chinese Anti-satellite System; 20) Future Evolution of Satellite Population; and 21) Challenge of Orbital Debris

CASI

Policies; Space Debris; International Space Station; Space Shuttles; Space Transportation

20070031008 NASA Langley Research Center, Hampton, VA USA

EVA Assembly of Large Space Structure Neutral Buoyancy, Zero-Gravity Simulation: NASA-LaRC Nestable Columns and Joints

April 1979; In English; See also 19810017623; See also NASA-TP-1872; Originally recorded in 16mm, Silent, Color, 21.5min.; DVD produced from the original 16mm recording

Report No.(s): L-1275; No Copyright; Avail.: CASI: C01, DVD; Movie/Video (High Res)

ONLINE: View Movie/Video (Low Res); View Movie/Video (Medium Res)

The film depicts an extravehicular activity (EVA) that involved the assembly of six 'space-weight' columns into a regular tetrahedral cell by a team of two 'space'-suited test subjects. This cell represents the fundamental 'element' of a tetrahedral truss structure. The tests were conducted under simulated zero-gravity conditions, achieved by neutral buoyancy in water. The cell was assembled on an 'outrigger' assembly aid off the side of a mockup of the Shuttle Orbiter cargo bay. Both manual and simulated remote manipulator system (RMS) modes were evaluated. The simulated RMS was used only to transfer stowed hardware from the cargo bay to the work sites. Articulation limits of the pressure suit and zero gravity could be accommodated by work stations with foot restraints. The results of this study have confirmed that astronaut EVA assembly of large, erectable space structur is well within man's capabilities.

Author (revised)

Extravehicular Activity; Large Space Structures; Trusses; Neutral Buoyancy Simulation; Space Shuttle Orbiters; Space Suits; Astronaut Performance; Space Erectable Structures

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*.

20070031014 National Advisory Committee for Aeronautics. Langley Aeronautical Lab., Langley Field, VA USA; Boeing Co., USA

The Lunar Orbiter: A Spacecraft to Advance Lunar Exploration

[1966]; In English; Originally recorded in 16mm, Sound, Color, 300ft., 7.5min.; DVD produced from the original 16mm recording

Report No.(s): L-1312; No Copyright; Avail.: CASI: C01, DVD; Movie/Video (High Res)

ONLINE: View Movie/Video (Low Res); View Movie/Video (Medium Res)

The film describes the Lunar Orbiter's mission to photograph landing areas on the Moon. The Orbiter will be launched

from Cape Kennedy using an Atlas Agena booster rocket. Once it is boosted in a trajectory toward the Moon, the Orbiter will deploy two-way earth communication antennas and solar panels for electricity. Attitude control jets will position the solar panels toward the sun and a tracker for a fix on its navigational star. The Orbiter will be put in an off-center orbit around the Moon where it will circle from four to six days. Scientists on Earth will study the effects of the Moon's gravitational field on the spacecraft, then the orbit will be lowered to 28 miles above the Moon's surface. Engineers will control the Orbiter manually or by computer to activate two camera lenses. The cameras will capture pictures of 12,000 square miles of lunar surface in 25 and 400 square mile increments. Pictures will be sent back to Earth using solar power to transmit electrical signals. The signals will be received by antennas at Goldstone, CA, and in Australia and Spain. Incoming photographic data will be electronically converted and processed to produce large-scale photographic images. The mission will be directed from the Space Flight Operations Facility in Pasadena, CA by NASA and Boeing engineers. After the photographic mission, the Orbiter will continue to circle the Moon providing information about micrometeoroids and radiation in the vicinity.
Derived from text
Lunar Orbiter; Lunar Photography; Lunar Surface; Lunar Exploration; Flight Operations; Moon

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*.

20070030194 NASA Glenn Research Center, Cleveland, OH, USA
Development and Application of a Portable Health Algorithms Test System
Melcher, Kevin J.; Fulton, Christopher E.; Maul, William A.; Sowers, T. Shane; July 2007; 19 pp.; In English; 54th Joint Army-Navy-NASA-Air Force (JANNAF) Prpulsion Meeting (JPM), 14-17 May 2007, Denver, CO, USA; Original contains color and black and white illustrations
Contract(s)/Grant(s): WBS 136905.08.05.08.08.01.03
Report No.(s): NASA/TM-2007-214840; E-16055; Copyright; Avail.: CASI: A03, Hardcopy

This paper describes the development and initial demonstration of a Portable Health Algorithms Test (PHALT) System that is being developed by researchers at the NASA Glenn Research Center (GRC). The PHALT System was conceived as a means of evolving the maturity and credibility of algorithms developed to assess the health of aerospace systems. Comprising an integrated hardware-software environment, the PHALT System allows systems health management algorithms to be developed in a graphical programming environment; to be tested and refined using system simulation or test data playback; and finally, to be evaluated in a real-time hardware-in-the-loop mode with a live test article. In this paper, PHALT System development is described through the presentation of a functional architecture, followed by the selection and integration of hardware and software. Also described is an initial real-time hardware-in-the-loop demonstration that used sensor data qualification algorithms to diagnose and isolate simulated sensor failures in a prototype Power Distribution Unit test-bed. Success of the initial demonstration is highlighted by the correct detection of all sensor failures and the absence of any real-time constraint violations.
Author
Systems Management; Systems Engineering; Computer Programs; Aerospace Systems; Algorithms; Health

20070030244 NASA Johnson Space Center, Houston, TX, USA
Orion Passive Thermal Control Overview
Miller, Stephen W.; September 13, 2007; 47 pp.; In English; TFAWS 2007, 10-14 Sep. 2007, Cleveland, OH, USA; Original contains color illustrations
Contract(s)/Grant(s): WBS 644423.02.36.07.10; No Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20070030244

An viewgraph presentation of Orion's passive thermal control system is shown. The topics include: 1) Orion in CxP

Hierarchy; 2) General Orion Description/Orientation; 3) Module Descriptions and Images; 4) Orion PTCS Overview; 5) Requirements/Interfaces; 6) Design Reference Missions; 7) Natural Environments; 8) Thermal Models; 9) Challenges/Issues; and 10) Testing
CASI
Temperature Control; General Overviews; Crew Exploration Vehicle; Avionics; Spacecraft Launching; Manned Space Flight; NASA Space Programs

20070030295 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Radiation Challenges for Electronics in the Vision for Space Exploration
LaBel, Kenneth A.; [2006]; 9 pp.; In English; Space Weather Week 2006, 25-28 April 2006, Boulder, CO, USA; Original contains color illustrations; No Copyright; Avail.: CASI: A02, Hardcopy
ONLINE: http://hdl.handle.net/2060/20070030295

The slides present a brief snapshot discussing electronics and exploration-related challenges. Radiation effects have been the prime target, however, electronic parts reliability issues must also be considered. Modern electronics are designed with a 3-5 year lifetime. Upscreening does not improve reliability, merely determines inherent levels. Testing costs are driven by device complexity; they increase tester complexity, beam requirements, and facility choices. Commercial devices may improve performance, but are not cost panaceas. There is need for a more cost-effective access to high energy heavy ion facilities such as NSCL and NSRL. Costs for capable test equipment can run more than $1M for full testing.
Author (revised)
Electronic Equipment; Space Exploration; Radiation Effects

20070030945 NASA Langley Research Center, Hampton, VA USA
Landing Energy Dissipation for Manned Reentry Vehicles
Fisher, Loyd. L.; June 07, 1960; In English; See also 19980228267; See also NASA-TN-D-453; Originally recorded in 16mm, Silent, Color, 128ft., 3.5min.; DVD produced from the original 16mm recording
Report No.(s): L-540; No Copyright; Avail.: CASI: C01, DVD; Movie/Video (High Res)
ONLINE: View Movie/Video (Low Res); View Movie/Video (Medium Res)

The film shows experimental investigations to determine the landing-energy-dissipation characteristics for several types of landing gear for manned reentry vehicles. The landing vehicles are considered in two categories: those having essentially vertical-descent paths, the parachute-supported vehicles, and those having essentially horizontal paths, the lifting vehicles. The energy-dissipation devices include crushable materials such as foamed plastics and honeycomb for internal application in couch-support systems, yielding metal elements as part of the structure of capsules or as alternates for oleos in landing-gear struts, inflatable bags, braking rockets, and shaped surfaces for water impact.
Author (revised)
Reentry Vehicles; Spacecraft Landing; Manned Reentry; Space Capsules

20070030950 National Advisory Committee for Aeronautics. Langley Aeronautical Lab., Langley Field, VA USA
Water Landing Characteristics of a 1/6-Scale Model Reentry Capsule with an 80-Inch Heat Shield
September 11, 1959; In English; Originally recorded in 16mm, Silent, Color, 150ft., 4min.; DVD produced from the original 16mm recording
Report No.(s): L-487; No Copyright; Avail.: CASI: C01, DVD; Movie/Video (High Res)
ONLINE: View Movie/Video (Low Res); View Movie/Video (Medium Res)

Variables for the reentry capsule water landing tests were flight path, vertical contact velocity, and contact attitude. The capsule weighed 1900 pounds with a center of gravity 16.8 inches above maximum diameter.
Derived from text
Water Landing; Spacecraft Reentry; Heat Shielding

20070030951 NASA Langley Research Center, Hampton, VA USA

Dynamic Model Tests of Models of the McDonnell Design of Project Mercury Capsule in the Langley 20-Foot Free-Spinning Tunnel

June 10, 1961; In English; 16mm, Silent, Black & White, 800ft., 22min.; DVD produced from the original 16mm recording

Report No.(s): L-463; No Copyright; Avail.: CASI: C01, DVD; Movie/Video (High Res)

ONLINE: View Movie/Video (Low Res); View Movie/Video (Medium Res)

On 10 June 1961, 33 tests of the aerodynamic response of the McDonnell model Mercury capsule were conducted. Variables included spin, different parachute tethers, and the addition of baffles.

Derived from text

Dynamic Models; Mercury Spacecraft; Wind Tunnel Tests; Dynamic Response

20070030952 National Advisory Committee for Aeronautics. Langley Aeronautical Lab., Langley Field, VA USA

Dynamic Model Tests of Models in the McDonnell Design of Project Mercury Capsule in the Langley 20-Foot Free-Spinning Tunnel

May 11, 1959; In English; Originally recorded in 16mm, Silent, Black & White, 830ft., 23min.; DVD produced from the original 16mm recording

Report No.(s): L-458; No Copyright; Avail.: CASI: C01, DVD; Movie/Video (High Res)

ONLINE: View Movie/Video (Low Res); View Movie/Video (Medium Res)

On 11 May 1959, 24 tests of the aerodynamic response of the McDonnell model Project Mercury capsule were conducted. The initial test demonstrated free-fall; a parachute was used in the remaining test. Several tests included the addition of baffles.

Derived from text

Dynamic Models; Mercury Spacecraft; Wind Tunnel Tests

20070030955 NASA Langley Research Center, Hampton, VA USA

Water Landing Characteristics of a Reentry Capsule

December 23, 1958; In English; See also 19980228040; See also NASA-MEMO-5-23-59L; Originally recorded in 16mm, Silent, Color, 110ft., 3min.; DVD produced from the original 16mm recording

Report No.(s): L-415; No Copyright; Avail.: CASI: C01, DVD; Movie/Video (High Res)

ONLINE: View Movie/Video (Low Res); View Movie/Video (Medium Res)

Experimental and theoretical investigations have been made to determine the water-landing characteristics of a conical-shaped reentry capsule having a segment of a sphere as the bottom. For the experimental portion of the investigation, a 1/12-scale model capsule and a full-scale capsule were tested for nominal flight paths of 65 deg and 90 deg (vertical), a range of contact attitudes from -30 deg to 30 deg, and a full-scale vertical velocity of 30 feet per second at contact. Accelerations were measured by accelerometers installed at the centers of gravity of the model and full-scale capsules. For the model test the accelerations were measured along the X-axis (roll) and Z-axis (yaw) and for the full-scale test they were measured along the X-axis (roll), Y-axis (pitch), and Z-axis (yaw). Motions and displacements of the capsules that occurred after contact were determined from high-speed motion pictures. The theoretical investigation was conducted to determine the accelerations that might occur along the X-axis when the capsule contacted the water from a 90 deg flight path at a 0 deg attitude. Assuming a rigid body, computations were made from equations obtained by utilizing the principle of the conservation of momentum. The agreement among data obtained from the model test, the full-scale test, and the theory was very good. The accelerations along the X-axis, for a vertical flight path and 0 deg attitude, were in the order of 40g. For a 65 deg flight path and 0 deg attitude, the accelerations along the X-axis were in the order of 50g. Changes in contact attitude, in either the positive or negative direction from 0 deg attitude, considerably reduced the magnitude of the accelerations measured along the X-axis. Accelerations measured along the Y- and Z-axes were relatively small at all test conditions.

Author

Water Landing; Conical Bodies; Reentry Vehicles; Full Scale Tests; Spacecraft Landing; Space Capsules

20070030957 National Advisory Committee for Aeronautics. Langley Aeronautical Lab., Langley Field, VA USA
Reentry Body Stability Tests Conducted in Langley Spin Tunnel
June 09, 1958; In English; Originally recorded in 16mm, Silent, Black & White, 40ft., 1min.; DVD produced from the original 16mm recording
Report No.(s): L-346; No Copyright; Avail.: CASI: C01, DVD; Movie/Video (High Res)
ONLINE: View Movie/Video (Low Res); View Movie/Video (Medium Res)

Reentry body stability tests were conducted in an initial configuration, with a small drogue chute, with an extendable flare, and in an alternate configuration with a covered flare.
Derived from text
Reentry Vehicles; Wind Tunnel Tests; Wind Tunnel Stability Tests; Spacecraft Stability

20070030961 National Advisory Committee for Aeronautics. Langley Aeronautical Lab., Langley Field, VA USA
Saturn: A Giant Thrust into Space
January 1962; In English; Originally recorded in 16mm, Color, Sound, 369ft., 10 min
Report No.(s): L-724; HQ-36; No Copyright; Avail.: CASI: C01, DVD; Movie/Video (High Res)
ONLINE: View Movie/Video (Low Res); View Movie/Video (Medium Res)

The film provides an introduction and overview of the Saturn launch vehicle. It is designed with stages to drop off as fuel is spent. There may be two, three, or four stages, depending on the payload. The Saturn rocket will be used to send Apollo missions to the Moon and back. Guidance systems and booster engine rockets are based on proven mechanisms. Scale models are used to test the engines. Hardware, airframes, guidance systems, instrumentation, and the rockets are produced at sites throughout the country. The engines go to Marshall Space Flight Center for further tests. After partial assembly, the vehicle is shipped to Cape Canaveral in large pieces where it is assembled using specially built equipment and structures. Further trials are performed to assure successful launches.
CASI
Saturn Launch Vehicles; Saturn Project

20070030964 NASA Langley Research Center, Hampton, VA USA
Blast Effects of Twin Variable-Cant Rocket Nozzles on Visibility During Landing on a Particle-Covered Surface
Hurt, G. J.; Lina, L. J.; September 08, 1964; In English; See also 19650002904; See also NASA-TN-D-2455; Originally recorded in 16mm, Silent, Black and White, 530ft., 14.5min.; DVD produced from the original 16mm recording
Report No.(s): L-689; No Copyright; Avail.: CASI: C01, DVD; Movie/Video (High Res)
ONLINE: View Movie/Video (Low Res); View Movie/Video (Medium Res)

A limited investigation has been conducted to determine the jet-blast effect of twin variable-cant supersonic nozzles. These tests were made to examine the result of using canted main rocket engines to sweep the blast debris outward from the proposed landing area of a rocket-powered vehicle making a vertical approach to a touchdown. Cant angles from 0 degrees to 75 degrees, at intervals of 15 degrees, were tested at low ambient pressure and at atmospheric ambient pressure. Nozzle chamber pressures used were 400 psi and 2000 psi.
Derived from text
Jet Blast Effects; Rocket Nozzles; Slopes; Visibility; Supersonic Nozzles; Vertical Landing

20070030966 NASA Langley Research Center, Hampton, VA USA
An Exploratory Investigation of Jet Blast Effects on a Dust Covered Surface at Low Ambient Pressure
Spady, Jr. A. A.; December 08, 1961; In English; See also 19620000062; See also NASA-TN-D-1017; Originally recorded in 16mm, Silent, Black & White, 702ft., 19min.; DVD produced from the original 16mm recording
Report No.(s): L-671; No Copyright; Avail.: CASI: C01, DVD; Movie/Video (High Res)
ONLINE: View Movie/Video (Low Res); View Movie/Video (Medium Res)

A preliminary investigation has been conducted to determine the effects of jet blast, at low ambient pressures, on a surface covered with loose particles. Tests were conducted on configurations having from one to four nozzles at 0, 10, 20, and 30 degree cant angles and heights of 2 and 4 inches above the particle-covered surface.
Author (revised)
Jet Nozzles; Jet Blast Effects; Rocket Launching; Dust; Spacecraft Landing

20070030968 NASA Langley Research Center, Hampton, VA USA
Effect of Load-Alleviating Structure on the Landing Behavior of a Reentry-Capsule Model
Hoffman, E. L.; McGhee, J. R.; Stubbs, S. M.; March 13, 1961; In English; See also 20040008118; See also NASA-TN-D-811; Originally recorded in 16mm., Silent, Color, 77ft., 2min.; DVD produced from the original 16mm recording
Report No.(s): L-606; No Copyright; Avail.: CASI: C01, DVD; Movie/Video (High Res)
ONLINE: View Movie/Video (Low Res); View Movie/Video (Medium Res)

Model tests have been made to determine the landing-impact characteristics of a parachute-supported reentry capsule that had a compliable metal structure as a load-alleviating device. A 1/6-scale dynamic model having compliable aluminum-alloy legs designed to give a low onset rate of acceleration on impact was tested at flight-path angles of 90 degrees (vertical) and 35 degrees, at a vertical velocity of 30 ft/sec (full scale), and at contact attitudes of 0 degrees and +/-30 degrees. Landings were made on concrete, sand, and water.
Author (revised)
Landing Loads; Impact Loads; Spacecraft Landing; Space Capsules; Aluminum Alloys

20070030969 NASA Langley Research Center, Hampton, VA USA
Landing of Manned Reentry Vehicles
February 1961; In English; Originally recorded in 16mm, Silent, Color, 130ft., 4min.; DVD produced from the original 16mm recording
Report No.(s): L-600; No Copyright; Avail.: CASI: C01, DVD; Movie/Video (High Res)
ONLINE: View Movie/Video (Low Res); View Movie/Video (Medium Res)

Landing characteristics were investigated using dynamic models. The landing speeds for several let-down systems are simulated. Demonstrations include: (1) the vertical landing of parachute-supported capsules on water; (2) reduction of landing acceleration by shaping the impact surface for water entry; (3) problems created by horizontal velocity due to wind; (4) the use of energy absorbers (yielding metal legs or torus bags) for land or water landings; (5) problems associated with horizontal land landings; (6) the use of a paraglider to aid in vehicle direction control; (7) a curved undersurface to serve as a skid-rocker to convert sinking-speed energy into angular energy; (8) horizontal-type landing obtained with winged vehicles on a hard runway; (9) the dangers of high-speed water landings; and (10) the positive effects of parachute support for landing winged vehicles.
Derived from text
Aerodynamic Characteristics; Dynamic Models; Manned Spacecraft; Water Landing; Vertical Landing; Spacecraft Landing

20070030971 NASA Langley Research Center, Hampton, VA USA
1/9-Scale Saturn Model
December 23, 1960; In English; Originally recorded in 16mm, Silent, Color, 140ft., 4min.; DVD produced from the original 16mm recording
Report No.(s): L-592; No Copyright; Avail.: CASI: C01, DVD; Movie/Video (High Res)
ONLINE: View Movie/Video (Low Res); View Movie/Video (Medium Res)

The film shows technicians assembling the nose cone on a Saturn model rocket in a test facility. The booster configuration is show. After the nose cone is in place, a meter is attached at the joint and vibration tests are conducted.
CASI
Nose Cones; Spacecraft Models; Scale Models; Saturn Launch Vehicles

20070030974 NASA Langley Research Center, Hampton, VA USA
Preliminary Landing Tests of a 1/6-Scale Dynamic Model of a Lunar Excursion Vehicle
July 02, 1962; In English; Originally recorded in 16mm, Silent, Black & White, 240ft., 6.5min.; DVD produced from the original 16mm recording
Report No.(s): L-733; No Copyright; Avail.: CASI: C01, DVD; Movie/Video (High Res)
ONLINE: View Movie/Video (Low Res); View Movie/Video (Medium Res)

The film shows 21 trials made on 8 days of the scale Model 413 lunar landing vehicle. Attitudes tested were a pitch of 0, -15, or 15 degrees and yaw of 0 or 45 degrees. Velocities were vertical 10 and horizontal 10, though two trials were simple vertical drops.
Derived from text
Lunar Landing; Landing Simulation; Lunar Landing Modules; Dynamic Models

20070030975 NASA Langley Research Center, Hampton, VA USA
Landing Characteristics of the Apollo Spacecraft with Deployed Heat Shield Impact Attenuation Systems
Stubbs, Sandy M.; October 11, 1965; In English; See also 19660005612; See also NASA-TN-D-3059; Originally recorded in 16mm, Silent, Color, 580ft., 16min.; DVD produced from the original 16mm recording
Report No.(s): L-886; No Copyright; Avail.: CASI: C01, DVD; Movie/Video (High Res)
ONLINE: View Movie/Video (Low Res); View Movie/Video (Medium Res)

An experimental investigation was made to determine the landing characteristics of a 1/4-scale dynamic model of the Apollo spacecraft command module using two different active (heat shield deployed prior to landing) landing systems for impact attenuation. One landing system (configuration 1) consisted of six hydraulic struts and eight crushable honeycomb struts. The other landing system (configuration 2), consisted of four hydraulic struts and six strain straps. Tests made on water and the hard clay-gravel composite landing surfaces simulated parachute letdown (vertical) velocities of 23 ft/sec (7.0 m/s) (full scale). Landings made on the sand landing surface simulated vertical velocities of 30 ft/sec (9.1 m/s). Horizontal velocities of from 0 to 50 ft/sec (15 m/s) were simulated. Landing attitudes ranged from -30'degrees to 20 degrees, and the roll attitudes were O degrees, 90 degrees, and 180 degrees. For configuration 1, maximum normal accelerations at the vehicle center of gravity for landings on water, sand, and the hard clay-gravel composite surface were 9g, 20g, and 18g, respectively. The maximum normal center-of-gravity acceleration for configuration 2 which was landed only on the hard clay-gravel landing surface was approximately 19g. Accelerations for configuration 2 were generally equal to or lower than accelerations for configuration 1 and normal.
Author
Aerodynamic Characteristics; Apollo Spacecraft; Command Modules; Heat Shielding; Impact Tests; Impact Acceleration

20070030977 NASA Langley Research Center, Hampton, VA USA
Model Investigation of Technique for Full Scale Landing Impact Tests at Simulated Lunar Gravity
Blanchard, Ulysse J.; January 11, 1965; In English; See also 19650008606; See also NASA-TN-D-2586; Originally recorded in 16mm, Silent, Color, 147ft., 4min.; DVD produced from the original 16mm recording
Report No.(s): L-856; No Copyright; Avail.: CASI: C01, DVD; Movie/Video (High Res)
ONLINE: View Movie/Video (Low Res); View Movie/Video (Medium Res)

An investigation of a 1/6-scale dynamic model has been made to develop and evaluate a technique for conducting full-scale landing-impact tests at simulated lunar gravity. Landings were made at touchdown pitch attitudes of -15 degrees, 0 degrees, and 15 degrees. All landings were made with two gear pads forward and at a roll attitude of 0 degrees. Both roll and yaw attitudes were constrained. Vertical landing speed was varied from 5 to 15 feet per second (1.5 to 4.6 m/s) and horizontal speed was varied from 0 to 10 feet per second (0 to 3.0 m/s). Most of the landings were made at a vertical and horizontal speed of 10 feet per second or 3.0 m/s (45 degree flight-path angle) while pitch attitude and surface characteristics, friction and topography, were varied. These parameters were investigated with the free-body earth-gravity and the simulated lunar-gravity test techniques. The landings were made at a model mass corresponding to a full-scale lunar weight (force due to gravity) of 1,440 pounds (6.41 kN) or an earth weight of 8,640 pounds (38.4 kN).
Derived from text
Angular Acceleration; Landing Simulation; Spacecraft Models; Touchdown; Lunar Landing; Dynamic Models

20070030978 NASA Langley Research Center, Hampton, VA USA
Dynamic Model Investigation of the Landing Characteristics of a Manned Spacecraft
Thompson, William C.; December 1964; In English; See also 19650007935; See also NASA-TN-D-2497; Originally recorded in 16mm, Silent, Color, 215ft., 6min.; DVD produced from the original 16mm recording
Report No.(s): L-848; No Copyright; Avail.: CASI: C01, DVD; Movie/Video (High Res)
ONLINE: View Movie/Video (Low Res); View Movie/Video (Medium Res)

Investigations were made to study the water-landing and certain grounds-surface landing characteristics of a Gemini spacecraft model. The water landing experiments were made by simulating paraglider and parachute letdowns with two 1/6-scale model configurations. Parameters included various combinations of attitude, horizontal speed, vertical speed, and landing skids extended and retracted. Investigations were made in calm water and in waves. The paraglider landings at horizontal speeds of 63 feet per second (19.8 m/sec) which resulted in a noseover or tumbling shortly after initial water contact. The maximum longitudinal acceleration of the model in calm water was about 14g units, and the maximum angular acceleration was 66 radians per second squared. In the parachute landings with the heat shield forward, the model skidded along the water surface on the heat shield. Parachute landings with the small end forward resulted in behavior similar to that of the paraglider landings. The ground-surface landings were made with a 1/3-scale model by simulating a parachute letdown with braking

rockets, which were fired prior to touchdown to dissipate vertical velocity. In these landings, control of timing and aligning the rockets on the model was very critical, and violent behavior resulted when either rocket alignment or timing was in error. In the landings that were correctly controlled, the model either remained upright or slowly rolled over on its side.
Author (revised)
Dynamic Models; Gemini Spacecraft; Spacecraft Models; Touchdown; Landing Simulation; Manned Spacecraft; Spacecraft Landing

20070030979 NASA Langley Research Center, Hampton, VA USA
Model Test of Mars Entry Vehicles in Langley Spin Tunnel
October 08, 1964; In English; Originally recorded in 16mm, Silent, Black & White, 120ft., 3.5min; DVD produced from the original 16mm recording
Report No.(s): L-844; No Copyright; Avail.: CASI: C01, DVD; Movie/Video (High Res)
ONLINE: View Movie/Video (Low Res); View Movie/Video (Medium Res)

Four models of Mars entry vehicles tested were a sphere with cg=35 percent (measured in percent of diameter from surface); Apollo with cg=16 percent (measured in percent of maximum diameter rearward of heat shield); a 103-degree cone with cg=20 percent (measured in percent of maximum diameter rearward of small end); and a tension structure: cg=25 percent (measured in percent of maximum diameter rearward of small end).
Derived from text
Mars Landing; Spacecraft Reentry; Spin Tests; Wind Tunnel Tests

20070030980 NASA Langley Research Center, Hampton, VA USA
Performance Characteristics of a Preformed Elliptical Parachute at Altitudes between 200,000 and 100,000 Thousand Feet Obtained by In-Flight Photography
Murro, Harold N.; Whitlock, Charles, H.; October 31, 1963; In English; See also 19640005308; See also NASA-TN-D-2183; Originally recorded in 16mm, Silent, Color, 3820ft., 35.5min.; DVD produced from the original 16mm recording
Report No.(s): L-816; No Copyright; Avail.: CASI: C01, DVD; Movie/Video (High Res)
ONLINE: View Movie/Video (Low Res); View Movie/Video (Medium Res)

The performance characteristics of a pre-formed elliptical parachute at altitudes between 200,000 and 100,000 feet were obtained by means of in-flight photography. The tests demonstrate that this type of parachute will open at altitudes of about 200,000 feet if conditions such as twisting of the suspension lines or draping of the suspension lines over the canopy do not occur. Drag-coefficient values between 0.6 and 0.8 were found to be reasonable for this type of parachute system in the altitude range between 200,000 and 100,000 feet.
Author (revised)
High Altitude Tests; Parachute Descent; Parachutes; Performance Tests

20070030981 NASA Langley Research Center, Hampton, VA USA
Landing Characteristics of a Re-entry Vehicle with a Passive Landing System for Impact Alleviation
Stubbs, Sandy M.; September 10, 1963; In English; See also 19640002968; See also NASA-TN-D-2035; Originally recorded in 16mm, Silent, Color, 180ft., 4.5min.; DVD produced from the original 16mm recording
Report No.(s): L-807; No Copyright; Avail.: CASI: C01, DVD; Movie/Video (High Res)
ONLINE: View Movie/Video (Low Res); View Movie/Video (Medium Res)

An experimental investigation was made to determine the landing characteristics of a 1/8-scale dynamic model of a reentry vehicle using a passive landing system to alleviate the landing-impact loads. The passive landing system consisted of a flexible heat shield with a small section of aluminum honeycomb placed between the heat shield and the crew compartment at the point that would be the first to contact the landing surface. The model was landed on concrete and sand landing surfaces at parachute letdown velocities. The investigations simulated a vertical velocity of 30 ft/sec (full scale), horizontal velocities of 0, 15, 30, 40, and 50 ft/sec (full scale), and landing attitudes ranging from -30 degrees to 20 degrees. The model investigation indicated that stable landings could be made on a concrete surface at horizontal velocities up to about 30 ft/sec, but the stable landing-attitude range at these speeds was small. The aluminum honeycomb bottomed occasionally during landings on concrete. When bottoming did not occur, maximum normal and longitudinal accelerations at the center of gravity of the vehicle were approximately 50g and 30g, respectively.
Author
Spacecraft Landing; Dynamic Models; Reentry Vehicles; Touchdown; Landing Loads

20070030982 NASA Langley Research Center, Hampton, VA USA

Characteristics of a Lunar Landing Configuration Having Various Multiple-Leg Landing-Gear Arrangements

Blanchard, Ulysse J.; September 08, 1963; In English; See also 19640005067; See also NASA-TN-D-2027; Originally recorded in 16mm, Silent, Color, 560ft., 15min.; DVD produced from the original 16mm recording

Report No.(s): L-803; No Copyright; Avail.: CASI: C01, DVD; Movie/Video (High Res)

ONLINE: View Movie/Video (Low Res); View Movie/Video (Medium Res)

An experimental investigation has been made of some lunar-landing characteristics of a 1/6-scale dynamic model of a landing module having multiple-leg landing-gear systems. Symmetric four-point and five-point systems and an asymmetric four-point system were investigated. The landing-gear legs were inverted tripod arrangements having a telescoping main strut which incorporated a yielding-metal strap for energy dissipation, hinged V-struts, and circular pads. The landing tests were made by launching a free model onto an impenetrable hard surface (concrete) and onto a powdered-pumice overlay of various depths. Landing motion and acceleration data were obtained for a range of touchdown speeds, touchdown speeds, touch attitudes, and landing-surface conditions. Symmetric four-point and five-point systems and an Maximum normal acceleration experienced at the module center of gravity during landings on hard surface or pumice was 2g (full-scale lunar value in terms of earth's gravity) over a wide range of touchdown conditions. Maximum angular acceleration experienced was 12-1/2 radians/sec(exp 2) and maximum longitudinal acceleration was 1-3/4 g. The module was very stable with all gear configurations during landings on hard surface (coefficient of friction, microns=0.4) at all conditions tested. Some overturn instability occurred during landings on powdered pumice (microns=0.7 to 1.0) depending upon flight path, pitch and yaw attitude, depth of pumice, surface topography, and landing-gear configuration. The effect of stability of roll attitude for the limited amount of roll-attitude landing data obtained was insignificant. Compared with the four-point system, the five-point system with equal maximum gear radius increased landing stability slightly and improved the static stability for subsequent lunar launch. A considerable increase in landing stability in the direction of motion was obtained with an asymmetric four-point gear having two pads offset to increase gear radius by 33 percent in the direction of horizontal flight.

Author

Lunar Landing; Landing Gear; Scale Models; Dynamic Models; Lunar Landing Modules; Landing Simulation; Impact Tests

20070030983 NASA Langley Research Center, Hampton, VA USA

Rendezvous Docking Simulator

August 1963; In English; Originally recorded in 16mm, Color, 180ft., 5min.; DVD produced from the original 16mm recording

Report No.(s): L-802; No Copyright; Avail.: CASI: C01, DVD; Movie/Video (High Res)

ONLINE: View Movie/Video (Low Res); View Movie/Video (Medium Res)

The simulation demonstrated linear and gimbal motions of the capsule and a Gemini-Agena docking.

Derived from text

Agena Rocket Vehicles; Spacecraft Docking; Gemini Spacecraft; Spacecraft Docking Modules

20070030985 NASA Langley Research Center, Hampton, VA USA

Dynamic Model Investigation of a 1/20 Scale Gemini Spacecraft in the Langley Spin Tunnel

Lee, Henry A.; Costigan, Peter J.; Bowman, James S., Jr.; November 15, 1963; In English; See also 19640010368; See also NASA-TN-D-2191; Originally recorded in 16mm, Silent, Black & White, 280ft., 10.5min

Report No.(s): L-788; No Copyright; Avail.: CASI: C01, DVD; Movie/Video (High Res)

ONLINE: View Movie/Video (Low Res); View Movie/Video (Medium Res)

The investigation was conducted in the Langley spin tunnel. The tunnel is an atmospheric wind tunnel with a vertically rising airstream in the test section and a maximum airspeed of approximately 90 feet per second. For this investigation, the model was hand launched into the vertically rising airstream. At times the model, both with and without a drogue parachute, was launched gently with as little disturbance as possible to determine what motions of the spacecraft were self-excited. At other times, the spacecraft with pre-deployed drogue parachute was launched into various spinning motions to determine the effectiveness of the drogue parachute in terminating these spinning motions. During drogue-parachute deployment tests, the spacecraft was launched into various spinning and tumbling motions and the drogue parachute was deployed. The motions of the model were photographed with a motion-picture camera, and some of the film records were read to obtain typical time histories of the model motion. The angles of attack indicated in the time histories presented are believed to be accurate within +/-1 degree. The mass and dimensional characteristics of the dynamic model are believed to be measured to an accuracy of:

+/-1 percent for the weight, +/-1 percent for z(sub cg)/d, +/-15 percent for x (sub cg), and +/-5 percent for the moments of inertia. The towline and bridle-line lengths were simulated to an accuracy of +/-1 foot full scale.
Author (revised)
Wind Tunnel Tests; Dynamic Models; Gemini Spacecraft; Drag Chutes; Spacecraft Stability; Spin Stabilization

20070030986 NASA Langley Research Center, Hampton, VA USA
Investigation of the Landing Characteristics of a Re-entry Vehicle Having a Canted Multiple Air Bag Load Alleviation System
McGehee, John R.; Stubbs, Sandy M.; May 15, 1963; In English; See also 19630008895; See also NASA-TN-D-1934; Originally recorded in 16mm, Silent, Color, 110ft., 3min.; DVD produced from the original 16mm recording
Report No.(s): L-785; No Copyright; Avail.: CASI: C01, DVD; Movie/Video (High Res)
ONLINE: View Movie/Video (Low Res); View Movie/Video (Medium Res)

An investigation was made to determine the landing-impact characteristics of a reentry vehicle having a multiple-air-bag load-alleviation system. A 1/16-scale dynamic model having four canted air bags was tested at flight-path angles of 90 degrees (vertical), 45 degrees, and 27 degrees for a parachute or paraglider vertical letdown velocity of 30 feet per second (full scale). Landings were made on concrete at attitudes ranging from -l5 degrees to 20 degrees. The friction coefficient between the model heat shield and the concrete was approximately 0.4. An aluminum diaphragm, designed to rupture at 10.8 pounds per square inch gage, was used to maintain initial pressure in the air bags for a short time period.
Author
Landing Loads; Reentry Vehicles; Dynamic Models; Spacecraft Landing; Air Bag Restraint Devices

20070030987 National Advisory Committee for Aeronautics. Langley Aeronautical Lab., Langley Field, VA USA
Aeroelastic Tests of an Eight Percent Scale Saturn C-1 Block II
March 04, 1963; In English; Originally recorded in 16mm, Sound, Color, 188ft., 5.25min.; DVD produced from the original 16mm recording
Report No.(s): L-769; No Copyright; Avail.: CASI: C01, DVD; Movie/Video (High Res)
ONLINE: View Movie/Video (Low Res); View Movie/Video (Medium Res)

Buffet and flutter characteristics of Saturn Apollo mission were studied using a dynamically scaled model. The model was built around a central aluminum tube for scaled stiffness distribution and strength to resist loads imposed during testing. Styrofoam sections attached to the core provided the correct external contours. Lead weights were added for correct mass distribution. An electromagnetic shaker was used to excite the model in its flexible modes of vibration during portions of the test. The model was supported on a sting, mounted by leaf springs, cables and torsion bars. The support system provided for simulating the full scale rigid body pitch frequency with minimum restraint imposed on elastic deflections. Bending moments recorded by sensors on the aluminum tube. Several modified nose configurations were tested: The basic configuration was tested with and without a flow separator disk on the escape rocket motor, tests also were made with the escape tower and rocket motor removed completely. For the final test, the Apollo capsule was replaced with a Jupiter nose cone. The test program consisted of determining model response throughout the transonic speed range at angles of attack up to 6 degrees and measuring the aerodynamic damping over the same range for the basic model and the modified configurations. Signals from the model pickup were recorded on tape for later analysis. The data obtained were used to estimate bending moments that would be produced on the full-scale vehicle by aerodynamic forces due to buffeting.
Derived from text
Buffeting; Flutter Analysis; Aerodynamic Forces; Aeroelasticity; Saturn Launch Vehicles; Vibration; Bending Moments

20070030989 NASA Langley Research Center, Hampton, VA USA
Tests of Dynamic Scale Model of Gemini Capsule in the Langley 20-Foot Free-Spinning Tunnel
November 07, 1962; In English; Originally recorded in 16mm, Silent, Black & White, 27min DVD produced from the original 16mm recording
Report No.(s): L-754; No Copyright; Avail.: CASI: C01, DVD; Movie/Video (High Res)
ONLINE: View Movie/Video (Low Res); View Movie/Video (Medium Res)

The film shows three spin tunnel tests of a 1/20 scale model of the Gemini capsule. In the first test, the capsule spins freely. In tests 2 and 3, a drogue parachute is attached to the capsule.
CASI
Gemini Spacecraft; Drag Chutes; Spin Tests; Wind Tunnel Tests

20070030990 NASA Langley Research Center, Hampton, VA USA

Performance of a Towed, 48-Inch-Diameter (121.92) Ballute Decelerator Tested in Free-Flight Mach Numbers from 4.2 to 0.4

Usry, J. W.; November 1968; In English; See also 19690008066; See also NASA-TN-D-4943; Originally recorded in 16mm, Silent, Color, 70ft., 2min.; DVD produced from the original 16mm recording

Report No.(s): L-1002; No Copyright; Avail.: CASI: C01, DVD; Movie/Video (High Res)

ONLINE: View Movie/Video (Low Res); View Movie/Video (Medium Res)

A ballute decelerator inflated by ram air was tested in free flight to determine the inflation, drag, and stability characteristics. The decelerator had a 40-inch (101.6-cm) envelope equatorial diameter and a 10-percent burble fence. It was towed 13.5 feet (4.12 m) aft of a cone-cylinder-flare payload with a maximum diameter of 18.21 inches (46.25 cm). The decelerator was deployed at an altitude of 115,000 feet (35.1 km) at a velocity of 4400 ft/sec (1342 m/sec) and inflated at a Mach number of 4.2 and a freestream dynamic pressure of 163 lb/ft(exp 2) (7.8 kN/m(exp 2)).

Author

Ballutes; Supersonic Speed; Stability Tests; Lateral Control; Inflatable Structures

20070030991 NASA Langley Research Center, Hampton, VA USA

Flight Test of a 40-Foot Nominal-Diameter Disk-Gap-Band Parachute Deployed at a Mach Number of 1.91 and a Dynamic Pressure of 11.6 Pounds per Square Foot

Eckstrom, Clinton V.; Preisser, John S.; April 1968; In English; See also 19680014773; See also NASA-TM-X-1575; Originally recorded in 16mm, Silent, Color, 180ft., 5min.; DVD produced from the original 16mm recording

Report No.(s): L-1000; No Copyright; Avail.: CASI: C01, DVD; Movie/Video (High Res)

ONLINE: View Movie/Video (Low Res); View Movie/Video (Medium Res)

A 40-foot (12.2 meter) nominal-diameter disk-gap-band parachute was flight tested as part of the NASA Supersonic Planetary Entry Decelerator Program (SPED-I). The test parachute was ejected by a deployment mortar from an instrumented payload at an altitude of 140,000 feet (42.5 kilometers). The payload was at a Mach number of 1.91 and the dynamic pressure was 11.6 pounds per square foot (555 newtons per square meter) at the time the parachute deployment mortar was fired. The parachute reached suspension line stretch in 0.43 second with a resultant snatch force loading of 1990 pounds (8850 newtons). The maximum parachute opening load of 6500 pounds (28,910 newtons) came 0.61 second later at a total elapsed time from mortar firing of 1.04 seconds. The first full inflation occurred at 1.12 seconds and stable inflation was achieved at approximately 1.60 seconds. The parachute had an average axial-force coefficient of 0.53 during the deceleration period. During the steady-state descent portion of the flight test, the average effective drag coefficient was also 0.53 and pitch-yaw oscillations of the canopy averaged less than 10 degrees in the altitude region above 100,000 feet (30.5 meters).

Author

Supersonic Speed; Aerodynamic Coefficients; Parachute Descent; Aerodynamic Characteristics

20070030992 NASA Langley Research Center, Hampton, VA USA

Summary of Attached Inflatable Decelerator (AID) Development

April 08, 1968; In English; Originally recorded in 16mm, Silent, Color, 226ft., 6min.; DVD produced from the original 16mm recording

Report No.(s): L-997; No Copyright; Avail.: CASI: C01, DVD; Movie/Video (High Res)

ONLINE: View Movie/Video (Low Res); View Movie/Video (Medium Res)

Attached inflatable decelerators (AID) were tested in an environmental chamber, a spin tunnel, and a wind tunnel. Deployment tests were conducted in environmental chamber to examine guided and unguided water alcohol vapor inflation. Subsonic performance tests were conducted in the spin tunnel. The full-scale wind tunnel was used for AID gust and supersonic performance tests. The supersonic tests were conducted at Mach number 3.0 with 12 ounces of fluid and Mach number 2.2 with six ounces of fluid.

Derived from text

Inflatable Structures; Aerodynamic Brakes; Supersonic Speed; Wind Tunnel Tests

20070030993 NASA Langley Research Center, Hampton, VA USA

Excerpts from Test Films: Langley Impacting Structures Facility, Lunar Module

January 1968; In English; Originally recorded in 16mm, Sound, Color, 105ft., 3min.; DVD produced from the original 16mm recording

Report No.(s): L-996; No Copyright; Avail.: CASI: C01, DVD; Movie/Video (High Res)

ONLINE: View Movie/Video (Low Res); View Movie/Video (Medium Res)

The film includes excerpts from three studies: (1) Landing characteristics of a dynamic model of the HL-10 manned lifting entry vehicle, conducted by Sandy M. Stubbs, in which the vehicle landed on water at horizontal velocities of 240- and 250-feet per second (ft/sec). (2) Dynamic model investigation of water pressures and accelerations encountered during landings of the Apollo spacecraft conducted by Sandy M. Stubbs, in which horizontal velocity was 50 ft/sec. and pitch attitude was -12 and -28 degrees. (3) Comparative landing impact tests of a 1/6-scale model as a free body under earth gravity and a tethered full-scale lunar module on the Lunar Gravity Simulator. Landing 8 is shown, with a vertical velocity of 10 ft/sec. and a horizontal velocity of 8 ft/sec. Motion pictures were taken at 400 and 64 pps.

Derived from text

Dynamic Models; Impact Tests; Manned Spacecraft; Horizontal Spacecraft Landing; Reentry Vehicles

20070030994 NASA Langley Research Center, Hampton, VA USA

Flight Test of a 30-Foot Nominal Diameter Cross Parachute Deployed at a Mach Number of 1.57 and a Dynamic Pressure of 9.7 Pounds per Square Foot

Eckstrom, Clinton V.; Preisser, John S.; March 1968; In English; See also 19680012309; See also NASA-TM-X-1542; Originally recorded in 16mm, Silent, Color, 120ft., 3.5min; DVD produced from the original 16mm recording

Report No.(s): L-994; No Copyright; Avail.: CASI: C01, DVD; Movie/Video (High Res)

ONLINE: View Movie/Video (Low Res); View Movie/Video (Medium Res)

A 30-foot (9.1-meter) nominal-diameter cross-type parachute with a cloth area (reference area) of 709 square feet (65.9 square meters) was flight tested in the rocket-launched portion of the NASA Planetary Entry Parachute Program (PEPP). The test parachute was ejected from an instrumented payload by means of a mortar when the system was at a Mach number of 1.57 and a dynamic pressure of 9.7 psf. The parachute deployed to suspension-line stretch in 0.44 second with a resulting snatch-force loading of 1100 pounds (4900 newtons), Canopy inflation began at 0.58 second and a first full inflation was achieved at approximately 0.77 second. The maximum opening load occurred at 0.81 second and was 4255 pounds (18,930 newtons). Thereafter, the test item exhibited a canopy-shape instability in that the four panel arms experienced fluctuations, a 'scissoring' type of motion predominating throughout the test period. Calculated values of axial-force coefficient during the deceleration portion of the test varied between 0.35 and 1.05, with an average value of 0.69. During descent, canopy-shape variations had reduced to small amplitudes and resultant pitch-yaw angles of the payload with respect to the local vertical averaged less than 10 degrees. The effective drag coefficient, based on the vertical components of velocity and acceleration during system descent, was 0.78.

Author

Aerodynamic Coefficients; Flight Tests; Parachutes; Parachute Descent

20070031001 NASA Langley Research Center, Hampton, VA USA

Dynamic Model Investigation of Water Pressures and Accelerations Encountered During Landings of the Apollo Spacecraft

Stubbs, Sandy M.; May 11, 1967; In English; See also 19670027235; See also NASA-TN-D-3980; Originally recorded in 6mm, Silent, Color, 205ft., 5.7min.; DVD produced from the original 16mm recording

Report No.(s): L-960; No Copyright; Avail.: CASI: C01, DVD; Movie/Video (High Res)

ONLINE: View Movie/Video (Low Res); View Movie/Video (Medium Res)

An experimental investigation was made to determine impact water pressures, accelerations, and landing dynamics of a 1/4-scale dynamic model of the command module of the Apollo spacecraft. A scaled-stiffness aft heat shield was used on the model to simulate the structural deflections of the full-scale heat shield. Tests were made on water to obtain impact pressure data at a simulated parachute letdown (vertical) velocity component of approximately 30 ft/sec (9.1 m/sec) full scale. Additional tests were made on water, sand, and hard clay-gravel landing surfaces at simulated vertical velocity components of 23 ft/sec (7.0 m/sec) full scale. Horizontal velocity components investigated ranged from 0 to 50 ft/sec (15 m/sec) full scale

and the pitch attitudes ranged from -40 degrees to 29 degrees. Roll attitudes were O degrees, 90 degrees, and 180 degrees, and the yaw attitude was 0 degrees.
Author
Apollo Spacecraft; Water Pressure; Dynamic Models; Command Modules; Spacecraft Landing; Impact Loads; Landing Simulation

20070031002 NASA Langley Research Center, Hampton, VA USA
Low Speed Dynamic Model Investigation of Apollo Command Module Configuration in the Langley Spin Tunnel
Lee, Henry A.; Burk, Sanger M., Jr.; February 15, 1967; In English; See also 19670023693; See also NASA-TN-D-3888; Originally recorded in 16mm, Silent, Black & White, 165ft., 4.5min.; DVD produced from the original 16mm recording
Report No.(s): L-948; No Copyright; Avail.: CASI: C01, DVD; Movie/Video (High Res)
ONLINE: View Movie/Video (Low Res); View Movie/Video (Medium Res)

An investigation has been conducted in the Langley spin tunnel to determine the dynamic stability of the Apollo command module at low subsonic speeds, both with and without drogue parachutes. The investigation consisted of tests to determine (1) the dynamic stability of the command module alone, (2) the motion of the command module during the deployment of a drogue parachute, (3) the effect of various drogue-parachute configurations on the stability of the command module, and (4) the effect of modifications to the command module to prevent an apex-forward trim condition.
Author
Command Modules; Apollo Spacecraft; Dynamic Models; Wind Tunnel Tests; Drag Chutes

20070031004 NASA Langley Research Center, Hampton, VA USA
Dynamic Model Investigation of the Rough-Water Landing Characteristics of a Spacecraft
Thompson, William C.; November 1966; In English; See also 19670013952; See also NASA-TN-D-3774; Originally recorded in 16mm, Silent, Color, 135ft., 3.5min.; DVD produced from the original 16mm recording
Report No.(s): L-940; No Copyright; Avail.: CASI: C01, DVD; Movie/Video (High Res)
ONLINE: View Movie/Video (Low Res); View Movie/Video (Medium Res)

The investigation was made to study the rough-water landing characteristics of a Gemini type of spacecraft. The investigations were made with a 1/6-scale dynamic model in a simulated sea state 4 rough water. Parachute letdown landings were simulated with the model at various yaw angles and horizontal velocities. The vertical velocity and landing attitude remained constant. The range of maximum lateral and longitudinal acceleration was from about 3-1/2g to 16g while that for the maximum normal acceleration was from lg to 15g. The range of maximum angular acceleration was from about 0 to 190 radians per second(exp 2). The smoothest behavior and the lowest angular acceleration occurred at the 90 degree yaw angle. The normal acceleration was near minimum at this condition.
Author
Gemini Spacecraft; Dynamic Models; Water Landing; Yaw; Spacecraft Landing

20070031006 NASA Langley Research Center, Hampton, VA USA
Deployment and Performance Characteristics of 5-Foot Diameter (1.5m) Attached Inflatable Decelerators from Mach Numbers 2.2-4.4
Bohon, Herman L.; Miserentino, Robert; May 1970; In English; See also 19700026642; See also NASA-TN-D5840; Originally recorded in 16mm, Silent, Color, 160ft., 4.5min.; DVD produced from the original 16mm recording
Report No.(s): L-1080; No Copyright; Avail.: CASI: C01, DVD; Movie/Video (High Res)
ONLINE: View Movie/Video (Low Res); View Movie/Video (Medium Res)

Deployment characteristics and steady-state performance data were obtained over the Mach number range from 2.2 to 4.4 and at angles of attack from 0 degrees to l0 degrees. All attached inflatable decelerator (AID) models deployed successfully and exhibited flutter-free performance after deployment. Shock loads commonly associated with inflation of parachutes during deployment were not experienced. Force and moment data and ram-air pressure data were obtained throughout the Mach number range and at angles of attack from 0 degrees to l0 degrees. The high drag coefficient of 1.14 was in good agreement with the value predicted by the theory used in the design and indicated other AID shapes may be designed on a rational basis with a high degree of confidence.
Author
Inflatable Structures; Aerodynamic Brakes; Parachutes; Supersonic Speed; Wind Tunnel Tests; Deceleration

20070031010 NASA Langley Research Center, Hampton, VA USA

Scaled Lunar Module Jet Erosion Experiments

Land, Norman S.; Scholl, Harland F.; March 04, 1966; In English; See also 19690013268; See also NASA-TN-D-5051; Originally recorded in 16mm, Silent, Color, 185ft., 5.1min.; DVD produced from the original 16mm recording

Report No.(s): L-1043; No Copyright; Avail.: CASI: C01, DVD; Movie/Video (High Res)

ONLINE: View Movie/Video (Low Res); View Movie/Video (Medium Res)

An experimental research program was conducted on the erosion of particulate surfaces by a jet exhaust. These experiments were scaled to represent the lunar module (LM) during landing. A conical cold-gas nozzle simulating the lunar module nozzle was utilized. The investigation was conducted within a large vacuum chamber by using gravel or glass beads as a simulated soil. The effects of thrust, descent speed, nozzle terminal height, particle size on crater size, and visibility during jet erosion were determined.

Author

Jet Exhaust; Conical Nozzles; Descent; Visibility; Soil Erosion; Lunar Landing Modules

20070031011 NASA Langley Research Center, Hampton, VA USA

Flight Tests Results from Supersonic Deployment of an 18-Foot Diameter (5.49 meter) Towed Ballute Decelerator

Mayhue, Robert J.; Eckstrom, Clinton V.; March 1969; In English; See also 19690017080; See also NASA-TM-X-1773; Originally recorded in 16mm, Silent, Color, 112ft., 3min.; DVD produced from the original 16mm recording

Report No.(s): L-1045; No Copyright; Avail.: CASI: C01, DVD; Movie/Video (High Res)

ONLINE: View Movie/Video (Low Res); View Movie/Video (Medium Res)

A ram-air-inflated, towed ballute decelerator having a maximum frontal diameter of 18 feet (5.49 meters) was deployed during free flight at a Mach number of 3.15 and a dynamic pressure of 38.5 lb/ft(exp 2) (1843.4 newtons/m(exp 2)). Deployment and extraction of the test ballute were normal but inflation stopped about 1 second after mortar firing and produced an average plateau drag force of 1500 pounds (6.7 kN) for about 1 second. Approximately 30 percent of expected total frontal area was obtained.

Author

Flight Tests; Ballutes; Supersonic Speed; Failure

20070031012 NASA Langley Research Center, Hampton, VA USA

Flight Test of a 40-Foot Nominal Diameter Disk-Gap-Band Parachute Deployed at a Mach Number of 3.31 and a Dynamic Pressure of 10.6 Pounds per Square Foot

Eckstrom, Clinton V.; November 1969; In English; See also 19700010021; See also NASA-TM-X-1924; Originally recorded in 16mm, Silent, Color, 116ft., 3.2min.; DVD produced from the original 16mm recording

Report No.(s): L-1066; No Copyright; Avail.: CASI: C01, DVD; Movie/Video (High Res)

ONLINE: View Movie/Video (Low Res); View Movie/Video (Medium Res)

A 40-foot-nominal-diameter (12.2 meter) disk-gap-band parachute was flight tested as part of the NASA supersonic high altitude parachute experiment (SHAPE) program. The test parachute (which included an experimental energy absorber in the attachment riser) was deployed from an instrumented payload by means of a deployment mortar when the payload was at a Mach number of 3.31 and a free-stream dynamic pressure of 10.6 pounds per square foot (508 newtons per square meter). The parachute deployed properly, the canopy inflating to a full-open condition at 1.03 seconds after mortar firing. The first full inflation of the canopy was immediately followed by a partial collapse with subsequent oscillations of the frontal area from about 30 to 75 percent of the full-open frontal area. After 1.07 seconds of operation, a large tear appeared in the cloth near the canopy apex. This tear was followed by two additional tears shortly thereafter. It was later determined that a section of the canopy cloth was severely weakened by the effects of aerodynamic heating. As a result of the damage to the disk area of the canopy, the parachute performance was significantly reduced; however, the parachute remained operationally intact throughout the flight test and the instrumented payload was recovered undamaged.

Author

Aerodynamic Drag; Flight Tests; Parachutes; Supersonic Speed; Fabrics

20
SPACECRAFT PROPULSION AND POWER

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

20070030191 NASA Glenn Research Center, Cleveland, OH, USA
Future Opportunities for Dynamic Power Systems for NASA Missions
Shaltens, Richard K.; August 2007; 20 pp.; In English; International Stirling Forum 2006 (ISF2006), 26-27 Sep. 2006, Osnabruck, Germany; Original contains color illustrations
Contract(s)/Grant(s): WBS 138494.04.01.01
Report No.(s): NASA/TM-2007-214707; E-15932; No Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20070030191

Dynamic power systems have the potential to be used in Radioisotope Power Systems (RPS) and Fission Surface Power Systems (FSPS) to provide high efficiency, reliable and long life power generation for future NASA applications and missions. Dynamic power systems have been developed by NASA over the decades, but none have ever operated in space. Advanced Stirling convertors are currently being developed at the NASA Glenn Research Center. These systems have demonstrated high efficiencies to enable high system specific power (>8 W(sub e)/kg) for 100 W(sub e) class Advanced Stirling Radioisotope Generators (ASRG). The ASRG could enable significant extended and expanded operation on the Mars surface and on long-life deep space missions. In addition, advanced high power Stirling convertors (>150 W(sub e)/kg), for use with surface fission power systems, could provide power ranging from 30 to 50 kWe, and would be enabling for both lunar and Mars exploration. This paper will discuss the status of various energy conversion options currently under development by NASA Glenn for the Radioisotope Power System Program for NASA s Science Mission Directorate (SMD) and the Prometheus Program for the Exploration Systems Mission Directorate (ESMD).
Author
Fission; Stirling Cycle; NASA Programs; Energy Conversion; Space Missions; Mars Surface

20070030302 NASA Glenn Research Center, Cleveland, OH, USA
Heat Transfer Analysis of a Closed Brayton Cycle Space Radiator
Juhasz, Albert J.; August 2007; 18 pp.; In English; Fifth International Energy Conversion Engineering Conference and Exhibit (IECEC), 25-27 Jun. 2007, Saint Louis, MO, USA; Original contains color and black and white illustrations
Report No.(s): NASA/TM-2007-215003; E-16193; No Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20070030302

This paper presents a mathematical analysis of the heat transfer processes taking place in a radiator for a closed cycle gas turbine (CCGT), also referred to as a Closed Brayton Cycle (CBC) space power system. The resulting equations and relationships have been incorporated into a radiator sub-routine of a numerical triple objective CCGT optimization program to determine operating conditions yielding maximum cycle efficiency, minimum radiator area and minimum overall systems mass. Study results should be of interest to numerical modeling of closed cycle Brayton space power systems and to the design of fluid cooled radiators in general.
Author
Brayton Cycle; Heat Transfer; Solar Generators; Solar Cells; Systems Engineering

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*.

20070030208 NASA Glenn Research Center, Cleveland, OH, USA
Use of Atomic Oxygen for Increased Water Contact Angles of Various Polymers for Biomedical Applications
Beger, Lauren; Roberts, Lily; deGroh, Kim; Banks, Bruce; August 2007; 19 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): WBS 22R-612-50-81-0441-01
Report No.(s): NASA/TM-2007-214925; E-16115; Copyright; Avail.: CASI: A03, Hardcopy

In the low Earth orbit (LEO) space environment, spacecraft surfaces can be altered during atomic oxygen exposure

through oxidation and erosion. There can be terrestrial benefits of such interactions, such as the modification of hydrophobic or hydrophilic properties of polymers due to chemical modification and texturing. Such modification of the surface may be useful for biomedical applications. For example, atomic oxygen texturing may increase the hydrophilicity of polymers, such as chlorotrifluoroethylene (Aclar), thus allowing increased adhesion and spreading of cells on textured Petri dishes. The purpose of this study was to determine the effect of atomic oxygen exposure on the hydrophilicity of nine different polymers. To determine whether hydrophilicity remains static after atomic oxygen exposure or changes with exposure, the contact angles between the polymer and a water droplet placed on the polymer s surface were measured. The polymers were exposed to atomic oxygen in a radio frequency (RF) plasma asher. Atomic oxygen plasma treatment was found to significantly alter the hydrophilicity of non-fluorinated polymers. Significant decreases in the water contact angle occurred with atomic oxygen exposure. Fluorinated polymers were found to be less sensitive to changes in hydrophilicity for equivalent atomic oxygen exposures, and two of the fluorinated polymers became more hydrophobic. The majority of change in water contact angle of the non-fluorinated polymers was found to occur with very low fluence exposures, indicating potential cell culturing benefit with short treatment time.

Author

Polymers; Surface Properties; Low Earth Orbits; Radio Frequencies; Hydrophobicity; Oxygen Atoms; Earth Orbital Environments

24
COMPOSITE MATERIALS

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

20070030252 NASA Langley Research Center, Hampton, VA, USA

Measurement of Heat Transfer in Unbonded Silica Fibrous Insulation and Comparison with Theory

Daryabeigi, Kamran; Knutson, Jeffrey R.; Cunnington, George R.; June 24, 2007; 11 pp.; In English; 29th International Thermal Conductivity Conference (ITCC), 24-27 Jun. 2007, Birmingham, AL, USA; Original contains black and white illustrations

Contract(s)/Grant(s): WBS 599481.02.07.07.02.03; Copyright; Avail.: CASI: A03, Hardcopy

Effective thermal conductivity of a high porosity unbonded silica fibrous insulation specimen was measured over a pressure range of 0.001 to 750 torr (0.1 to 101.3 x 10(exp 3) Pa), and with large temperature gradients maintained across the sample thickness: hot side temperature range of 360 to 1360 K, with the cold side at room temperature. The measurements were compared with the theoretical solution of combined radiation/conduction heat transfer. The previously developed radiation heat transfer model used in this study is based on a modified diffusion approximation, and uses deterministic parameters that define the composition and morphology of the medium: distributions of fiber size and orientation, fiber volume fractions, and the spectral complex refractive index of the fibers. The close agreement between experimental and theoretical data further verifies the theoretical model over a wide range of temperatures and pressures.

Author

Insulation; Mathematical Models; Silicon Dioxide; Conductive Heat Transfer; Fiber Orientation; Approximation

20070030254 NASA Langley Research Center, Hampton, VA, USA

Thermal Testing and Analysis of an Efficient High-Temperature Multi-Screen Internal Insulation

Weiland, Stefan; Handrick, Karin; Daryabeigi, Kamran; June 24, 2007; 12 pp.; In English; 29th International Thermal Conductivity Conference (ITCC), 24-27 Jun. 2007, Birmingham, AL, USA; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 599481.02.07.07.02.03; Copyright; Avail.: CASI: A03, Hardcopy

Conventional multi-layer insulations exhibit excellent insulation performance but they are limited to the temperature range to which their components reflective foils and spacer materials are compatible. For high temperature applications, the internal multi-screen insulation IMI has been developed that utilizes unique ceramic material technology to produce reflective screens with high temperature stability. For analytical insulation sizing a parametric material model is developed that includes the main contributors for heat flow which are radiation and conduction. The adaptation of model-parameters based on effective steady-state thermal conductivity measurements performed at NASA Langley Research Center (LaRC) allows for extrapolation to arbitrary stack configurations and temperature ranges beyond the ones that were covered in the conductivity

measurements. Experimental validation of the parametric material model was performed during the thermal qualification test of the X-38 Chin-panel, where test results and predictions showed a good agreement.
Author
High Temperature; Multilayer Insulation; Thermal Analysis; Mathematical Models

20070030303 Army Research Lab., Hampton, VA, USA
Towards a Delamination Fatigue Methodology for Composite Materials
OBrien, Thomas K.; July 08, 2007; 5 pp.; In English; 16th International Conference on Composite Materials (ICCM-16), 8-13 Jul. 2007, Kyoto, Japan; Original contains color and black and white illustrations
Contract(s)/Grant(s): WBS 732759.07.09; Copyright; Avail.: CASI: A01, Hardcopy

A methodology that accounts for both delaminaton onset and growth in composite structural components is proposed for improved fatigue life prediction to reduce life cycle costs and improve accept/reject criteria for manufacturing flaws. The benefits of using a Delamination Onset Threshold (DOT) approach in combination with a Modified Damage Tolerance (MDT) approach is highlighted. The use of this combined approach to establish accept/reject criteria, requiring less conservative initial manufacturing flaw sizes, is illustrated.
Author
Composite Materials; Fatigue Life; Delaminating; Methodology; Tolerances (Mechanics)

20070030949 NASA Langley Research Center, Hampton, VA USA
Thermo-Lag Ablation Tests
January 08, 1960; In English; Originally recorded in 16mm, Silent, Color, 1130ft., 31min.; DVD produced from the original 16mm recording
Report No.(s): L-516; No Copyright; Avail.: CASI: C01, DVD; Movie/Video (High Res)
ONLINE: View Movie/Video (Low Res); View Movie/Video (Medium Res)

Thermo-lag, an ablation material made by Emerson Electric Co., was tested in the preflight jet at Wallops Island, VA. Variables included temperature and mach number.
Derived from text
Ablative Materials; Temperature Effects; High Temperature Tests

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*.

20070030220 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Variations in Stratospheric Inorganic Chlorine Between 1991 and 2006
Lary, D. J.; Waugh, D. W.; Douglass, A. R.; Stolarski, R. S.; Newman, P. A.; Mussa, H.; [2007]; 18 pp.; In English; Original contains black and white illustrations; Copyright; Avail.: CASI: A03, Hardcopy

So how quickly will the ozone hole recover? This depends on how quickly the chlorine content (Cl2) of the atmosphere will decline. The ozone hole forms over the Antarctic each southern spring (September and October). The extremely small ozone amounts in the ozone hole are there because of chemical reactions of ozone with chlorine. This chlorine originates largely from industrially produced chlorofluorocarbon (CFC) compounds. An international agreement, the Montreal Protocol, is drastically reducing the amount of chlorine-containing compounds that we are releasing into the atmosphere. To be able to attribute changes in stratospheric ozone to changes in chlorine we need to know the distribution of atmospheric chlorine. However, due to a lack of continuous observations of all the key chlorine gases, producing a continuous time series of stratospheric chlorine has not been achieved to date. We have for the first time devised a technique to make a 17-year time series for stratospheric chlorine that uses the long time series of HCl observations made from several space borne instruments and a neural network. The neural networks allow us to both inter-calibrate the various HCl instruments and to infer the total amount of atmospheric chlorine from HCl. These new estimates of Cl, provide a much needed critical test for current global models that currently predict significant differences in both Cl(sub y) and ozone recovery. These models exhibit differences

in their projection of the recovery time and our chlorine content time series will help separate the good from the bad in these projections.
Author
Chlorine; Stratosphere; Inorganic Chemistry; Geophysics

20070030223 NASA Langley Research Center, Hampton, VA, USA
Effect of LEO Exposure on Aromatic Polymers Containing Phenylphosphine Oxide Groups
Watson, K. A.; Ghose, S.; Lillehei, P. T.; Smith, J. G., Jr.; Connell, J. W.; June 03, 2007; 13 pp.; In English; SAMPE 2007 Symposium and Exhibition (52nd ISSE), 3-7 Jun. 2007, Baltimore, MD, USA; Original contains color illustrations
Contract(s)/Grant(s): WBS 321878.04.07.04; Copyright; Avail.: CASI: A03, Hardcopy

As part of the Materials on The International Space Station Experiment (MISSE), aromatic polymers containing phenylphosphine oxide groups were exposed to low Earth orbit (LEO) for approximately 4 years. All of the aromatic polymers containing phenylphosphine oxide groups survived the exposure despite the high fluence of atomic oxygen that completely eroded other polymer films such as Kapton and Mylar of comparable or greater thickness. The samples consisted of a colorless polyimide film and a poly(arylene ether benzimidazole) film and thread. The samples were characterized for changes in physical properties, thermal/optical properties (i.e. solar absorptivity and thermal emissivity), surface chemistry (X-ray photoelectron spectroscopy), and surface topography (atomic force microscopy). The data from the polymer samples on MISSE were compared to samples from the same batch of material stored under ambient conditions on Earth. In addition, comparisons were made between the MISSE samples and those subjected to shorter term space flight exposures. The results of these analyses will be presented.
Author
Low Earth Orbits; Oxides; Phenyls; Phosphines; Aromatic Compounds; Copolymers

26
METALS AND METALLIC MATERIALS

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

20070030209 NASA Glenn Research Center, Cleveland, OH, USA
Structural Benchmark Testing for Stirling Convertor Heater Heads
Krause, David L.; Kalluri, Sreeramesh; Bowman, Randy R.; August 2007; 16 pp.; In English; Space Technology and Applications International Forum (STAIF-2007), 11-15 Feb. 2007, Albuquerque, NM, USA; Original contains color illustrations
Contract(s)/Grant(s): WBS 138494.04.01.01
Report No.(s): NASA/TM-2007-214934; E-16111; Paper 28; No Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20070030209

The National Aeronautics and Space Administration (NASA) has identified high efficiency Stirling technology for potential use on long duration Space Science missions such as Mars rovers, deep space missions, and lunar applications. For the long life times required, a structurally significant design limit for the Stirling convertor heater head is creep deformation induced even under relatively low stress levels at high material temperatures. Conventional investigations of creep behavior adequately rely on experimental results from uniaxial creep specimens, and much creep data is available for the proposed Inconel-718 (IN-718) and MarM-247 nickel-based superalloy materials of construction. However, very little experimental creep information is available that directly applies to the atypical thin walls, the specific microstructures, and the low stress levels. In addition, the geometry and loading conditions apply multiaxial stress states on the heater head components, far from the conditions of uniaxial testing. For these reasons, experimental benchmark testing is underway to aid in accurately assessing the durability of Stirling heater heads. The investigation supplements uniaxial creep testing with pneumatic testing of heater head test articles at elevated temperatures and with stress levels ranging from one to seven times design stresses. This paper presents experimental methods, results, post-test microstructural analyses, and conclusions for both accelerated and non-accelerated tests. The Stirling projects use the results to calibrate deterministic and probabilistic analytical creep models of the heater heads to predict their life times.
Author
Stirling Cycle; Creep Tests; Nickel Alloys; Inconel (Trademark); Deformation; Heat Resistant Alloys; Creep Properties

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*.

20070030192 NASA Glenn Research Center, Cleveland, OH, USA
Polymethylmethacrylate (PMMA) Material Test Results for the Capillary Flow Experiments (CFE)
Lerch, Bradley A.; Thesken, John C.; Bunnell, Charles T.; August 2007; 23 pp.; In English; Original contains color and black and white illustrations
Contract(s)/Grant(s): WBS 32-376-10-30-04
Report No.(s): NASA/TM-2007-214835; E-16049; Copyright; Avail.: CASI: A03, Hardcopy

In support of the Capillary Flow Experiments (CFE) program, several polymethylmethacrylate (PMMA) flight vessels were constructed. Some vessels used a multipiece design, which was chemically welded together. Due to questions regarding the effects of the experiment fluid (silicone oil) on the weld integrity, a series of tests were conducted to provide evidence of the adequacy of the current vessel design. Tensile tests were conducted on PMMA samples that were both in the as-received condition, and also aged in air or oil for up to 8 weeks. Both welded and unwelded samples were examined. Fracture of the joints was studied using notched tensile specimens and Brazilian disk tests. Results showed that aging had no effect on tensile properties. While the welded samples were weaker than the base parent material, the weld strength was found to be further degraded by bubbles in the weld zone. Finally a fracture analysis using the worst-case fracture conditions of the vessel was performed, and the vessel design was found to have a factor of three safety margin.
Author
Polymethyl Methacrylate; Weld Strength; Tensile Tests; Tensile Properties; Mechanical Properties; Capillary Flow; Fracturing

20070030959 National Advisory Committee for Aeronautics. Langley Aeronautical Lab., Langley Field, VA USA
Experimental Ablation Cooling
Bond, Aleck C.; Rashis, Bernard; Levin, L. Ross; February 07, 1958; In English; See also 19930090170; See also NACA-RM-L58E15a; Originally recorded in 16mm, Silent, Black & White, 330 feet, 9 minutes; DVD produced from the original 16mm recording
Report No.(s): L-296; No Copyright; Avail.: CASI: C01, DVD; Movie/Video (High Res)
ONLINE: View Movie/Video (Low Res); View Movie/Video (Medium Res)

The film shows ablation tests on Teflon, nylon, a 27 percent phenolic resin, Haveg Rocketon, and graphite. Teflon hemisphere-shaped and flat face noses were tested with laboratory-scale ceramic-heated, pilot-model ceramic-heated, and electric-arc-powered air jets. Nylon hemisphere-shaped noses were tested with laboratory-scale ceramic-heated and electric-arc-powered air jets. Phenolic resin hemisphere-shaped noses were tested with laboratory-scaled ceramic-heated air jets. Haveg Rocketon and graphite hemisphere-shaped noses were tested with electric-arc-powered air jets.
Derived from text
Ablation; Ablative Materials; Cooling; High Temperature Tests; Ablative Nose Cones; Aerodynamic Heating

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*.

20070030190 NASA Glenn Research Center, Cleveland, OH, USA
Comparing the Robustness of High-Frequency Traveling-Wave Tube Slow-Wave Circuits
Chevalier, Christine T.; Wilson, Jeffrey D.; Kory, Carol L.; August 2007; 11 pp.; In English; Original contains black and white illustrations
Contract(s)/Grant(s): WBS 953033.01.03.45
Report No.(s): NASA/TP-2007-214700; E-15901; Copyright; Avail.: CASI: A03, Hardcopy

A three-dimensional electromagnetic field simulation software package was used to compute the cold-test parameters, phase velocity, on-axis interaction impedance, and attenuation, for several high-frequency traveling-wave tube slow-wave

circuit geometries. This research effort determined the effects of variations in circuit dimensions on cold-test performance. The parameter variations were based on the tolerances of conventional micromachining techniques.
Author
Circuits; Robustness (Mathematics); Micromachining; Phase Velocity; Wave Propagation; Three Dimensional Models; Electromagnetic Fields

20070030202 Research and Technology Organization, Neuilly-sur-Seine, France
HF Interference, Procedures and Tools
June 2007; 176 pp.; In English; Original contains color and black and white illustrations
Report No.(s): RTO-TR-IST-050; AC/323(IST-050)TP/44; Copyright; Avail.: CASI: C01, CD-ROM: A09, Hardcopy

This Report presents the results of the work carried out by IST-050/RTG-022, the Research Task Group (RTG) on 'HF Interference, Procedures and Tools', to address the concerns raised by the potential for unintentional radio interference to be caused by the widespread operation of broadband wire-line telecommunications systems, such as PowerLine TeleCommunications (PLT, PLC) and various forms of Digital Subscriber Line (xDSL). Increase of the existing HF noise floor by widespread use of PLT and/or xDSL will bring up problems for Military Radio Users as well as for HF Communication Intelligence (COMINT) in all NATO countries. The signal-to-noise ratio thus may be reduced for tactical and strategic HF radio as well as for fixed sensitive COMINT sites. Each Chapter of the Report addresses specific topics, namely, introduction, HF radio, characteristics of PLT and xDSL systems, emission limits, measurement methods, propagation models, EMC modelling, and EMC analysis, culminating in conclusions and recommendations. The Report also provides a comprehensive list of references and a software tool (electronically available). Briefly, the findings of the RTG do indicate that the PLT emissions have the potential to cause appreciable degradation in the exploitation of the HF spectrum by military users.
Author
Broadband; Radio Frequency Interference; Telecommunication; Signal to Noise Ratios; Electromagnetic Compatibility

20070030256 NASA Langley Research Center, Hampton, VA, USA
Phototransistors Development and their Applications to Lidar
Abedin, M. N.; Refaat, Tamer F.; Ismail, Syed; Singh, Upendra N.; June 19, 2007; 8 pp.; In English; NSTC 2007: 1st Annual NASA Science Technology Conference, 19-21 Jun. 2007, Adelphi, MD, USA; Original contains color and black and white illustrations
Contract(s)/Grant(s): WBS 478643.02.02.02.14; Copyright; Avail.: CASI: A02, Hardcopy

Custom-designed two-micron phototransistors have been developed using Liquid Phase Epitaxy (LPE), Molecular Beam Epitaxy (MBE) and Metal-Organic Chemical Vapor Deposition (MOCVD) techniques under Laser Risk Reduction Program (LRRP). The devices were characterized in the Detector Characterization Laboratory at NASA Langley Research Center. It appears that the performance of LPE- and MBE-grown phototransistors such as responsivity, noise-equivalent-power, and gain, are better than MOCVD-grown devices. Lidar tests have been conducted using LPE and MBE devices under the 2-micrometer CO2 Differential Absorption Lidar (DIAL) Instrument Incubator Program (IIP) at the National Center for Atmospheric Research (NCAR), Boulder, Colorado. The main focus of these tests was to examine the phototransistors performances as compared to commercial InGaAs avalanche photodiode by integrating them into the Raman-shifted Eye-safe Aerosol Lidar (REAL) operating at 1.543 micrometers. A simultaneous measurement of the atmospheric backscatter signals using the LPE phototransistors and the commercial APD demonstrated good agreement between these two devices. On the other hand, simultaneous detection of lidar backscatter signals using MBE-grown phototransistor and InGaAs APD, showed a general agreement between these two devices with a lower performance than LPE devices. These custom-built phototransistors were optimized for detection around 2-micrometer wavelength while the lidar tests were performed at 1.543 micrometers. Phototransistor operation at 2-micron will improve the performance of a lidar system operating at that wavelength. Measurements include detecting hard targets (Rocky Mountains), atmospheric structure consisting of cirrus clouds and boundary layer. These phototransistors may have potential for high sensitivity differential absorption lidar measurements of carbon dioxide and water vapor at 2.05-micrometers and 1.9-micrometers, respectively.
Author
Optical Radar; Phototransistors; Earth Sciences; Liquid Phase Epitaxy; Fabrication

20070030939 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

Star Tracker Based ATP System Conceptual Design and Pointing Accuracy Estimation

Orfiz, Gerardo G.; Lee, Shinhak; January 26, 2006; 10 pp.; In English; SPIE Photonics West: Free Space Laser Conference Technologies XVIII, 2 Jan. 2006, San Jose, CA, USA; Original contains black and white illustrations; Copyright; Avail.: Other Sources

ONLINE: http://hdl.handle.net/2014/40166

A star tracker based beaconless (a.k.a. non-cooperative beacon) acquisition, tracking and pointing concept for precisely pointing an optical communication beam is presented as an innovative approach to extend the range of high bandwidth (> 100 Mbps) deep space optical communication links throughout the solar system and to remove the need for a ground based high power laser as a beacon source. The basic approach for executing the ATP functions involves the use of stars as the reference sources from which the attitude knowledge is obtained and combined with high bandwidth gyroscopes for propagating the pointing knowledge to the beam pointing mechanism. Details of the conceptual design are presented including selection of an orthogonal telescope configuration and the introduction of an optical metering scheme to reduce misalignment error. Also, estimates are presented that demonstrate that aiming of the communications beam to the Earth based receive terminal can be achieved with a total system pointing accuracy of better than 850 nanoradians (3 sigma) from anywhere in the solar system. Author

Target Acquisition; Star Trackers; Accuracy; Optical Communication; Communication Networks; Bandwidth; Space Communication; Beams (Radiation)

20070030942 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

Error Analysis for High Resolution Topography with Bi-Static Single-Pass SAR Interferometry

Muellerschoen, Ronald J.; Chen, Curtis W.; Hensley, Scott; Rodriguez, Ernesto; April 24, 2006; 9 pp.; In English; IEEE Radar Conference, Verona, New York, April 24, 2006, 24 Apr. 2006, Verona, NY, USA; Original contains black and white illustrations; Copyright; Avail.: Other Sources

ONLINE: http://hdl.handle.net/2014/40143

We present a flow down error analysis from the radar system to topographic height errors for bi-static single pass SAR interferometry for a satellite tandem pair. Because of orbital dynamics the baseline length and baseline orientation evolve spatially and temporally, the height accuracy of the system is modeled as a function of the spacecraft position and ground location. Vector sensitivity equations of height and the planar error components due to metrology, media effects, and radar system errors are derived and evaluated globally for a baseline mission. Included in the model are terrain effects that contribute to layover and shadow and slope effects on height errors. The analysis also accounts for nonoverlapping spectra and the non-overlapping bandwidth due to differences between the two platforms' viewing geometries. The model is applied to a 514 km altitude 97.4 degree inclination tandem satellite mission with a 300 m baseline separation and X-band SAR. Results from our model indicate that global DTED level 3 can be achieved.

Author

Interferometry; Topography; Error Analysis; Superhigh Frequencies; Terrain; Position (Location); Bandwidth

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*.

20070030308 NASA Langley Research Center, Hampton, VA, USA

Control of Space-Based Electron Beam Free Form Fabrication

Seifzer. W. J.; Taminger, K. M.; August 06, 2007; 9 pp.; In English; 18th Annual Solid Freeform Fabrication Symposium, 6-8 Aug. 2007, Austin, TX, USA; Original contains color illustrations

Contract(s)/Grant(s): WBS 561581.02.08.07.15.03; No Copyright; Avail.: CASI: A02, Hardcopy

ONLINE: http://hdl.handle.net/2060/20070030308

Engineering a closed-loop control system for an electron beam welder for space-based additive manufacturing is challenging. For earth and space based applications, components must work in a vacuum and optical components become occluded with metal vapor deposition. For extraterrestrial applications added components increase launch weight, increase complexity, and increase space flight certification efforts. Here we present a software tool that closely couples path planning

and E-beam parameter controls into the build process to increase flexibility. In an environment where data collection hinders real-time control, another approach is considered that will still yield a high quality build.
Author
Electron Beams; Fabrication; Control Systems Design; Feedback Control; Forming Techniques; Additives

20070030828 NASA Langley Research Center, Hampton, VA, USA; NASA Langley Research Center, Hampton, VA, USA
Far-Infrared Blocked Impurity Band Detector Development
Hogue, H. H.; Guptill, M. T.; Monson, J. C.; Stewart, J. W.; Huffman, J. E.; Mlynczak, M. G.; Abedin, M. N.; August 26, 2007; 11 pp.; In English; 2007 SPIE Photonics and Optics Conference, 26-30 Aug. 2007, San Diego, CA, USA; Original contains color and black and white illustrations
Contract(s)/Grant(s): NNL06AA25C; Copyright; Avail.: CASI: A03, Hardcopy

DRS Sensors & Targeting Systems, supported by detector materials supplier Lawrence Semiconductor Research Laboratory, is developing far-infrared detectors jointly with NASA Langley under the Far-IR Detector Technology Advancement Partnership (FIDTAP). The detectors are intended for spectral characterization of the Earth's energy budget from space. During the first year of this effort we have designed, fabricated, and evaluated pilot Blocked Impurity Band (BIB) detectors in both silicon and germanium, utilizing pre-existing customized detector materials and photolithographic masks. A second-year effort has prepared improved silicon materials, fabricated custom photolithographic masks for detector process, and begun detector processing. We report the characterization results from the pilot detectors and other progress.
Author
Fabrication; Far Infrared Radiation; Impurities; Detectors; Energy Bands

20070030859 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
Lead-Free vs Tin-Lead Reliability of Advanced Electronic Assemblies
Ghaffarian, Reza; December 6, 2005; 9 pp.; In English; Microelectronic Reliability on Quality Workshop, 6-7 Dec. 2005, Manhattan Beach, CA, USA; Original contains black and white illustrations; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/40172

This presentation will provide the technical background and specific information published in literature related to reliability test, analyses, modeling, and associated issues for lead-free solder package assemblies in comparison to their tin-lead solder alloys. It also presents current understanding of lead-free thermal cycle test performance in support.
Author
Reliability Analysis; Electronic Equipment; Solders; Temperature Effects; Tin

20070030904 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Effect of Temperature Cycling and Exposure to Extreme Temperatures on Reliability of Solid Tantalum Capacitors
Teverovsky, Alexander; March 25, 2007; 18 pp.; In English; The Passive Components Conference (CARTS 2007), 25-29 Mar. 2007, Albuquerque, NM, USA; Original contains black and white illustrations; Copyright; Avail.: CASI: A03, Hardcopy

Commercial solid chip tantalum capacitors are typically rated to a temperature range from -55 C to +125 C, for both operational and storage conditions. For most electronic components, the storage temperature range is wider than the operational one, and the reason for the relatively narrow storage temperature for tantalum capacitors is not clear. Parts manufactured for the automotive industry, for example THJ capacitors available from AVX, have a continuous operating temperature of 150 C and are tested by temperature cycling between -55 C and +150 C (however, five cycles only). Military-grade tantalum capacitors manufactured according to MIL-PRF-55365 are rated to the same temperature range as commercial parts. During manufacturing, unmounted parts are subjected to five thermal shocks (TS) between -55 C and +125 C as a part of conformance inspection and to 10 TS as a part of qualification inspection (mounted). This means that no testing guarantees that these parts can withstand multiple cycling even within the operating temperature range. Contrary to tantalum capacitors, military-grade ceramic chip capacitors manufactured per MIL-PRF-123 and microcircuits manufactured per MIL-PRF-38535 have much more stringent requirements for temperature cycling (TC). Ceramic capacitors should demonstrate the capability to withstand 100 TS between -55 C and +125 C, and the microcircuits during qualification testing are stressed with 100 TC between -65 C and +150 C. In this work, results of multiple TC testing (up to 1,000 cycles) of different types of solid tantalum capacitors are analyzed and reported. Deformation of chip tantalum capacitors during temperature variations simulating reflow soldering conditions was measured to evaluate the possibility of the pop-corning effect in the parts. To simulate the effect of short-time exposures to solder reflow temperatures on the reliability of ta!talum capacitors, several part types were subjected to multiple cycles (up to 100) between room temperature and 240 C with

periodical measurements of electrical characteristics of the parts. Mechanisms of degradation caused by temperature cycling and exposure to high temperatures, and the requirements of MIL-PRF-55365 for assessment of the resistance of the parts to soldering heat are
Derived from text
Capacitors; Performance Tests; Tantalum; Temperature Effects; Thermal Shock; Thermodynamic Cycles; Thermal Stresses; Thermal Degradation; Accelerated Life Tests

20070030935 NASA Langley Research Center, Hampton, VA, USA
Robustness Analysis of Integrated LPV-FDI Filters and LTI-FTC System for a Transport Aircraft
Khong, Thuan H.; Shin, Jong-Yeob; August 20, 2007; 22 pp.; In English; AIAA Guidance, Navigation, and Control Conference and Exhibit, 20-23 August 2007, Hilton Head, SC, USA; Original contains color and black and white illustrations
Contract(s)/Grant(s): NCC1-02043; No Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20070030935

This paper proposes an analysis framework for robustness analysis of a nonlinear dynamics system that can be represented by a polynomial linear parameter varying (PLPV) system with constant bounded uncertainty. The proposed analysis framework contains three key tools: 1) a function substitution method which can convert a nonlinear system in polynomial form into a PLPV system, 2) a matrix-based linear fractional transformation (LFT) modeling approach, which can convert a PLPV system into an LFT system with the delta block that includes key uncertainty and scheduling parameters, 3) micro-analysis, which is a well known robust analysis tool for linear systems. The proposed analysis framework is applied to evaluating the performance of the LPV-fault detection and isolation (FDI) filters of the closed-loop system of a transport aircraft in the presence of unmodeled actuator dynamics and sensor gain uncertainty. The robustness analysis results are compared with nonlinear time simulations.
Author
Fault Detection; Isolation; Linear Parameter-Varying Control; Linear Systems; Mathematical Models; Robustness (Mathematics); Electronic Filters; Transport Aircraft; Time Response

20070030937 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
Magnetometer Based on the Opto-Electronic Oscillator
Matsko, Andrey B.; Strekalov, Dmitry; Maleki, Lute; December 1, 2005; 7 pp.; In English; MRS Fall Meeting, 1 Dec. 2005, Boston, MA, USA; Original contains black and white illustrations; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/40168

We theoretically propose and discuss properties of two schemes of an all-optical self-oscillating magnetometer based on an opto-electronic oscillator stabilized with an atomic vapor cell. Proof of the principle DC magnetic field measurements characterized with 2 x 10(exp -7) G sensitivity and 1 - 1000 mG dynamic range in one of the schemes are demonstrated.
Author
Magnetometers; Self Oscillation; Direct Current; Magnetic Fields; Electric Fields; Dynamic Range

20070031103 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
Tuning of MEMS Gyroscope using Evolutionary Algorithm and 'Switched Drive-Angle' Method
Keymeulen, Didier; Ferguson, Michael I.; Breuer, Luke; Peay, Chris; Oks, Boris; Cheng, Yen; Kim, Dennis; MacDonald, Eric; Foor, David; Terrile, Rich; Yee, Karl; March 6, 2006; 7 pp.; In English; IEEE Aerospace Conference, 4-11 Mar. 2006, Big Sky, MT, USA; Original contains black and white illustrations; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/40146

We propose a tuning method for Micro-Electro-Mechanical Systems (MEMS) gyroscopes based on evolutionary computation that has the capacity to efficiently increase the sensitivity of MEMS gyroscopes through tuning and, furthermore, to find the optimally tuned configuration for this state of increased sensitivity. We present the results of an experiment to determine the speed and efficiency of an evolutionary algorithm applied to electrostatic tuning of MEMS micro gyros. The MEMS gyro used in this experiment is a pyrex post resonator gyro (PRG) in a closed-loop control system. A measure of the quality of tuning is given by the difference in resonant frequencies, or frequency split, for the two orthogonal rocking axes. The current implementation of the closed-loop platform is able to measure and attain a relative stability in the sub-millihertz range, leading to a reduction of the frequency split to less than 100 mHz.
Author
Gyroscopes; Microelectromechanical Systems; Field-Programmable Gate Arrays; Resonators; Resonant Frequencies; Electrostatics

20070031104 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
Embedded Resistors and Capacitors in Organic and Inorganic Substrates
Gerke, Robert David; Ator, Danielle; March 4, 2006; 18 pp.; In English; IEEE Aerospace Conference, 4-11 Mar. 2006, Big Sky, MT, USA; Original contains black and white illustrations; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/40156

Embedded resistors and capacitors were purchased from two technology; organic PWB and inorganic low temperature co-fire ceramic (LTCC). Small groups of each substrate were exposed to four environmental tests and several characterization tests to evaluate their performance and reliability. Even though all passive components maintained electrical performance throughout environmental testing, differences between the two technologies were observed. Environmental testing was taken beyond manufacturers' reported testing, but general not taken to failure. When possible, data was quantitatively compared to manufacturer's data.
Author
Embedding; Resistors; Performance Tests; Environmental Tests; Capacitors

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*.

20070030051 NASA Langley Research Center, Hampton, VA, USA
Influence of Finite Span and Sweep on Active Flow Control Efficacy
Greenblatt, David; Washburn, Anthony E.; June 25, 2007; 24 pp.; In English; 25th AIAA Applied Aerodynamics Conference, 25-28 Jun. 2007, Miami, FL, USA; Original contains color and black and white illustrations
Contract(s)/Grant(s): WBS 73259.07.03
Report No.(s): AIAA Paper 2007-4275; Copyright; Avail.: CASI: A03, Hardcopy

Active flow control efficacy was investigated by means of leading-edge and flap-shoulder zero mass-flux blowing slots on a semispan wing model that was tested in unswept (standard) and swept configurations. On the standard configuration, stall commenced inboard, but with sweep the wing stalled initially near the tip. On both configurations, leading-edge perturbations increased C(sub L,max) and post stall lift, both with and without deflected flaps. Without sweep, the effect of control was approximately uniform across the wing span but remained effective to high angles of attack near the tip; when sweep was introduced a significant effect was noted inboard, but this effect degraded along the span and produced virtually no meaningful lift enhancement near the tip, irrespective of the tip configuration. In the former case, control strengthened the wingtip vortex; in the latter case, a simple semi-empirical model, based on the trajectory or streamline of the evolving perturbation, served to explain the observations. Control on finite-span flaps did not differ significantly from their two-dimensional counterpart, while control over a tip flap produced significant variations to all three moments in the presence of large deflection and these variations were linear with input slot momentum. Control from the flap produced expected lift enhancement and CL,max improvements in the absence of sweep, but these improvements degraded with the introduction of sweep.
Author
Active Control; Semispan Models; Wing Span; Sweep Effect; Leading Edges; Flaps (Control Surfaces); Flow Distribution

20070030119 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Loop Heat Pipe Operation with Thermoelectric Converters and Coupling Blocks
Ku, Jentung; Nagano, Hosei; June 25, 2007; 14 pp.; In English; 5th International Energy Conversion Engineering Conference and Exhibit, 25-27 June 2007, St. Louis, MO, USA; Original contains black and white illustrations
Report No.(s): AIAA Paper 2007-4713; Copyright; Avail.: CASI: A03, Hardcopy

This paper presents theoretical and experimental studies on using thermoelectric converters (TECs) and coupling blocks to control the operating temperature of a miniature loop heat pipes (MLHP). The MLHP has two parallel evaporators and two parallel condensers, and each evaporator has its own integral compensation chamber (CC). A TEC is attached to each CC, and connected to the evaporator via a copper thermal strap. The TEC can provide both heating and cooling to the CC, therefore extending the LHP operating temperature over a larger range of the evaporator heat load. A bi-polar power supply is used for the TEC operation. The bipolar power supply automatically changes the direction of the current to the TEC, depending on whether the CC requires heating or cooling, to maintain the CC temperature at the desired set point. The TEC can also enhance the startup success by maintaining a constant CC temperature during the start-up transient. Several aluminum coupling blocks

are installed between the vapor line and liquid line. The coupling blocks serve as a heat exchanger which preheats the cold returning liquid so as to reduce the amount of liquid subcooling, and hence the power required to maintain the CC at the desired set point temperature. This paper focuses on the savings of the CC control heater power afforded by the TECs when compared to traditional electric heaters. Tests were conducted by varying the evaporator power, the condenser sink temperature, the CC set point temperature, the number of coupling blocks, and the thermal conductance of the thermal strap. Test results show that the TECs are able to control the CC temperature within k0.5K under all test conditions, and the required TEC heater power is only a fraction of the required electric heater power.
Author
Heat Pipes; Thermoelectric Generators; Heat Exchangers; Thermal Conductivity; Evaporators

20070030222 NASA Langley Research Center, Hampton, VA, USA
Virtual Diagnostics Interface: Real Time Comparison of Experimental Data and CFD Predictions for a NASA Ares I-Like Vehicle
Schwartz, Richard J.; Fleming, Gary A.; June 10, 2007; 12 pp.; In English; ICIASF - 22nd International Congress on Instrumentation in Aerospace Simulation Facilities, 10-14 Jun. 2007, Pacific Grove, CA, USA; Original contains color illustrations
Contract(s)/Grant(s): WBS 877868; Copyright; Avail.: CASI: A03, Hardcopy

Virtual Diagnostics Interface technology, or ViDI, is a suite of techniques utilizing image processing, data handling and three-dimensional computer graphics. These techniques aid in the design, implementation, and analysis of complex aerospace experiments. LiveView3D is a software application component of ViDI used to display experimental wind tunnel data in real-time within an interactive, three-dimensional virtual environment. The LiveView3D software application was under development at NASA Langley Research Center (LaRC) for nearly three years. LiveView3D recently was upgraded to perform real-time (as well as post-test) comparisons of experimental data with pre-computed Computational Fluid Dynamics (CFD) predictions. This capability was utilized to compare experimental measurements with CFD predictions of the surface pressure distribution of the NASA Ares I Crew Launch Vehicle (CLV) - like vehicle when tested in the NASA LaRC Unitary Plan Wind Tunnel (UPWT) in December 2006 - January 2007 timeframe. The wind tunnel tests were conducted to develop a database of experimentally-measured aerodynamic performance of the CLV-like configuration for validation of CFD predictive codes.
Author
Ares 1 Launch Vehicle; Computational Fluid Dynamics; Data Bases; Real Time Operation; Wind Tunnel Tests

20070030251 NASA Langley Research Center, Hampton, VA, USA
Mobile CARS - IRS Instrument for Simultaneous Spectroscopic Measurement of Multiple Properties in Gaseous Flows
Bivolaru, Daniel; Lee, Joseph W.; Jones, Stephen B.; Tedder, Sarah A.; Danehy, Paul M.; Weikl, M. C.; Magnotti, G.; Cutler, Andrew D.; June 10, 2007; 10 pp.; In English; Original contains color and black and white illustrations
Contract(s)/Grant(s): WBS 599489.02.07.07.06.02; Copyright; Avail.: CASI: A02, Hardcopy

This paper describes a measurement system based on the dual-pump coherent anti-Stokes Raman spectroscopy (CARS) and interferometric Rayleigh scattering (IRS) methods. The IRS measurement is performed simultaneously with the CARS measurement using a common green laser beam as a narrow-band light source. The mobile CARS-IRS instrument is designed for the use both in laboratories as well as in ground-based combustion test facilities. Furthermore, it is designed to be easily transported between laboratory and test facility. It performs single-point spatially and temporally resolved simultaneous measurements of temperature, species mole fraction of N2, O2, and H2, and two-components of velocity. A mobile laser system can be placed inside or outside the test facility, while a beam receiving and monitoring system is placed near the measurement location. Measurements in a laboratory small-scale Mach 1.6 H2-air combustion-heated supersonic jet were performed to test the capability of the system. Final setup and pretests of a larger scale reacting jet are ongoing at NASA Langley Research Center s Direct Connect Supersonic Combustor Test Facility (DCSCTF).
Author
Raman Spectroscopy; Gas Flow; Computational Fluid Dynamics; Coherent Radiation; Interferometry; Test Facilities

20070030311 NASA Langley Research Center, Hampton, VA, USA
Parametric Study of Flow Control Over a Hump Model Using an Unsteady Reynolds- Averaged Navier-Stokes Code
Rumsey, Christopher L.; Greenblatt, David; September 2007; 48 pp.; In English; Original contains color and black and white illustrations
Contract(s)/Grant(s): WBS 561581.02.08
Report No.(s): NASA/TM-2007-214897; L-19386; Copyright; Avail.: CASI: A03, Hardcopy

This is an expanded version of a limited-length paper that appeared at the 5th International Symposium on Turbulence and Shear Flow Phenomena by the same authors. A computational study was performed for steady and oscillatory flow control over a hump model with flow separation to assess how well the steady and unsteady Reynolds-averaged Navier-Stokes equations predict trends due to Reynolds number, control magnitude, and control frequency. As demonstrated in earlier studies, the hump model case is useful because it clearly demonstrates a failing in all known turbulence models: they under-predict the turbulent shear stress in the separated region and consequently reattachment occurs too far downstream. In spite of this known failing, three different turbulence models were employed to determine if trends can be captured even though absolute levels are not. Overall the three turbulence models showed very similar trends as experiment for steady suction, but only agreed qualitatively with some of the trends for oscillatory control.
Author
Navier-Stokes Equation; Reynolds Averaging; Reynolds Number; Flow Regulators; Computational Fluid Dynamics; Unsteady Flow; Parameterization

20070030932 Boeing Co., Huntington Beach, CA, USA; NASA Langley Research Center, Hampton, VA, USA
Nonlinear Aeroelastic Analysis Using a Time-Accurate Navier-Stokes Equations Solver
Kuruvila, Geojoe; Bartels, Robert E.; Hong, Moeljo S.; Bhatia, G.; June 18, 2007; 14 pp.; In English; IFASD 2007 - International Forum on Aeroelasticity and Structural Dynamics, 18-20 June 2007, Stockholm, Sweden; Original contains color and black and white illustrations; Copyright; Avail.: CASI: A03, Hardcopy

A method to simulate limit cycle oscillation (LCO) due to control surface freeplay using a modified CFL3D, a time-accurate Navier-Stokes computational fluid dynamics (CFD) analysis code with structural modeling capability, is presented. This approach can be used to analyze aeroelastic response of aircraft with structural behavior characterized by nonlinearity in the force verses displacement curve. A limited validation of the method, using very low Mach number experimental data for a three-degrees-of-freedom (pitch/plunge/flap deflection) airfoil model with flap freeplay, is also presented.
Author
Computational Fluid Dynamics; Navier-Stokes Equation; Nonlinearity; Aeroelasticity; Accuracy

20070030933 NASA Langley Research Center, Hampton, VA, USA
Experimental Study of an Axisymmetric Dual Throat Fluidic Thrust Vectoring Nozzle for Supersonic Aircraft Application
Flamm, Jeffrey D.; Deere, Karen A.; Mason, Mary L.; Berrier, Bobby L.; Johnson, Stuart K.; July 08, 2007; 28 pp.; In English; 43rd AIAA/ASME/SAE/ASEE Joint Propulsion Conference and Exhibit, 8-11 July 2007, Cincinnati, OH, USA; Original contains color and black and white illustrations
Report No.(s): AIAA Paper 2007-5084; No Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20070030933

An axisymmetric version of the Dual Throat Nozzle concept with a variable expansion ratio has been studied to determine the impacts on thrust vectoring and nozzle performance. The nozzle design, applicable to a supersonic aircraft, was guided using the unsteady Reynolds-averaged Navier-Stokes computational fluid dynamics code, PAB3D. The axisymmetric Dual Throat Nozzle concept was tested statically in the Jet Exit Test Facility at the NASA Langley Research Center. The nozzle geometric design variables included circumferential span of injection, cavity length, cavity convergence angle, and nozzle expansion ratio for conditions corresponding to take-off and landing, mid climb and cruise. Internal nozzle performance and thrust vectoring performance was determined for nozzle pressure ratios up to 10 with secondary injection rates up to 10 percent of the primary flow rate. The 60 degree span of injection generally performed better than the 90 degree span of injection using an equivalent injection area and number of holes, in agreement with computational results. For injection rates less than 7 percent, thrust vector angle for the 60 degree span of injection was 1.5 to 2 degrees higher than the 90 degree span of injection. Decreasing cavity length improved thrust ratio and discharge coefficient, but decreased thrust vector angle and thrust vectoring efficiency. Increasing cavity convergence angle from 20 to 30 degrees increased thrust vector angle by 1 degree over the range of injection rates tested, but adversely affected system thrust ratio and discharge coefficient. The dual throat nozzle concept

generated the best thrust vectoring performance with an expansion ratio of 1.0 (a cavity in between two equal minimum areas). The variable expansion ratio geometry did not provide the expected improvements in discharge coefficient and system thrust ratio throughout the flight envelope of typical a supersonic aircraft. At mid-climb and cruise conditions, the variable geometry design compromised thrust vector angle achieved, but some thrust vector control would be available, potentially for aircraft trim. The fixed area, expansion ratio of 1.0, Dual Throat Nozzle provided the best overall compromise for thrust vectoring and nozzle internal performance over the range of NPR tested compared to the variable geometry Dual Throat Nozzle.
Author
Nozzle Design; Supersonic Aircraft; Throats; Thrust Vector Control; Symmetry; Fluidics; Computational Fluid Dynamics

20070030953 National Advisory Committee for Aeronautics. Langley Aeronautical Lab., Langley Field, VA USA
Flow Studies of Decelerators at Supersonic Speeds
March 26, 1959; In English; Originally recorded in 16mm, Silent, Black & White, 350ft., 10min.; DVD produced from the original 16mm recording
Report No.(s): L-445; No Copyright; Avail.: CASI: C01, DVD; Movie/Video (High Res)
ONLINE: View Movie/Video (Low Res); View Movie/Video (Medium Res)

Wind tunnel tests recorded the effect of decelerators on flow at various supersonic speeds. Rigid parachute models were tested for the effects of porosity, shroud length, and number of shrouds. Flexible model parachutes were tested for effects of porosity and conical-shaped canopy. Ribbon dive brakes on a missile-shaped body were tested for effect of tension cable type and ribbon flare type. The final test involved a plastic sphere on riser lines.
CASI
Wind Tunnel Tests; Porosity; Supersonic Speed; Drag Chutes; Supersonic Flow

20070031083 Washington Univ., Saint Louis, MO, USA
Two-Dimensional RANS Simulation of Synthetic Jet Flow Field
Cui, J.; Agarwal, R. K.; Proceedings of the 2004 Workshop on CFD Validation of Synthetic Jets and Turbulent Separation Control; April 2007, pp. 1.8.1 - 1.8.5; In English; See also 20070031059; Original contains color and black and white illustrations; Copyright; Avail.: CASI: A01, Hardcopy

A synthetic jet is generated by a piezoelectric diaphragm embedded on one side of a cavity. Flow enters and exits the cavity through an orifice in a periodic manner. Synthetic jets have been shown to exert significant control authority in many applications and have the additional benefit of being compact with zero net mass flux. During the past several years, many experimental and simulation studies have been reported in the literature to characterize the behavior of synthetic jets and their applications in flow control. However, there has not been a systematic study to assess the current capabilities of different classes of turbulent flow solution methodologies to predict flow fields induced by the synthetic jets. The purpose of this NASA Langley workshop is to provide a systematic evaluation of various turbulent flow simulations methodologies by examining their performance against three experimental test cases. Out of the three benchmark cases, Case 1: a synthetic jet issuing into the quiescent air, has been studied here by employing a 2D grid (4 zones, 35,986 grid points total). The simulations are performed by employing the computational code WIND-v.5, which is a multi-zone structuredgrid compressible Reynolds-Averaged Navier-Stokes (RANS) solver. Several turbulence models have been tested, such as Shear-Stress Transport (SST), Spalart-Allmaras (SA), SST combined with LES. The grid size and time-step independence have also been assessed. Comparisons with the experimental data show that the SST model gives the best results.
Derived from text
Flow Distribution; Jet Flow; Reynolds Averaging; Two Dimensional Flow; Computational Fluid Dynamics; Mathematical Models; Navier-Stokes Equation; Simulation

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*.

20070030110 Princeton Lightwave, Inc., Cranbury, NJ, USA; NASA Goddard Space Flight Center, Greenbelt, MD, USA
InGaAsP Avalanche Photodetectors for Non-Gated 1.06 micrometer Photon-Counting Receivers
Itzler, Mark A.; Jiang, Xudong; Ben-Michael, Rafael; Slomkowski, Krystyna; Krainak, Michael A.; April 09, 2007; 1 pp.; In English; SPIE Defense and Security Symposium, 9-13 April 2007, Orlando, FL, USA; Copyright; Avail.: CASI: A01, Hardcopy

The efficient detection of single photons at 1.06 micron is of considerable interest for lidar/ladar systems designed for remote sensing and ranging as well as for free-space optical transmission in photon-starved applications. However, silicon-based single photon avalanche diodes (SPADs) used at shorter wavelengths have very low single photon detection efficiency (approximately 1 - 2%) at 1.06 micron, and InP/InGaAs SPADs designed for telecommunications wavelengths near 1.5 micron exhibit high dark count rates that generally inhibit non-gated (free-running) operation. To bridge this 'single photon detection gap' for wavelengths just beyond 1 micron, we have developed high performance, large area (80 - 200 micron diameter) InP-based InGaAsP quaternary absorber SPADs optimized for operation at 1.06 micron and based on a highly reliable planar geometry avalanche photodiode structure. We will show that dark count rates are sufficiently low to allow for non-gated operation while achieving detection efficiencies far surpassing those found for Si SPADs. At a detection efficiency of 10%, 80 micron diameter devices exhibit dark count rates below 1000 Hz and count rates of at least 3 MHz when operated at -40 C. Significantly higher detection efficiencies (30 - 50%) are achievable with acceptable tradeoffs in dark count rate. In this paper, we will also discuss performance modeling for these devices and compare their behavior with longer wavelength InP-based InGaAs ternary absorber SPADs fabricated on a related device design platform.
Author
Detection; Indium Gallium Arsenides; Indium Phosphides; Photometers; Photons; Photometry

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*.

20070030257 NASA Langley Research Center, Hampton, VA, USA
Recent Progress Made in the Development of High-Energy UV Transmitter
Prasad, Narasimha S.; Singh, Upendra N.; Armstrong, Darrell J.; June 19, 2007; 5 pp.; In English; NSTC 2007: 1st Annual NASA Science Technology Conference, 19-21 Jun. 2007, Adelphi, MD, USA; Original contains color illustrations
Contract(s)/Grant(s): WBS 478643.02.02.02.15; No Copyright; Avail.: CASI: A01, Hardcopy
ONLINE: http://hdl.handle.net/2060/20070030257

In this paper, the status of an all-solid-state UV converter development for ozone sensing applications is discussed. A high energy Nd:YAG laser for pumping the UV converter arrangement was recently reported. The pump is an all-solid-state, single longitudinal mode, and conductively cooled Nd:YAG laser operating at 1064 nm wavelength. Currently, this pump laser provides an output pulse energy of greater than 1J/pulse at 50 Hz PRF and a pulsewidth of 22 ns with an electrical-to-optical system efficiency of greater than 7% and a M(sup 2) value of approx. 2. The spatial profile of the output beam is a rectangular super Gaussian. This Nd:YAG pump laser has been developed to pump the nonlinear optics based UV converter arrangement to generate 320 nm and 308 nm wavelengths by means of 532 nm wavelength. Previously, this UV converter arrangement has demonstrated IR-to-UV conversion efficiency of 24% using a flash lamp pumped laser providing a round, flat top spatial profile. Recently, the UV converter was assembled and tested at NASA LaRC for pumping with the diode pumped Nd:YAG laser. With current spatial profile, the UV converter was made operational. Current efforts to maximize the nonlinear conversion efficiency by refining its spatial profile to match RISTRA OPO requirements are progressing.
Author
Solid State; Transmitters; Ultraviolet Radiation; High Power Lasers; Converters

20070030314 NASA Langley Research Center, Hampton, VA, USA

A Master-Oscillator-Power-Amplifier 2-micron Laser Using Fiber Phase-conjugate Mirror

Yu, Jirong; Bai, Yingxin; Shkunov, V.; Rockwell, D.; Betin, A.; Wang, J.; Petros, M.; Petzar, Paul; Trieu, Bo; July 30, 2007; 3 pp.; In English; Nonlinear Optics: Materials, Fundamentals and Applications Topical Meeting and Tabletop Exhibit, 30 Jul. - 3 Aug. 2007, Kona, HI, USA; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 478643.02.02.02.10; Copyright; Avail.: CASI: A01, Hardcopy

For the first time, a 2-micron master-oscillator-power-amplifier laser using a fiber based phase conjugation mirror has been demonstrated. The beam quality improvement and 56% of the PCM reflectivity have been achieved.

Author

Lasers; Mirrors; Oscillators; Phase Conjugation; Power Amplifiers; Conjugates

20070031110 NASA Langley Research Center, Hampton, VA, USA

High Energy 2-micron Laser Developments

Yu, Jirong; Trieu, Bo C.; Petros, Mulugeta; Bai, Yingxin; Petzar, Paul J.; Koch, Grady J.; Singh, Upendra N.; Kavaya, Michael J.; June 28, 2007; 33 pp.; In English; 20th Annual Solid State and Diode Laser Technology Review, 25-28 June 2007, Los Angeles, CA, USA; Original contains color and black and white illustrations; Copyright; Avail.: CASI: A03, Hardcopy

This viewgraph presentation shows the development of 2-micron solid state lasers. The topics covered include: 1) Overview 2-micron solid state lasers; 2) Modeling and population inversion measurement; 3) Side pump oscillator; and 4) One Joule 2-m Laser.

CASI

Solid State Lasers; Fabrication; Laser Pumping; Amplifiers; Laser Outputs; Semiconductor Lasers

37
MECHANICAL ENGINEERING

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

20070030258 NASA Langley Research Center, Hampton, VA, USA

Development of a Pressure Sensitive Paint System for Measuring Global Surface Pressures on Rotorcraft Blades

Watkins, A. Neal; Leighty, Bradley D.; Lipford, William E.; Wong, Oliver D.; Oglesby, Donald M.; Ingram, JoAnne L.; June 10, 2007; 9 pp.; In English; ICIASFP 22nd International Congress on Instrumentation in Aerospace Simulation Facilities, 10-14 Jun. 2007, Pacific Grove, CA, USA; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 561581.02.08.07.14.02; Copyright; Avail.: CASI: A02, Hardcopy

This paper will describe the results from a proof of concept test to examine the feasibility of using Pressure Sensitive Paint (PSP) to measure global surface pressures on rotorcraft blades in hover. The test was performed using the U.S. Army 2-meter Rotor Test Stand (2MRTS) and 15% scale swept rotor blades. Data were collected from five blades using both the intensity- and lifetime-based approaches. This paper will also outline several modifications and improvements that are underway to develop a system capable of measuring pressure distributions on up to four blades simultaneously at hover and forward flight conditions.

Author

Pressure; Pressure Sensitive Paints; Rotary Wing Aircraft; Computational Fluid Dynamics; Rotor Blades (Turbomachinery)

39
STRUCTURAL MECHANICS

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

20070030205 NASA Glenn Research Center, Cleveland, OH, USA
Spherical Cryogenic Hydrogen Tank Preliminary Design Trade Studies
Arnold, Steven M.; Bednarcyk, Brett A.; Collier, Craig S.; Yarrington, Phillip W.; August 2007; 27 pp.; In English; 48th Structures, Structural Dynamics, and Materials Conference, 23-26 Apr. 2007, Waikiki, HI, USA; Original contains color illustrations
Contract(s)/Grant(s): WBS 561581.02.08.03.15.03
Report No.(s): NASA/TM-2007-214846; E-16061; Copyright; Avail.: CASI: A03, Hardcopy

A structural analysis, sizing optimization, and weight prediction study was performed by Collier Research Corporation and NASA Glenn on a spherical cryogenic hydrogen tank. The tank consisted of an inner and outer wall separated by a vacuum for thermal insulation purposes. HyperSizer (Collier Research and Development Corporation), a commercial automated structural analysis and sizing software package was used to design the lightest feasible tank for a given overall size and thermomechanical loading environment. Weight trade studies were completed for different panel concepts and metallic and composite material systems. Extensive failure analyses were performed for each combination of dimensional variables, materials, and layups to establish the structural integrity of tank designs. Detailed stress and strain fields were computed from operational temperature changes and pressure loads. The inner tank wall is sized by the resulting biaxial tensile stresses which cause it to be strength driven, and leads to an optimum panel concept that need not be stiffened. Conversely, the outer tank wall is sized by a biaxial compressive stress field, induced by the pressure differential between atmospheric pressure and the vacuum between the tanks, thereby causing the design to be stability driven and thus stiffened to prevent buckling. Induced thermal stresses become a major sizing driver when a composite or hybrid composite/metallic material systems are used for the inner tank wall for purposes such as liners to contain the fuel and reduce hydrogen permeation.
Author
Cryogenics; Structural Analysis; Failure Analysis; Composite Materials; Compression Loads; Stress-Strain Relationships; Thermal Stresses; Thermodynamics; Spherical Tanks

42
GEOSCIENCES (GENERAL)

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

20070030196 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Laboratory for Atmospheres: 2006 Technical Highlights
Stewart, Richard W.; April 2007; 162 pp.; In English; Original contains color illustrations
Report No.(s): NASA/TM-2007-214150; Rept-2007-00557-1; Copyright; Avail.: CASI: A08, Hardcopy

The 2006 Technical Highlights describes the efforts of all members of the Laboratory for Atmospheres. Their dedication to advancing Earth science through conducting research, developing and running models, designing instruments, managing projects, running field campaigns, and numerous other activities, are highlighted in this report.
Author
Atmospheric Chemistry; Earth Sciences; Earth Atmosphere; Laboratories; Remote Sensing; Climate Models

20070031033 Science Systems and Applications, Inc., Bay Saint Louis, MS, USA
Surface Obstruction Elevation Determination Using Spatially Averaged SRTM and NED Datasets
Estep, Leland; Spruce, Joseph; Slawomir, Blonski; McKellip, Rodney; [2007]; 7 pp.; In English
Contract(s)/Grant(s): NNS04AB54T
Report No.(s): SSTI-2220-0108; No Copyright; Avail.: Other Sources

The objective of this study was to evaluate the use of SRTM (Shuttle Radar Topographic Mission) and NED (National Elevation Dataset) data for determination of surface obstruction elevations. Such data serve as input to boundary layer atmospheric models that are important for mapping biologic or nuclear plume dispersion trajectory and concentration

estimates. Both urban and forested area SRTM-NED elevations were evaluated via correlation comparisons to ground truth data. It was shown that spatial averaging of both SRTM-NED elevation data and ground truth data was necessary to derive suitable correlations. It was shown that a 7x7 window aggregation appeared to be optimum for spatial averaging of both SRTM-NED and ground truth datasets. However, spatial averaging of ground truth must be held within acceptable limits to avoid inordinate information loss. The effect of autocorrelation was considered negligible for the methods and datasets used. Author

Shuttle Imaging Radar; Topography; Ground Truth; Boundary Layers; Atmospheric Models; Elevation

43
EARTH RESOURCES AND REMOTE SENSING

Includes remote sensing of earth features, phenomena and resources by aircraft, balloon, rocket, and spacecraft; analysis of remote sensing data and imagery; development of remote sensing products; photogrammetry; and aerial photography. For related instrumentation see *35 Instrumentation and Photography*.

20070030107 Jacobs Sverdrup Technology, Inc., Houston, TX, USA; NASA Johnson Space Center, Houston, TX, USA

Remote and Ground Truth Spectral Measurement Comparisons of FORMOSAT III

Abercromby, Kira Jorgensen; Hamada, Kris; Guyote, Michael; Okada, Jennifer; Barker, Edwin; September 10, 2007; 10 pp.; In English; Advanced Maui Optical and Space Surveillance (AMOS) Technologies Conference, 1-14 September 2007, Maui, HI, USA; Original contains color illustrations; Copyright; Avail.: CASI: A02, Hardcopy

FORMOSAT III are a set of six research satellites from Taiwan that were launched in April 2006. The satellites are in 800 km, 71 degree inclination orbits and separated by 24 degrees in ascending node. Laboratory spectral measurements were taken of outer surface materials on FORMOSAT III. From those measurements, a computer model was built to predict the spectral reflectance accounting for both solar phase angle and orientation of the spacecraft relative to the observer. However, materials exposed to the space environment have exhibited spectral changes including a darkening and a 'reddening' of the spectra. This 'reddening' is characterized by an increase in slope of the reflectance as the wavelength increases. Therefore, the model of pre-flight materials was augmented to include the presumed causative agent: space weathering effects. Remote data were collected on two of the six FORMOSAT satellites using the 1.6 meter telescope at the AMOS (Air Force Maui Optical and Supercomputing) site with the Spica spectrometer. Due to the separation in ascending node, observations were acquired of whichever one of the six satellites was visible on that specific night. Three nights of data were collected using the red (6000 - 9500 angstroms) filter and five nights of data were collected using the blue (3200 - 6600 angstroms) filter. A comparison of the data showed a good match to the pre-flight models for the blue filter region. The absorption feature near 5500 angstroms due to the copper colored Kapton multi-layer insulation (MLI) was very apparent in the remote samples and a good fit to the data was seen in all satellites observed. The features in the red filter regime agreed with the pre-flight model up through 7000 angstroms where the reddening begins and the slope of the remote sample increases. A comparison of the satellites showed similar features in the red and blue filter regions, i.e. the satellite surfaces were aging at the same rate. A comparison of the pre-flight model to the first month of remote measurements showed the amount by which the satellite had reddened. The second month of data observed a satellite at a higher altitude and was therefore, not compared to the first month. A third month of data was collected but of satellites at the lower altitude regime and can only be compared to the first month. One cause of the reddening that was ruled out in early papers was a possible calibration issue.
Author

Spectrum Analysis; Spectral Reflectance; Remote Sensing; Ground Truth; Computerized Simulation; Aerospace Environments

20070030132 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Overview of TRMM Data Products and Services

Stocker, Erich Franz; Aman, A.; Bman, B.; Cman, C.; April 15, 2007; 2 pp.; In English; European Geosciences General Assembly 2007, 15-20 Apr. 2007, Vienna, Austria; No Copyright; Avail.: Other Sources; Abstract Only

November 27, 2007 marks the l0th anniversary of the launch of the Tropical Rainfall Measuring Mission (TRMM) satellite. In anticipation of this anniversary, this paper will present an overview of the various TRMM data products currently available including the standard products, near real-time products, special products, and prototype products. It also will present an easy way to obtain these data. TRMM standard products have been publicly available since a few months after launch in November 1997. TRMM is currently on version 6 of the data product. Version 3 was the 'at launch' version. The approval for each of these versions came through the Joint TRMM Science Team. Standard products are divided into 3 categories: single TRMM instrument, Visible Infrared Scanner (VIRS), TRMM Microwave Imager (TMI), and Precipitation Radar (PR);

combined TRMM products (PR and TMI); finally TRMM and other satellites (combined, TMI, SSMI, AMSRE, AMSU). The single TRMM instrument products are processed through 4 levels: Level lA, science data packets processed into orbital files; Level 1B and lC, geolocated data at the instrument field of view; Level 2, geolocated, geophysical parameters at the instrument field of view; Level 3, time aggregated, gridded geophysical parameters. These products are available with 24 hours of production through an anonymous ftp account on trmmopen.gsfc.nasa.gov. The TRMM data system started to produce near real-time products at the end of 1999. They are currently available only through a controlled user account. However, approval to get access to this account can be obtained by sending a note to Erich.F.Stoclter\@nasa.gov providing the reason for access and contact information including a valid email. TRMM is not restricting access but needs the information to determine the usefulness of near-real time data to the general science community including applications agencies. TRMM near real-time products are swath products up to Level 2 of processing. The oldest data in the swath is generally no older than 120 minutes when it becomes available to the community. The real-time products including a VIRS level lB, a TMI parameter reduced 1B, a TMI level 2 parameter reduced rain product, a PR level 2 surface rain product, and a PR level 2 rain product with 25 vertical levels. Currently, TRMM also produces a gridded 3 hour global merged product from several radiometers including AMSU and from radiometercalibrated IR data. The paper also describes several simple-format gridded text products available fiom the trmmopen.gsfc.nasa.gov anonymous fip server denoted as 3668 products. These products were produced to provide rain estimates from the three TRMM instruments in a universal format (ASCII) that requires very little data format knowledge. The paper goes on to describe prototype L1 radiometer products that apply an early intercalibration approach that provides a starting point to be used for Global Precipitation Measurement mission radiometer products. The paper also provides a brief overview of a precipitation features data product being produced using TRMM products including the Lighting Imaging Sensor (LIS) using an algorithm developed at the University of Utah and distributed by that organization. The paper concludes with some possible changes to products that are planned for the next reprocessing cycle and special services such as geographical subsetting available to the science community.
Author
Data Systems; Imaging Techniques; Satellite Observation; Information Systems; Algorithms; Internet Resources; On-Line Systems; Data Bases; Information Retrieval; Remote Sensing

20070030248 NASA Langley Research Center, Hampton, VA, USA
GIFTS SM EDU Radiometric and Spectral Calibrations
Tian, J.; Reisse, R. a.; Johnson, D. G.; Gazarik, J. J.; June 25, 2007; 4 pp.; In English; 32nd International Symposium on Remote Sensing of Environment, 25-29 Jun. 2007, San Jose, Costa Rica; Original contains black and white illustrations; No Copyright; Avail.: CASI: A01, Hardcopy
ONLINE: http://hdl.handle.net/2060/20070030248

The Geosynchronous Imaging Fourier Transform Spectrometer (GIFTS) Sensor Module (SM) Engineering Demonstration Unit (EDU) is a high resolution spectral imager designed to measure infrared (IR) radiance using a Fourier transform spectrometer (FTS). The GIFTS instrument gathers measurements across the long-wave IR (LWIR), short/mid-wave IR (SMWIR), and visible spectral bands. The raw interferogram measurements are radiometrically and spectrally calibrated to produce radiance spectra, which are further processed to obtain atmospheric profiles via retrieval algorithms. This paper describes the processing algorithms involved in the calibration. The calibration procedures can be subdivided into three categories: the pre-calibration stage, the calibration stage, and finally, the post-calibration stage. Detailed derivations for each stage are presented in this paper.
Author
Imaging Spectrometers; Fourier Transformation; Geosynchronous Orbits; Remote Sensing; Modules

20070030249 NASA Langley Research Center, Hampton, VA, USA
Characterizing the Radiation Fields in the Atmosphere Using a Cloud-Aerosol-Radiation Product from Integrated CERES, MODIS, CALIPSO and CloudSat Data
Minnis, Patrick; Wielicki, Bruce; Trepte, Charles a.; Sun-Mack, Sunny; Chen, Yan; Gibson, Sharon; Kato, Seiji; Stephens, Graeme; July 23, 2007; 4 pp.; In English; IGARSS 2007- 27th IEEE International Geoscience and Remote Sensing Symposium, 23-27 Jul. 2007, Barcelona, Spain; Original contains color illustrations
Contract(s)/Grant(s): WBS 281945.02.14.01.17; Copyright; Avail.: CASI: A01, Hardcopy

CloudSat and CALIPSO cloud and aerosol information is convolved with CERES and MODIS cloud and radiation data to produce a merged 3-dimensional cloud and radiation dataset.
Author
Aerosols; CALIPSO (Pathfinder Satellite); CloudSat; MODIS (Radiometry); Algorithms; CERES (Experiment)

20070030305 NASA Langley Research Center, Hampton, VA, USA

Influence of World and Gravity Model Selection on Surface Interacting Vehicle Simulations

Madden, Michael M.; August 20, 2007; 16 pp.; In English; AIAA Modeling and Simulation Technologies Conference and Exhibit, 20-23 Aug. 2007, Hilton Head, SC, USA; Original contains color illustrations

Contract(s)/Grant(s): WBS 160961.01.02.01

Report No.(s): AIAA Paper 2007-6730; No Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: http://hdl.handle.net/2060/20070030305

A vehicle simulation is surface-interacting if the state of the vehicle (position, velocity, and acceleration) relative to the surface is important. Surface-interacting simulations perform ascent, entry, descent, landing, surface travel, or atmospheric flight. Modeling of gravity is an influential environmental factor for surface-interacting simulations. Gravity is the free-fall acceleration observed from a world-fixed frame that rotates with the world. Thus, gravity is the sum of gravitation and the centrifugal acceleration due to the world s rotation. In surface-interacting simulations, the fidelity of gravity at heights above the surface is more significant than gravity fidelity at locations in inertial space. A surface-interacting simulation cannot treat the gravity model separately from the world model, which simulates the motion and shape of the world. The world model's simulation of the world's rotation, or lack thereof, produces the centrifugal acceleration component of gravity. The world model s reproduction of the world's shape will produce different positions relative to the world center for a given height above the surface. These differences produce variations in the gravitation component of gravity. This paper examines the actual performance of world and gravity/gravitation pairs in a simulation using the Earth.

Author

Mathematical Models; Surface Vehicles; Flight Simulation; Earth Gravitation

20070030851 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

The HYDROS Mission: Requirements and Baseline System Design

Njoku, Eni; Spencer, Michael; McDonald, Kyle; Smith, Joel; Houser, Paul; Doiron, Terence; O'Neill, Peggy; Girard, Ralph; Entekhabi, Dara; March 6, 2003; 8 pp.; In English; IEEE Aerospace Conference, 6-13 Mar. 2004, Big Sky, MT, USA; Original contains black and white illustrations; Copyright; Avail.: Other Sources

ONLINE: http://hdl.handle.net/2014/40159

The HYDROS mission is under development by NASA as part of its Earth System Science Pathfinder (ESSP) program. HYDROS is designed to provide global maps of the Earth's soil moisture and freezel/thaw state every 2-3 days, for weather and climate prediction, water and carbon cycle studies, natural hazards monitoring, and national security applications. HYDROS uses a unique active and passive L-band microwave system that optimizes measurement accuracy, spatial resolution, and coverage. It provides measurements in nearly all weather conditions, regardless of solar illumination. The designs of the radar and radiometer electronics, antenna feedhorn and reflector, and science data system, are driven by specific mission and science objectives. These objectives impose requirements on the frequencies, polarizations, sampling, spatial resolution, and accuracy of the system. In this paper we describe the HYDROS mission requirements, baseline design, and measurement capabilities.

Author

Soil Moisture; Earth Sciences; Soil Mapping; Climate; Predictions; Carbon Cycle

44
ENERGY PRODUCTION AND CONVERSION

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

20070030206 NASA Glenn Research Center, Cleveland, OH, USA

Hybrid Power Management (HPM)

Eichenberg, Dennis J.; August 2007; 20 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): WBS 069746.02.03

Report No.(s): NASA/TM-2007-214913; E-16081; No Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: http://hdl.handle.net/2060/20070030206

The NASA Glenn Research Center s Avionics, Power and Communications Branch of the Engineering and Systems Division initiated the Hybrid Power Management (HPM) Program for the GRC Technology Transfer and Partnership Office.

HPM is the innovative integration of diverse, state-of-the-art power devices in an optimal configuration for space and terrestrial applications. The appropriate application and control of the various power devices significantly improves overall system performance and efficiency. The advanced power devices include ultracapacitors and fuel cells. HPM has extremely wide potential. Applications include power generation, transportation systems, biotechnology systems, and space power systems. HPM has the potential to significantly alleviate global energy concerns, improve the environment, and stimulate the economy. One of the unique power devices being utilized by HPM for energy storage is the ultracapacitor. An ultracapacitor is an electrochemical energy storage device, which has extremely high volumetric capacitance energy due to high surface area electrodes, and very small electrode separation. Ultracapacitors are a reliable, long life, maintenance free, energy storage system. This flexible operating system can be applied to all power systems to significantly improve system efficiency, reliability, and performance. There are many existing and conceptual applications of HPM.
Author
Electrochemical Capacitors; Fuel Cells; Electric Energy Storage; Electric Automobiles; Electric Hybrid Vehicles; Spacecraft Power Supplies

45
ENVIRONMENT POLLUTION

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

20070030227 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Estimating When the Antarctic Ozone Hole Will Recover
Newman, Paul A.; Nash, Eric R.; Douglass, Anne R.; Nielsen, J. Eric; Pawson, Steven; Stolarski, Richard S.; August 20, 2007; 1 pp.; In English; 15th Conference on Air-Sea Interactions, 20-24 Aug. 2007, Portland, OR, USA; No Copyright; Avail.: Other Sources; Abstract Only

The Antarctic ozone hole develops each year and culminates by early spring (late September - early October). The severity of the hole has been assessed from satellites using the minimum total ozone value from the October monthly mean (depth of the hole) and by calculating the average area coverage during this September-October period. Profile information shows that ozone is completely destroyed in the 14-21 km layer by early October. Ozone is mainly destroyed by halogen (chlorine and bromine) catalytic cycles, and these losses are modulated by temperature variations. Because atmospheric halogen levels are responding to international agreements that limit or phase out production, the amount of halogens in the stratosphere should decrease over the next few decades. Using projections of halogen levels combined with age-of-air estimates, we find that the ozone hole is recovering at an extremely slow rate and that large ozone holes will regularly recur over the next 2 decades. We estimate that the ozone hole will begin to show first signs of size decrease in about 2023, and the hole will fully recover to pre-1980 levels in approximately 2070. Estimates of the ozone hole's recovery from models reveal important differences that will be discussed.
Author
Antarctic Regions; Chlorine; Halogens; Ozone; Ozone Depletion; Atmospheric Effects; Environmental Chemistry

20070031034 Science Systems and Applications, Inc., Bay Saint Louis, MS, USA
NASA's Potential Contributions for Using Solar Ultraviolet Radiation in Conjunction with Photocatalysis for Urban Air Pollution Mitigation
Ryan, robert E.; Underwood, Lauren W.; [2007]; 5 pp.; In English
Contract(s)/Grant(s): NNS04AB54T
Report No.(s): SSTI-2220-0105; No Copyright; Avail.: CASI: A01, Hardcopy
ONLINE: http://hdl.handle.net/2060/20070031034

More than 75 percent of the U.S. population lives in urban communities where people are exposed to levels of smog or pollution that exceed the EPA (U.S. Environmental Protection Agency) safety standards. Urban air quality presents a unique problem because of a number of complex variables, including traffic congestion, energy production, and energy consumption activities, all of which can contribute to and affect air pollution and air quality in this environment. In environmental engineering, photocatalysis is an area of research whose potential for environmental clean-up is rapidly developing popularity and success. Photocatalysis, a natural chemical process, is the acceleration of a photoreaction in the presence of a catalyst. Photocatalytic agents are activated when exposed to near UV (ultraviolet) light (320-400 nm) and water. In recent years, surfaces coated with photocatalytic materials have been extensively studied because pollutants on these surfaces will degrade when the surfaces are exposed to near UV light. Building materials, such as tiles, cement, glass, and aluminum sidings, can

be coated with a thin film of a photocatalyst. These coated materials can then break down organic molecules, like air pollutants and smog precursors, into environmentally friendly compounds. These surfaces also exhibit a high affinity for water when exposed to UV light. Therefore, not only are the pollutants decomposed, but this superhydrophilic nature makes the surface self-cleaning, which helps to further increase the degradation rate by allowing rain and/or water to wash byproducts away. According to the Clean Air Act, each individual state is responsible for implementing prevention and regulatory programs to control air pollution. To operate an air quality program, states must adopt and/or develop a plan and obtain approval from the EPA. Federal approval provides a means for the EPA to maintain consistency among different state programs and ensures that they comply with the requirements of the Clean Air Act.
Author
Air Quality; Chemical Reactions; Catalysts; Air Pollution; Solar Radiation; Ultraviolet Radiation; Environment Protection; By-Products; Environmental Engineering

46
GEOPHYSICS

Includes Earth structure and dynamics, aeronomy; upper and lower atmosphere studies; ionospheric and magnetospheric physics; and geomagnetism. For related information see *47 Meteorology and Climatology*; and *93 Space Radiation*.

20070030054 Oxford Univ., Oxford, UK
Aeolian Sediment Transport Pathways and Aerodynamics at Troughs on Mars
Bourke, Mary C.; Bullard, Joanna E.; Barnouin-Jha, Olivier S.; Journal of Geophysical Research; July 13, 2004; Volume 109, pp. 1-16; In English
Contract(s)/Grant(s): NNG04GJ92G; Copyright; Avail.: Other Sources
ONLINE: http://dx.doi.org/10.1029/2003JE002155

Interaction between wind regimes and topography can give rise to complex suites of aeolian landforms. This paper considers aeolian sediment associated wit11 troughs on Mars and identifies a wider range of deposit types than has previously been documented. These include wind streaks, falling dunes, 'lateral' dunes, barchan dunes, linear dunes, transverse ridges, sand ramps, climbing dunes, sand streamers, and sand patches. The sediment incorporated into these deposits is supplied by wind streaks and ambient Planitia sources as well as originating within the trough itself, notably from the trough walls and floor. There is also transmission of sediment between d~~neTsh. e flow dynamics which account for the distribution of aeolian sediment have been modeled using two-dimensional computational fluid dynamics. The model predicts flow separation on the upwind side of the trough followed by reattachment and acceleration at the downwind margin. The inferred patterns of sediment transport compare well with the distribution of aeolian forms. Model data indicate an increase of wind velocity by approx. 30 % at the downwind trough margin. This suggests that the threshold wind speed necessary for sand mobilization on Mars will be more freq~~entmlye t in these inclined locations.
Author
Wind Effects; Aerodynamics; Computational Fluid Dynamics; Troughs; Sediment Transport; Separated Flow; Mars Atmosphere; Landforms; Boundary Layer Separation

20070030055 Planetary Science Inst., Tucson, AZ, USA; NASA Ames Research Center, Moffett Field, CA, USA
A Comparison of Methods Used to Estimate the Height of Sand Dunes on Mars
Bourke, M. C.; Balme, M.; Beyer, R. A.; Williams, K. K.; Zimbelman, J.; Geomorphology; November 29, 2006; Volume 81, pp. 440-452; In English
Contract(s)/Grant(s): NNG04GJ92G; Copyright; Avail.: Other Sources

The collection of morphometric data on small-scale landforms from other planetary bodies is difficult. We assess four methods that can be used to estimate the height of aeolian dunes on Mars. These are (1) stereography, (2) slip face length, (3) profiling photoclinometry, and (4) Mars Orbiter Laser Altimeter (MOLA). Results show that there is good agreement among the methods when conditions are ideal. However, limitations inherent to each method inhibited their accurate application to all sites. Collectively, these techniques provide data on a range of morphometric parameters, some of which were not previously available for dunes on Mars. They include dune height, width, length, surface area, volume, and longitudinal and transverse profiles. Thc utilization of these methods will facilitate a more accurate analysis of aeolian dunes on Mars and enable comparison with dunes on other planetary surfaces.
Author
Dunes; Mars Surface; Photogrammetry; Stereophotography; Data Acquisition; Landforms; Wind Effects

20070030113 Planetary Science Inst., Tucson, AZ, USA

Recent Aeolian Dune Change on Mars

Bourke, M. C.; Edgett, K. S.; Cantor, B. A.; [2007]; 1 pp.; In English

Contract(s)/Grant(s): NNG04GJ92G; No Copyright; Avail.: Other Sources

ONLINE: http://dx.doi.org/10.1016/j.geomorph.2007.05.012

Previous comparisons of Martian aeolian dunes in satellite images have not detected any change in dune form or position. Here, we show dome dunes in the north polar region that shrank and then disappeared over a period of 3.04 Mars years (5.7 Earth years), while larger, neighboring dunes showed no erosion or movement. The removal of sand from these dunes indicates that not only is the threshold wind speed for saltation exceeded under present conditions on Mars, but that any sand that is available for transport is likely to be moved. Dunes that show no evidence of change could be crusted, indurated. or subject to infrequent episodes of movement.

Author

Mars Surface; Sands; Dunes; Erosion; Wind Effects; Sediment Transport; Mars Environment

20070030116 Arizona Univ., Tucson, AZ, USA

Dynamics of Unusual Debris Flows on Martian Sand Dunes

Miyamoto, Hideaki; Dohm, James M.; Baker, Victor R.; Beyer, Ross A.; Bourke, Mary; Geophysical Research Leters; July 08, 2004; ISSN 0094-8276; Volume 31, pp. L13701; In English

Contract(s)/Grant(s): NNG04GJ92G; Copyright; Avail.: Other Sources

ONLINE: http://dx.doi.org/10.1029/2004GL020313

Gullies that dissect sand dunes in Russell impact crater often display debris flow-like deposits in their distal reaches. The possible range of both the rheological properties and the flow rates are estimated using a numerical simulation code of a Bingham plastic flow to help explain the formation of these features. Our simulated results are best explained by a rapid debris flow. For example, a debris flow with the viscosity of 10(exp 2) Pa s and the yield strength of 10(exp 2) Pa can form the observed deposits with a flow rate of 0.5 cu m/s sustained over several minutes and total discharged water volume on the order of hundreds of cubic meters, which may be produced by melting a surface layer of interstitial ice within the dune deposits to several centimeters depth.

Author

Mars Surface; Dunes; Sands; Debris; Computerized Simulation; Flow Velocity; Deposits

20070030855 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

Laboratory Reflectance Spectra of 160 Minerals, 0.4 to 2.5 Micrometers

Grove, C. I.; Hook, S. J.; Paylor, E. D., III; February 15, 1992; 394 pp.; In English; Original contains black and white illustrations

Report No.(s): JPL-Publ-92-2; Copyright; Avail.: Other Sources

ONLINE: http://hdl.handle.net/2014/40148

This reports provides reflectance spectra of 160 minerals in both digital and printed form. In order to demonstrate the effect of particle size on reflectance, the spectral data for 135 of the minerals are presented at three different grain sizes. These are 125-500 microns, 45-125 microns and less than 45 microns. Ancillary information is provided with each mineral spectrum, which includes the mineral name, minerology, supplier, sampling locality and our designated sample number. The purity of every mineral sample was evaluated by X-ray diffraction (XRD). The composition of certain minerals known to deviate strongly from idealized end-member compositions was determined by electron microprobe analysis. The compositional information obtained by microbe analysis and accessory minerals identified by XRD are noted with the ancillary information. In addition, the spectrum acquired from the coarsest grain size available for each sample was processed with a feature-finding algorithm to quantify the characteristics of the spectral absorption features. All the reflectance spectra presented here are provided in digital form on IBM-compatible 3.5' diskettes. Also included on diskette is a program for displaying the spectral data and searching for spectral features that runs on an IBM-compatible PC with standard VCA graphics.

Author

Absorption Spectra; Minerals; Reflectance; Emission Spectra; X Ray Diffraction; Microorganisms

47
METEOROLOGY AND CLIMATOLOGY

Includes weather observation forecasting and modification.

20070030079 NASA Ames Research Center, Moffett Field, CA, USA

Implications of Persistent Ice Supersaturation in Cold Cirrus for Stratospheric Water Vapor

Jensen, E.; Pfister, L.; Geophysical Research Letters; January 13, 2005; Volume 32, pp. L01808; In English; Original contains color and black and white illustrations

Contract(s)/Grant(s): NNA04CC40A; No Copyright; Avail.: CASI: A01, Hardcopy

ONLINE: http://hdl.handle.net/2060/20070030079; http://dx.doi.org/10.1029/2004GL021125

Recent measurements made near the tropical tropopause during the NASA Cirrus Regional Study of Tropical Anvils and Cirrus Layers - Florida Area Cirrus Experiment (CRYSTAL-FACE) indicate persistent ice saturation ratios (s(sub i)) of about 1.2-1.3 in cold ice clouds (T < 200 K) even when the ice surface area is substantial . These observations challenge the conventional thinking that any water vapor in excess of ice saturation should be depleted by crystal growth given sufficient time. Here we use model simulations to evaluate the impact of this steady-state ice supersaturation on cirrus formed in situ within the tropical tropopause layer and water vapor fluxes across the tropical tropopause. We show that cirrus occurrence frequencies are unexpectedly increased, and we estimate an increase of about 0.5-1 ppmv in the water vapor concentration in air entering the stratosphere. Inclusion of the enhanced in-cloud supersaturation in our simulations improves agreement with satellite measurements of water vapor.

Author

Ice Clouds; Satellite Observation; Stratosphere; Tropical Regions; Tropopause; Water Vapor; Cloud Physics; Atmospheric Moisture; Earth Atmosphere

20070030112 Maryland Univ. Baltimore County, Baltimore, MD, USA; NASA Goddard Space Flight Center, Greenbelt, MD, USA

Utility of AIRS Retrievals for Climate Studies

Molnar, Guyla I.; Susskind, Joel; April 09, 2007; 13 pp.; In English; Algorithms and Technologies for Multispectral, Hyperspectral, and Ultraspectral Imagery XIII, 9-13 April 2007, Orlando, FL, USA; Original contains black and white illustrations; Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: http://dx.doi.org/10.1117/12.718466

Satellites provide an ideal platform to study the Earth-atmosphere system on practically all spatial and temporal scales. Thus, one may expect that their rapidly growing datasets could provide crucial insights not only for short-term weather processes/predictions but into ongoing and future climate change processes as well. Though Earth-observing satellites have been around for decades, extracting climatically reliable information from their widely varying datasets faces rather formidable challenges. AIRS/AMSU is a state of the art infrared/microwave sounding system that was launched on the EOS Aqua platform on May 4, 2002, and has been providing operational quality measurements since September 2002. In addition to temperature and atmospheric constituent profiles, outgoing longwave radiation and basic cloud parameters are also derived from the AIRS/AMSU observations. However, so far the AIRS products have not been rigorously evaluated and/or validated on a large scale. Here we present preliminary assessments of monthly and 8-day mean AIRS 'Version 4.0' retrieved products (available to the public through the DAAC at NASA/GSFC) to assess their utility for climate studies. First we present 'consistency checks' by evaluating the time series of means, and 'anomalies' (relative to the first 4 full years' worth of AIRS 'climate statistics') of several climatically important retrieved parameters. Finally, we also present preliminary results regarding interrelationships of some of these geophysical variables, to assess to what extent they are consistent with the known physics of climate variability/change. In particular, we find at least one observed relationship which contradicts current general circulation climate (GCM) model results: the global water vapor climate feedback which is expected to be strongly positive is deduced to be slightly negative (shades of the 'Lindzen effect'?). Though the current AIRS climatology covers only -4.5 years, it will hopefully extend much further into the future.

Author

Air Land Interactions; Atmospheric General Circulation Models; Climate Models; Climatology; Time Series Analysis; Temperature Profiles

20070030186 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Three Way Comparison between Two OMI/Aura and One POLDER/PARASOL Cloud Pressure Products

Sneep, M.; deHaan, J. F.; Stammes, P.; Vanbaunce, C.; Joiner, J.; Vasilkov, A. P.; Levelt, P. F.; [2007]; 31 pp.; In English; Original contains black and white illustrations

Contract(s)/Grant(s): SHRON EO-072; Copyright; Avail.: CASI: A03, Hardcopy

The cloud pressures determined by three different algorithms, operating on reflectances measured by two space-borne instruments in the 'A' train, are compared with each other. The retrieval algorithms are based on absorption in the oxygen A-band near 760 nm, absorption by a collision induced absorption in oxygen near 477nm, and the filling in of Fraunhofer lines by rotational Raman scattering. The first algorithm operates on data collected by the POLDER instrument on board PARASOL, while the latter two operate on data from the OMI instrument on board Aura. The satellites sample the same air mass within about 15 minutes. Using one month of data, the cloud pressures from the three algorithms are found to show a similar behavior, with correlation coefficients larger than 0.85 between the data sets for thick clouds. The average differences in the cloud pressure are also small, between 2 and 45 hPa, for the whole data set. For optically thin to medium thick clouds, the cloud pressure the distribution found by POLDER is very similar to that found by OMI using the O2 - O2 absorption. Somewhat larger differences are found for very thick clouds, and we hypothesise that the strong absorption in the oxygen A-band causes the POLDER instrument to retrieve lower pressures for those scenes.

Author

Satellite-Borne Instruments; Ozone; Clouds (Meteorology); Microsatellites; Pressure Distribution; Aura Spacecraft

20070030218 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Evaluation of a Cloud Resolving Model Using TRMM Observations for Multiscale Modeling Applications

Posselt, Derek J.; L'Ecuyer, Tristan; Tao, Wei-Kuo; Hou, Arthur Y.; Stephens, Graeme L.; [2007]; 47 pp.; In English; Original contains black and white illustrations

Contract(s)/Grant(s): NAS1-00072; NNG06GC46G; No Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: http://hdl.handle.net/2060/20070030218

The climate change simulation community is moving toward use of global cloud resolving models (CRMs), however, current computational resources are not sufficient to run global CRMs over the hundreds of years necessary to produce climate change estimates. As an intermediate step between conventional general circulation models (GCMs) and global CRMs, many climate analysis centers are embedding a CRM in each grid cell of a conventional GCM. These Multiscale Modeling Frameworks (MMFs) represent a theoretical advance over the use of conventional GCM cloud and convection parameterizations, but have been shown to exhibit an overproduction of precipitation in the tropics during the northern hemisphere summer. In this study, simulations of clouds, precipitation, and radiation over the South China Sea using the CRM component of the NASA Goddard MMF are evaluated using retrievals derived from the instruments aboard the Tropical Rainfall Measuring Mission (TRMM) satellite platform for a 46-day time period that spans 5 May - 20 June 1998. The NASA Goddard Cumulus Ensemble (GCE) model is forced with observed largescale forcing derived from soundings taken during the intensive observing period of the South China Sea Monsoon Experiment. It is found that the GCE configuration used in the NASA Goddard MMF responds too vigorously to the imposed large-scale forcing, accumulating too much moisture and producing too much cloud cover during convective phases, and overdrying the atmosphere and suppressing clouds during monsoon break periods. Sensitivity experiments reveal that changes to ice cloud microphysical parameters have a relatively large effect on simulated clouds, precipitation, and radiation, while changes to grid spacing and domain length have little effect on simulation results. The results motivate a more detailed and quantitative exploration of the sources and magnitude of the uncertainty associated with specified cloud microphysical parameters in the CRM components of MMFs.

Author

Clouds (Meteorology); TRMM Satellite; Algorithms; Multiscale Models; Atmospheric General Circulation Models

20070030219 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Comparisons of Instantaneous TRMM Ground Validation and Satellite Rain Rate Estimates at Different Spatial Scales

Wolff, David B.; Fisher, Brad L.; [2007]; 68 pp.; In English; Original contains color and black and white illustrations; Copyright; Avail.: CASI: A04, Hardcopy

This study provides a comprehensive inter-comparison of instantaneous rain estimates from the two rain sensors aboard the TRMM satellite with ground data from thee designated Ground Validation Sites: Kwajalein Atoll, Melbourne, Florida and Houston, Texas. The satellite rain retrievals utilize rain observations collected by the TRMM microwave imager (TMI) and the Precipitation Radar (PR) aboard the TRMM satellite. Three standard instantaneous rain products are the generated from the rain information retrieved from the satellite using the TMI, PR and Combined (COM) rain algorithms. The validation data

set used in this study was obtained from instantaneous rain rates inferred from ground radars at each GV site. The first comparison used 0.5(sup 0) x 0.5(sup 0) gridded data obtained from the TRMM 3668 product, and similarly gridded GV data obtained from ground-based radars. The comparisons were made at the same spatial and temporal scales in order to eliminate sampling biases in our comparisons. An additional comparison was made by averaging rain rates for the PR, COM and GV estimates within each TMI footprint (approx. 150 square kilometers). For this analysis, unconditional mean rain rates from PR, COM and GV estimates were calculated within each TMI footprint that was observed within 100 km from the respective GV site (and also observed by the PR). This analysis used all the available matching data from the period 1999-2004, representing a sample size of over 50,000 footprints for each site. In the first analysis our results showed that all of the respective rain rate estimates agree well, with some exceptions. The more salient differences were associated with heavy rain events in which one or more of the algorithms failed to properly retrieve these extreme events. Also, it appears that there is a preferred mode of precipitation for TMI rain rates at or near 2 mm per hour over the ocean. This mode was noted over ocean areas of Melbourne, Florida and Kwajalein, Republic of the Marshall Islands, and is shown to exist in TRMM tropical-global ocean areas as well. Further research by algorithm developers is needed to explain or justify the seemingly errant observed probability distributions.
Author
Algorithms; Meteorological Radar; Precipitation (Meteorology); Rain; TRMM Satellite; Ground Tests

20070030895 Meteorological Coll., Kashiwa, Japan
Monthly Report of the Meteorological Satellite Center: May 2007
May 2007; In English; Copyright; Avail.: Other Sources

The CD-ROM concerning the April 2007 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.
CASI
Atmospheric Sounding; Meteorological Parameters; Satellite Observation; Satellite Sounding

20070031095 Meteorological Satellite Center, Kiyose, Japan
Monthly Report of the Meteorological Satellite Center: January 2007
January 2007; In English; Copyright; Avail.: Other Sources

The CD-ROM concerning the January 2007 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.
Author
Satellite Observation; Satellite Sounding; Atmospheric Sounding; Meteorological Parameters; Satellite Imagery; Japan

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*.

20070030103 NASA Johnson Space Center, Houston, TX, USA
Interactions of the SAP Domain of Human Ku70 with DNA Substrate: A Molecular Dynamics Study
Hu, Shaowen; Carra, Claudio; Huff, Janice; Pluth, Janice M.; Cucinotta, Francis A.; September 08, 2007; 13 pp.; In English; 13th International Congress of Radiation Research, 8-12 Jul. 2007, San Francisco, CA, USA; Original contains color illustrations; Copyright; Avail.: CASI: A03, Hardcopy

NASA is developing a systems biology approach to improve the assessment of health risks associated with space

radiation. The primary toxic and mutagenic lesion following radiation exposure is the DNA double strand break (DSB), thus a model incorporating proteins and pathways important in response and repair of this lesion is critical. One key protein heterodimer for systems models of radiation effects is the Ku70/80 complex. The Ku70/80 complex is important in the initial binding of DSB ends following DNA damage, and is a component of nonhomologous end joining repair, the primary pathway for DSB repair in mammalian cells. The SAP domain of Ku70 (residues 556-609), contains an a helix-extended strand-helix motif and similar motifs have been found in other nucleic acid-binding proteins critical for DNA repair. However, the exact mechanism of damage recognition and substrate specificity for the Ku heterodimer remains unclear in part due to the absence of a high-resolution structure of the SAP/DNA complex. We performed a series of molecular dynamics (MD) simulations on a system with the SAP domain of Ku70 and a 10 base pairs DNA duplex. Large-scale conformational changes were observed and some putative binding modes were suggested based on energetic analysis. These modes are consistent with previous experimental investigations. In addition, the results indicate that cooperation of SAP with other domains of Ku70/80 is necessary to explain the high affinity of binding as observed in experiments.
Author
Deoxyribonucleic Acid; Molecular Dynamics; Substrates; Cells (Biology); Extraterrestrial Radiation

20070030104 NASA Johnson Space Center, Houston, TX, USA
Concominant Cytokine secretion and Amino Acid Metabolism Alterations in Human Leucocytes Subjected to Microgravity Analog and Cortisol Treatment in vitro
Uchakin, P. N.; Smith, Scott M.; Uchakina, O. N.; Tobin, B. W.; [2007]; 1 pp.; In English; American Society for Gravitational and Space Biology, 25-28 Oct. 2007, Moffett Field, CA, USA
Contract(s)/Grant(s): NCC9-58; NIH R15 GM62795-03; No Copyright; Avail.: Other Sources; Abstract Only

Space flight is complex environment and consists of many physical and physiological stress-factors which are able to diminish immune responsiveness. The objective of this work was to investigate the underlying metabolic mechanisms of stress-induced immune suppression using High Aspect Ratio Vessel (HARV) tissue culture as a microgravity (10(sup -2)g) analog. Peripheral blood mononuclear cells from 6 healthy donors were activated with LPS+PHA mixture and cultured in the HARV or in a 2-dimensional static (STAT) environment for 48h in a 5% CO2, 95% humidity atmosphere, at 37 C. Additionally, cell cultures were treated with sub- (10(exp -8)M) and supra-physiological (10(sup -6)M) stress doses of hydrocortisone (HCS). Secretion of interleukin(IL)-2, interferon (IFN)- gamma, IL-4, IL-10, and concentrations of 41 amino-metabolites were assessed in the supernatants. Two-way RM ANOVA with post hoc Tukey test was used to determine statistical significance (p less than 0.05). The level of all cytokines was significantly (P less than 0.05) lower in HARV environment. This effect was HCS-depended only for IFN-gamma and IL-4 (power of performed tests with alpha=0.05: 0.953 and 0.8 correspondingly). Concurrently, significantly higher concentrations of ala, arg, asn, asp, gln, gly, tyr, his, ile, leu, lys, phe, try, and orn were registered in HARV. In contrast, concentration of arg was lower in HARV compare to STAT conditions. The concentration of hys in HARV was dependent on HCS treatment (power 0.8; alpha=0.05). Physical and endocrine stress-factors of microgravity are able to significantly alter metabolism of amino acids and immune competence in vitro. Understanding the cause and implications of these alterations will help to develop nutritional or other countermeasures for stress-induced immune suppression.
Author
Amino Acids; In Vitro Methods and Tests; Leukocytes; Metabolism; Microgravity; Secretions; Drugs; Culture Techniques; Tissues (Biology)

20070030105 NASA Johnson Space Center, Houston, TX, USA
Determinants of Time to Fatigue during Non-Motorized Treadmill Exercise
DeWitt, John K.; Lee, M. C.; Wilson, Cassie A.; Hagan, R. Donald; [2007]; 27 pp.; In English; Original contains color illustrations; Copyright; Avail.: CASI: A03, Hardcopy

Treadmill exercise is commonly used for aerobic and anaerobic conditioning. During non-motorized treadmill exercise, the subject must provide the power necessary to drive the treadmill belt. The purpose of this study was to determine what factors affected the time to fatigue on a pair of non-motorized treadmills. Twenty subjects (10 males/10 females) attempted to complete five minutes of locomotion during separate trials at 3.22, 4.83, 6.44, 8.05, 9.66, and 11.27 km (raised dot) h(sup -1). Total exercise time (less than or equal to 5 min) was recorded. Exercise time was converted to the amount of 15 second intervals completed. Peak oxygen uptake (VO2) was measured using a graded exercise test on a standard treadmill, and anthropometric measures were collected from each subject before entering into the study. A Cox proportional hazards regression model was used to determine significant predictive factors in a multivariate analysis. Non-motorized treadmill speed and absolute peak VO2 were found to be significant predictors of exercise time, but there was no effect of

anthropometric characteristics. Gender was found to be a predictor of treadmill time, but this was likely due to a higher peak VO2 in males than in females. These results were not affected by the type of treadmill tested in this study. Coaches and therapists should consider the cardiovascular fitness of an athlete or client when prescribing target speed since these factors are related to the total exercise time than can be achieved on a non-motorized treadmill.
Author
Physical Exercise; Treadmills; Fatigue (Biology); Cardiovascular System; Mathematical Models; Physiological Responses; Time Dependence

20070030266 Mercer Univ., Macon, GA, USA
Amino Acid Metabolism and Immune Responsiveness in vitro in a Microgravity Analog
Uchakin, Peter N.; Smith, Scott M.; Uchakina, Olga N.; Tobin, Brian W.; [2007]; 16 pp.; In English; Original contains black and white illustrations
Contract(s)/Grant(s): NCC 9-58; NSBRI NFPR00204; No Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20070030266

Nutrition is one of the major contributors to the health of space crews. Environmental changes associated with space flight (microgravity, radiation) may affect nutrient bioavailability as well as nutrient requirements. The objective of this study was to investigate amino acid metabolism and the mitogen-induced immune response in a model of the microgravity environment. Expression of activation marker (CD25) by T-cell helper (CD3+CD4+) and suppressor/cytotoxic (CD3+CD8+) subsets, cytokine secretion, and concentration of amino acids were assessed in cultures of peripheral blood mononuclear cells activated by a combination of lipopolysaccharide and phytohemagglutinin and subjected to clinorotation in a High Aspect Rotating Vessel (HARV). Significant decreases in mitogen-induced CD25 expression and cytokine secretion were observed in cultures subjected to the microgravity analog (HARV) compared to control cultures. Observed changes in immune system variables were associated with significantly greater concentrations of glutamine, isoleucine, leucine, lysine, ornithine, phenylalanine, tryptophan, and tyrosine concentrations in HARV cell cultures. The concentration of valine was significantly less in HARV cultures than in control cultures. Thus, physical stress factors associated with the modeled microgravity environment significantly affected metabolic processes and immune responsiveness in mitogen-activated cell culture.
Author
Amino Acids; Immunity; In Vitro Methods and Tests; Metabolism; Microgravity; Nutrition

20070030843 NASA Johnson Space Center, Houston, TX, USA
Advanced Electrocardiographic Predictors of Sudden Death in Familial Dysautonomia
Solaimanzadeh, I.; Schlegel, T. T.; Greco, E. C.; DePalma, J. L.; Starc, V.; Marthol, H.; Tutaj, M.; Buechner, S.; Axelrod, F. B.; Hilz, M. J.; [2007]; 29 pp.; In English; Original contains black and white illustrations; Copyright; Avail.: CASI: A03, Hardcopy

To identify accurate predictors for the risk of sudden death in patients with familial dysautonomia (FD). Ten-minute resting high-fidelity 12-lead ECGs were obtained from 14 FD patients and 14 age/gender-matched healthy subjects. Multiple conventional and advanced ECG parameters were studied for their ability to predict sudden death in FD over a subsequent 4.5-year period, including multiple indices of linear and non-linear heart rate variability (HRV); QT variability; waveform complexity; high frequency QRS; and derived Frank-lead parameters. Four of the 14 FD patients died suddenly during the follow-up period, usually with concomitant pulmonary disorder. The presence of low vagally-mediated HRV was the ECG finding most predictive of sudden death. Concomitant left ventricular hypertrophy and other ECG abnormalities such as increased QTc and JTc intervals, spatial QRS-T angles, T-wave complexity, and QT variability were also present in FD patients, suggesting that structural heart disease is fairly common in FD. Although excessive or unopposed cardiac vagal (relative to sympathetic) activity has been postulated as a contributor to sudden death in FD, the presence of low vagally-mediated HRV was paradoxically the best predictor of sudden death. However, we suggest that low vagally-mediated HRV be construed not as a direct cause of sudden death in FD, but rather as an effect of concurrent pathological processes, especially hypoxia due to pulmonary disorders and sleep apnea, that themselves increase the risk of sudden death in FD and simultaneously diminish HRV. We speculate that adenosine may play a role in sudden death in FD, possibly independently of vagal activity, and that adenosine inhibitors such as theophylline might therefore be useful as prophylaxis in this disorder.
Author
Death; Electrocardiography; Heart Diseases; Autonomy; Abnormalities

20070030844 NASA Johnson Space Center, Houston, TX, USA

Microbiological Monitoring for the Constellation Program: Current Requirements and Future Considerations

Ott, C. Mark; September 27, 2007; 1 pp.; In English; NASA Microarray Workshop 2007, 26-28 Sep. 2007, Huntsville, AL, USA; No Copyright; Avail.: Other Sources; Abstract Only

Microbiological requirements for spaceflight are based on assessments of infectious disease risk which could impact crew health or mission success. The determination of risk from infectious disease is composed of several factors including (1) crew susceptibility, (2) crew exposure to the infectious disease agent, (3) the concentration of the infectious agent, and (4) the characteristics of the infectious agent. As a result of the Health Stabilization Program, stringent monitoring, and cleaning protocols, in-flight environmental microbial monitoring is not necessary for short-duration spaceflights. However, risk factors change for long-duration missions, as exemplified by the presence of medically significant organisms in the environments of both the Mir and International Space Station (ISS). Based upon this historical evidence, requirements for short duration usage aboard the Orion Crew Exploration Vehicle and Lunar Lander Vehicle will not require in-flight monitoring; however, as mission duration increases with a Lunar Outpost, an ability to detect microbial hazard will be necessary. The nature of the detection requirements will depend on the maturity of technology in a rapidly evolving marketplace. Regardless, the hardware will still need to maximize information to discipline experts and the crew, while minimizing the size, mass, power consumption, and crew time usage. The refinement of these monitors will be a major goal in our efforts to travel successfully to Mars.

Author

Crew Exploration Vehicle; Microbiology; Manned Space Flight; Constellation Program; Aerospace Medicine; Infectious Diseases; In-Flight Monitoring

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*.

20070030048 NASA Johnson Space Center, Houston, TX, USA

Space Radiation and its Associated Health Consequences

Wu, Honglu; February 22, 2007; 1 pp.; In English; No Copyright; Avail.: Other Sources; Abstract Only

During space travel, astronauts are exposed to energetic particles of a complex composition and energy distribution. For the same amount of absorbed dose, these particles can be much more effective than X- or gamma rays in the induction of biological effects, including cell inactivation, genetic mutations, cataracts, and cancer induction. Several of the biological consequences of space radiation exposure have already been observed in astronauts. This presentation will introduce the space radiation environment and discuss its associated health risks. Accurate assessment of the radiation risks and development of respective countermeasures are essential for the success of future exploration missions to the Moon and Mars.

Author

Aerospace Environments; Biological Effects; Extraterrestrial Radiation; Health; Physiological Effects; Radiation Effects

20070030049 NASA Johnson Space Center, Houston, TX, USA

Artificial Gravity as a Multi-System Countermeasure: Effects on Cognitive Function

Sipes, Walter E.; Seaton, Kim; Slack, Kellely; Bowie, Kendra; April 08, 2007; 1 pp.; In English; 28th Annual International Gravitational Physiology Meeting, 8-13 Apr. 2007, San Antonio, TX, USA; Copyright; Avail.: Other Sources; Abstract Only

The Space Flight Cognitive Assessment Tool for Windows (WinSCAT) is a medical requirement on the International Space Station, and its purpose is to evaluate cognitive functioning after physical insult (e.g., head trauma, decompression sickness, exposure to toxic gases, medication side effects). The current objective is to assess cognitive functioning in a long duration space mission analog environment where Artificial Gravity is being applied as a countermeasure in a Bed Rest study. Methods: Fifteen male subjects (8 treatment and 7 control) who participated in 21 days of -6 degree head-down bed rest were assessed. Three practice and three baseline WinSCAT test sessions were administered during the pre-bed rest phase of study participation. During the bed rest phase, the WinSCAT test was scheduled every other day, following the centrifuge, for a total of 10 test sessions. (The treatment group received 60 minutes of centrifugation each day during the 21 days of bed rest. The control subjects were strapped to the centrifuge for the same length of time as the treatment group but were not spun.) During

the post-bed rest (reconditioning) phase, the test was administered 4 times. Results: Individual differences were found both within and between the treatment and control groups. After controlling for the number of subjects in each group, the treatment group accounted for more off-nominal WinSCAT scores than the control group. Conclusions:There is some preliminary evidence that centrifuge spinning might negatively impact cognitive functioning. However, due to sample size limitations, it cannot be ascertained whether there were significant differences in cognitive performance between the treatment and control groups. If centrifugation had a negative effect on cognitive functioning, consistent decrements would be expected to be found with all treatment subjects across time. Individual differences in underlying cognitive ability and motivation level are other possible explanations for the results found in this study.
Author
Artificial Gravity; Countermeasures; Mental Performance; Human Performance; Centrifuging

20070030082 NASA Johnson Space Center, Houston, TX, USA
Cases in Space Medicine: Right Lower Quadrant Abdominal Pain in a Female Crewmember on the International Space Station
Hamilton, Douglas R.; Scheuring, Richard; Jones, Jeffery; [2007]; 42 pp.; In English; Copyright; Avail.: CASI: A03, Hardcopy

A case study of a medical emergency aboard the International Space Station is reviewed. The case involves a female crewmember who is experiencing acute abdominal pain. The interplay of the Crew Medical Officer (CMO) and the NASA Flight Surgeon is given. Possible diagnoses, and advised medical actions are reviewed. Along the case study questions are posed to the reader, and at the end answers are given.
CASI
Emergencies; Flight Surgeons; Pain; Diagnosis; Clinical Medicine; Prognosis; Aerospace Medicine; Symptomology; Signs and Symptoms

20070030085 Wyle Labs., Inc., Houston, TX, USA
Pharmaceutical Care and the Role of a Pharmacist in Space Medicine
Bayuse, Tina; May 14, 2007; 24 pp.; In English; ASMA Annual Conference, 13-17 May 2007, New Orleans, LA, USA; Original contains color illustrations
Contract(s)/Grant(s): NAS9-02078; No Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20070030085

Space medicine is primarily preventative medicine Outcomes of space medicine pharmaceutical care are: a) Elimination or reduction of a patient's symptomatology; b) Arresting or slowing of long term effects from microgravity; and c) Preventing long term effects or symptomatology as a result of microgravity. Space medicine pharmaceutical care is about both the patient and the mission. Pharmaceutical care in the area of space medicine is evolving. A pharmacist serves a critical role in this care. Commercial space travel will require pharmacist involvement.
Derived from text
Aerospace Medicine; Pharmacology; Symptomology; Microgravity

20070030086 NASA Johnson Space Center, Houston, TX, USA
Clinical Space Medicine Products as Developed by the Medical Operations Support Team (MOST)
Polk, James D.; Doerr, Harold K.; Hurst, Victor W., IV; Schmid, Josef; May 13, 2007; 4 pp.; In English; ASMA Annual Conference, 13-17 May 2007, New Orleans, LA, USA
Contract(s)/Grant(s): NAS9-02078; Copyright; Avail.: CASI: A01, Hardcopy

Medical Operations Support Team (MOST) is introducing/integrating teaching practices associated with high fidelity human patient simulation into the NASA culture, in particular, into medical training sessions and medical procedure evaluations. Current/Future Products iclude: a) Development of Sub-optimal Airway Protocols for the International Space Station (ISS) using the ILMA; b) Clinical Core Competency Training for NASA Flight Surgeons (FS); c) Post-Soyuz Landing Clinical Training for NASA FS; d) Experimental Integrated Training for Astronaut Crew Medical Officers and NASA FS; and e) Private Clinical Refresher Training.
Derived from text
Clinical Medicine; Training Evaluation; Spacecrews; Medical Personnel; Aerospace Medicine; Education

20070030087 NASA Johnson Space Center, Houston, TX, USA

Microscopic Observation of Self-Propagation of Calcifying Nanoparticles (Nanobacteria)

Mathew, Grace; McKay, David S.; Ciftcioglu, Neva; [2007]; 23 pp.; In English; Original contains color and black and white illustrations; Copyright; Avail.: CASI: A03, Hardcopy

Biologists typically define living organisms as carbon and water-based cellular forms with :self-replication' as the fundamental trait of the life process. However, this standard dictionary definition of life does not help scientists to categorize self-replicators like viruses, prions, proteons and artificial life. CNP also named nanobacteria were discovered in early 1990s as about 100 nanometer-sized bacteria-like particles with unique apatite mineral-shells around them, and found to be associated with pathological-calcification related diseases. Although CNP have been isolated and cultured from mammalian blood and diseased calcified tissues, and their biomineralizing properties well established, their biological nature and self-replicating capability have always been severely challenged. The terms 'self-replication', 'self-assembly' or 'self-propagation' have been widely used for all systems including nanomachines, crystals, computer viruses and memes. In a simple taxonomy, all biological and non-biological 'self replicators', have been classified into 'living' or 'nonliving' based on the properties of the systems and the amount of support they require to self-replicate. To enhance our understanding about self-replicating nature of CNP, we have investigated their growth in specific culture conditions using conventional inverted light microscope and BioStation IM, Nikon s latest time-lapse imaging system. Their morphological structure was examined using scanning (SEM) and transmission (TEM) electron microscopy. This present study, in conjunction with previous findings of metabolic activity, antibiotic sensitivity, antibody specificity, morphological aspects and infectivity, all concomitantly validate CNP as living self-replicators.

Author

Bacteria; Nanoparticles; Transmission Electron Microscopy; Scanning Electron Microscopy; Organisms; Viruses; Metabolism

20070030089 NASA Johnson Space Center, Houston, TX, USA

Differences in Ground Reaction Forces between Motorized and Non-Motorized Treadmill Locomotion

Everett, Megahn E.; Lee, S. M. C.; DeWitt, J. K.; Laughlin, M.; Wilson, C.; Loehr, J. A.; Hagan, R. D.; [2007]; 19 pp.; In English; Original contains black and white illustrations; Copyright; Avail.: Other Sources

Bone mineral density and maximal aerobic capacity (VO2pk) are decreased following long-duration spaceflight. The aim of this study was to determine whether similar cardiovascular exercise intensities used to protect VO2pk would provide equivalent ground reaction forces (GRF), a potential indicator of a countermeasure s osteo-protective capacity, when exercising on motorized and non-motorized treadmills. Twenty subjects completed exercise bouts on four treadmills at an intensity of approximately 70% of VO2pk. The treadmill conditions were a standard motorized laboratory treadmill as a control condition, the treadmill with vibration isolation and stabilization (TVIS) in the motorized and non-motorized mode, and a Russian built non-motorized treadmill. Greater GRF and loading rate occurred during motorized compared to non-motorized treadmill locomotion at the designated speeds ($p < 0.05$). There were no differences observed within the motorized (lab vs. TVIS-motorized) or within the non-motorized (TVIS non-motorized vs. Russian) treadmill conditions. These results suggest that motorized treadmill exercise may be superior to non-motorized treadmill exercise as an osteo-protective countermeasure during long-duration space flight. These findings also should be considered when prescribing exercise for protection against osteopenia and osteoporosis.

Author

Locomotion; Treadmills; Cardiovascular System; Loading Rate; Countermeasures; Bone Mineral Content

20070030098 NASA Johnson Space Center, Houston, TX, USA

Involvement of DNA-PK(sub cs) in DSB Repair Following Fe-56 Ion Irradiation

O'Neill, Peter; Harper, Jane; Anderson, Jennifer a.; Cucinnota, Francis A.; July 13, 2007; 1 pp.; In English; 18th Annual NASA Space Radiation Investigators Conference, 13-15 Jul. 2007, Rohnert Park, CA, USA

Contract(s)/Grant(s): DE-FG02-05ER64090; OE-AI03-05ER64088; Copyright; Avail.: Other Sources; Abstract Only

When cells are exposed to radiation, cellular lesions are induced in the DNA including double strand breaks (DSBs), single strand breaks and clustered DNA damage, which if not repaired with high fidelity may lead to detrimental biological consequences. Complex DSBs are induced by ionizing radiation and characterized by the presence of base lesions close to the break termini. They are believed to be one of the major causes of the biological effects of IR. The complexity of DSBs increases with the ionization density of the radiation and these complex DSBs are distinct from the damage induced by sparsely ionizing gamma-radiation. It has been hypothesized that complex DSBs produced by heavy ions in space pose problems to the DNA repair machinery. We have used immuno-cyto-chemical staining of phosphorylated histone H2AX

(gamma-H2AX) foci, as a marker of DSBs. We have investigated the formation and loss of gamma-H2AX foci and RAD51 foci (a protein involved in the homologous recombination pathway) in mammalian cells induced by low fluences of low-LET gamma-radiation and high-LET Fe-56 ions (1GeV/n, 151 keV/micron LET). M059J and M059K cells, which are deficient and proficient in DNA-PK(sub cs) activity respectively, were used to examine the role of DNA-PK(sub cs), a key protein in the non-homologous end joining (NHEJ) pathway of DSB repair, along with HF19 human fibroblasts. Following irradiation with Fe-56 ions the rate of repair was slower in M059J cells compared with that in M059K, indicating a role for DNA-PK(sub cs) in the repair of DSB induced by Fe-56 ions. However a small percentage of DSBs induced are rejoined within 5 h although many DSBs still persist up to 24 h. When RAD51 was examined in M059J/K cells, RAD51 foci are visible 24 hours after irradiation in approximately 40% of M059J cells compared with <5% of M059K cells indicating that persistent DSBs or those formed at stalled replication forks recruit RAD51 in DNA-PK(sub cs) deficient cells. Following 1 Gy gamma-radiation the induction of gamma-H2AX foci is similar in M059J and M059K cells. However, the repair rate of DSBs is slower in M059J cells than in M059K as shown previously but faster than seen with DSB induced by 56Fe ions. Vanillin, an inhibitor of DNA-PK(sub cs), reduces significantly the rate of DSB repair in HF19 cells following 1 Gy gamma-radiation but at 0.25 Gy gamma-irradiation the rate of DSB repair is similar in the presence or absence vanillin, thus suggesting the repair of a sub-set of DSBs induced by low dose, low-LET radiation does not require DNA-PK(sub cs). This sub-set of DSBs is formed in lower yield with high LET radiation. The complexity of DNA DSBs induced by HZE radiation will be discussed in terms of reduced repair efficiency and provide scope to model different sub-classes of DSBs as precursors that may lead to the detrimental health effects of HZE radiation.
Author
Biological Effects; Deoxyribonucleic Acid; Gamma Rays; Ion Irradiation; Ionizing Radiation; Radiation Effects; Mutagenesis; Iron Isotopes

20070030099 NASA Johnson Space Center, Houston, TX, USA
Cooperative Effects of Corticosteroids and Catecholamines upon Immune Deviation of the Type-1/Type-2 Cytokine Balance in Favor of Type-2 Expression in Human Peripheral Blood Mononuclear Cells
Salicru, A. N.; Sams, Clarence F.; Marshall, G. D.; [2007]; 16 pp.; In English; Original contains color illustrations; Copyright; Avail.: CASI: A03, Hardcopy

A growing number of studies show strong associations between stress and altered immune function. In vivo studies of chronic and acute stress have demonstrated that cognitive stressors are strongly correlated with high levels of catecholamines (CT) and corticosteroids (CS). Although both CS and CT individually can inhibit the production of T-helper 1 (TH1, type-1 like) cytokines and simultaneously promote the production of T-helper 2 (TH2, type-2 like) cytokines in antigen-specific and mitogen stimulated human leukocyte cultures in vitro, little attention has been focused on the effects of combination CT and CS in immune responses that may be more physiologically relevant. We therefore investigated the combined effects of in vitro CT and CS upon the type-1/type-2 cytokine balance of human peripheral blood mononuclear cells (PBMC) as a model to study the immunomodulatory effects of superimposed acute and chronic stress. Results demonstrated a significant decrease in type-1 cytokine production (IFN-gamma) and a significant increase in type-2 cytokine production (IL-4, IL-10) in our CS+CT incubated cultures when compared to either CT or CS agents alone. Furthermore, variable enhancement of type-1/type-2 immune deviation occurred depending upon when the CT was added. The data suggest that CS can increase the sensitivity of PBMC to the immunomodulatory effects of CT and establishes an in vitro model to study the combined effects of in vivo type-1/type-2 cytokine alterations observed in acute and chronic stress. Introduction
Author
Catecholamine; Corticosteroids; Immunity; Physiological Responses; Stress (Physiology); Stress (Psychology); Immune Systems; Stress Functions; Hematology

20070030101 NASA Johnson Space Center, Houston, TX, USA
Immune Dysregulation Following Short versus Long Duration Space Flight, Version 03
Crucian, Brian E.; Stowe, Raymond P.; Pierson, Duane L.; Sams, Clarence F.; [2007]; 21 pp.; In English; Original contains color and black and white illustrations; Copyright; Avail.: CASI: A03, Hardcopy

Immune system dysregulation has been demonstrated to occur during spaceflight and has the potential to cause serious health risks to crewmembers participating in exploration-class missions. A comprehensive immune assessment was recently performed on 13 short duration Space Shuttle crewmembers and 8 long duration International Space Station (ISS) crewmembers. Statistically significant post-flight phenotype alterations (as compared to pre-flight baseline) for the Shuttle crewmembers included: granulocytosis, increased percentage of B cells, reduced percentage of NK cells, elevated CD4/CD8 ratio, elevated levels of memory CD4+ T cells, and a CD8+ T cell shift to a less differentiated state. For the Shuttle

crewmembers, T cell function was surprisingly elevated post-flight, among both the CD4+ and CD8+ subsets. This is likely an acute stress response in less-deconditioned crewmembers. The percentage of CD4+/IL-2+, CD4+/IFNg+ and CD8+/IFNg+ T cells were all decreased at landing. Culture secreted IFNg production was significantly decreased at landing, whereas production of Th2 cytokines was largely unchanged. It was found that the IFNg:IL-10 ratio was obviously declined in the Shuttle crewmembers immediately post-flight. A similar pattern of alterations were observed for the long duration ISS crewmembers. In contrast to Shuttle crewmembers, the ISS crewmembers demonstrated a dramatic reduction in T cell function immediately post-flight. This may be related to the effect of acute landing stress in conjunction with prolonged deconditioning associated with extended flight. The reduction in IFNg:IL-10 ratio (Th2 shift) was also observed post-flight in the ISS crewmembers to a much higher degree. These data indicate consistent peripheral phenotype changes and altered cytokine production profiles occur following space travel of both short and long duration.
Author
Long Duration Space Flight; Immune Systems; Aerospace Medicine; International Space Station; Cells (Biology)

20070030102 NASA Johnson Space Center, Houston, TX, USA
Mechanical Vibrations Reduce the Intervertebral Disc Swelling and Muscle Atrophy from Bed Rest
Holguin, Nilsson; Muir, Jesse; Evans, Harlan J.; Qin, Yi-Xian; Rubin, Clinton; Wagshul, Mark; Judex, Stefan; September 16, 2007; 2 pp.; In English; ASBMR 29th Annual Meeting, 16-19 Sep. 2007, Honolulu, HI, USA; Original contains color illustrations; Copyright; Avail.: CASI: A01, Hardcopy

Loss of functional weight bearing, such as experienced during space flight or bed rest (BR), distorts intervertebral disc (IVD) and muscle morphology. IVDs are avascular structures consisting of cells that may derive their nutrition and waste removal from the load induced fluid flow into and out of the disc. A diurnal cycle is produced by forces related to weight bearing and muscular activity, and comprised of a supine and erect posture over a 24 hr period. A diurnal cycle will include a disc volume change of approx. 10-13%. However, in space there are little or no diurnal changes because of the microgravity, which removes the gravitational load and compressive forces to the back muscles. The BR model and the etiology of the disc swelling and muscle atrophy could provide insight into those subjects confined to bed for chronic disease/injury and aging. We hypothesize that extremely low-magnitude, high frequency mechanical vibrations will abate the disc degeneration and muscle loss associated with long-term BR.
Author
Atrophy; Bed Rest; Muscles; Vibration; Spine; Swelling; Morphology; Intervertebral Disks

20070030106 Wyle Labs., Inc., Houston, TX, USA
Potential for Measurement of Trace Volatile Organic Compounds in Closed Environments Using Gas Chromatograph/ Differential Mobility Spectrometer
Limero, Thomas; Cheng, Patti; [2007]; 1 pp.; In English, Amsterdam; Copyright; Avail.: Other Sources; Abstract Only

For nearly 3.5 years, the Volatile Organic Analyzer (VOA) has routinely analyzed the International Space Station (ISS) atmosphere for a target list of approximately 20 volatile organic compounds (VOCs). Additionally, an early prototype of the VOA collected data aboard submarines in two separate trials. Comparison of the data collected on ISS and submarines showed a surprising similarity in the atmospheres of the two environments. Furthermore, in both cases it was demonstrated that the VOA data can detect hardware issues unrelated to crew health. Finally, it was also clear in both operations that the VOA s size and resource consumption were major disadvantages that would restrict its use in the future. The VOA showed the value of measuring VOCs in closed environments, but it had to be shrunk if it was to be considered for future operations in these environments that are characterized by cramped spaces and limited resources. The Sionex Microanalyzer is a fraction of the VOA s size and this instrument seems capable of maintaining or improving upon the analytical performance of the VOA. The two design improvements that led to a smaller, less complex instrument are the Microanalyzer s use of recirculated air as the gas chromatograph s carrier gas and a micromachined detector. Although the VOA s ion mobility spectrometer and the Microanalyzer s differential mobility spectrometer (DMS) are related detector technologies, the DMS was more amenable to micromachining. This paper will present data from the initial assessment of the Microanalyzer. The instrument was challenged with mixtures that simulated the VOCs typically detected in closed-environment atmospheres.
Author
Volatile Organic Compounds; Ion Mobility Spectroscopy; Gas Chromatography; Closed Ecological Systems; Aerospace Medicine; Gas Detectors

20070030109 NASA Johnson Space Center, Houston, TX, USA

The Apollo Medical Operations Project: Recommendations to Improve Crew Health and Performance for Future Exploration Missions and Lunar Surface Operations

Scheuring, Richard A.; Jones, Jeffrey A.; Polk, James D.; Gillis, David B.; Schmid, Joseph; Duncan, James M.; Davis, Jeffrey R.; Novak, Joseph D.; August 2007; 458 pp.; In English; Original contains black and white illustrations

Report No.(s): NASA/TM-2007-214755; S-1005; Copyright; Avail.: CASI: A20, Hardcopy

Medical requirements for the future Crew Exploration Vehicle (CEV), Lunar Surface Access Module (LSAM), advanced Extravehicular Activity (EVA) suits and Lunar habitat are currently being developed. Crews returning to the lunar surface will construct the lunar habitat and conduct scientific research. Inherent in aggressive surface activities is the potential risk of injury to crewmembers. Physiological responses to and the operational environment of short forays during the Apollo lunar missions were studied and documented. Little is known about the operational environment in which crews will live and work and the hardware that will be used for long-duration lunar surface operations.Additional information is needed regarding productivity and the events that affect crew function such as a compressed timeline. The Space Medicine Division at the NASA Johnson Space Center (JSC) requested a study in December 2005 to identify Apollo mission issues relevant to medical operations that had impact to crew health and/or performance. The operationally oriented goals of this project were to develop or modify medical requirements for new exploration vehicles and habitats, create a centralized database for future access, and share relevant Apollo information with the multiple entities at NASA and abroad participating in the exploration effort.

Author

Aerospace Medicine; Spacecrews; Extravehicular Activity; Physiological Responses; Data Bases

20070030123 NASA Johnson Space Center, Houston, TX, USA

Evaluating ACLS Algorithms for the International Space Station (ISS) - A Paradigm Revisited

Alexander, Dave; Brandt, Keith; Locke, James; Hurst, Victor, IV; Mack, Michael D.; Pettys, Marianne; Smart, Kieran; May 13, 2007; 21 pp.; In English; ASMA Annual Conference, 13-17 May 2007, New Orleans, LA, USA; Original contains color and black and white illustrations

Contract(s)/Grant(s): NAS9-02078; No Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: http://hdl.handle.net/2060/20070030123

The ISS may have communication gaps of up to 45 minutes during each orbit and therefore it is imperative to have medical protocols, including an effective ACLS algorithm, that can be reliably autonomously executed during flight. The aim of this project was to compare the effectiveness of the current ACLS algorithm with an improved algorithm having a new navigation format.

Derived from text

Aerospace Medicine; International Space Station; Algorithms; Fibrillation; Life Support Systems

20070030124 NASA Johnson Space Center, Houston, TX, USA

Early Results and Spaceflight Implications of the SWAB Flight Experiment

Ott, C. Mark; Pierson, Duane L.; September 17, 2007; 1 pp.; In English; 5th Space Microbiology Workshop, 17-21 Sep. 2007, Tokyo, Japan; No Copyright; Avail.: Other Sources; Abstract Only

Microbial monitoring of spacecraft environments provides key information in the assessment of infectious disease risk to the crew. Monitoring aboard the Mir space station and International Space Station (ISS) has provided a tremendous informational baseline to aid in determining the types and concentrations of microorganisms during a mission. Still, current microbial monitoring hardware utilizes culture-based methodology which may not detect many medically significant organisms, such as Legionella pneumophila. We hypothesize that evaluation of the ISS environment using non-culture-based technologies would reveal microorganisms not previously reported in spacecraft, allowing for a more complete health assessment. To achieve this goal, a spaceflight experiment, operationally designated as SWAB, was designed to evaluate the DNA from environmental samples collected from ISS and vehicles destined for ISS. Results from initial samples indicate that the sample collection and return procedures were successful. Analysis of these samples using denaturing gradient gel electrophoresis and targeted PCR primers for fungal contaminants is underway. The current results of SWAB and their implication for in-flight molecular analysis of environmental samples will be discussed.

Author

Spacecraft Environments; Microorganisms; Infectious Diseases; Contaminants; Deoxyribonucleic Acid; Fungi

20070030177 NASA Johnson Space Center, Houston, TX, USA
Medical Significance of Microorganisms in Spacecraft Environment
Pierson, Duane L.; Ott, C. Mark; September 17, 2007; 1 pp.; In English; 5th Space Microbiology Workshop, 17-21 Sep. 2007, Tokyo, Japan; No Copyright; Avail.: Other Sources; Abstract Only

Microorganisms can spoil food supplies, contaminate drinking water, release noxious volatile compounds, initiate allergic responses, contaminate the environment, and cause infectious diseases. International acceptability limits have been established for bacterial and fungal contaminants in air and on surfaces, and environmental monitoring is conducted to ensure compliance. Allowable levels of microorganism in water and food have also been established. Environmental monitoring of the space shuttle, the Mir, and the ISS have allowed for some general conclusions. Generally, the bacteria found in air and on interior surfaces are largely of human origin such as Staphylococcus spp., Micrococcus spp. Common environmental genera such as Bacillus spp. are the most commonly isolated bacteria from all spacecraft. Yeast species associated with humans such as Candida spp. are commonly found. Aspergillus spp., Penicillium spp., and Cladosporium spp. are the most commonly isolated filamentous fungi. Microbial levels in the environment differ significantly depending upon humidity levels, condensate accumulation, and availability of carbon sources. However, human 'normal flora' of bacteria and fungi can result in serious, life-threatening diseases if human immunity is compromised. Disease incidence is expected to increase as mission duration increases.
Author
Bacteria; Microorganisms; Contaminants; Infectious Diseases; Allergic Diseases; Staphylococcus; Spacecraft Environments; Fungi

20070030954 National Advisory Committee for Aeronautics. Langley Aeronautical Lab., Langley Field, VA USA
Studies of Accelerations in Manned Vehicles During Exit and Reentry Flight
February 19, 1959; In English; Originally recorded in 16mm, Silent, Color, Black & White, 340ft, 9.5min.; DVD produced from the original 16mm recording
Report No.(s): L-431; No Copyright; Avail.: CASI: C01, DVD; Movie/Video (High Res)
ONLINE: View Movie/Video (Low Res); View Movie/Video (Medium Res)

Several experiments with human centrifugation are shown with subjects wearing different flight suits.
CASI
Human Centrifuges; Manned Reentry; Centrifugal Force; Acceleration Stresses (Physiology)

20070031093 Universities Space Research Association, Houston, TX, USA; Universities Space Research Association, Houston, TX, USA
Environmental Physiology at the Johnson Space Center: Past, Present, and Future
Conkin, Johnny; July 19, 2007; 79 pp.; In English; Introduction to Aerospace Medicine, 19 Jul. 2007, Galveston, TX, USA; Original contains color and black and white illustrations
Contract(s)/Grant(s): NNJ06HG25A; No Copyright; Avail.: CASI: A05, Hardcopy
ONLINE: http://hdl.handle.net/2060/20070031093

This viewgraph presentation reviews the work in environmental physiology done at Johnson Space Center (JSC). The work is aimed at keeping astronauts healthy. This is a different approach than treating the sick, and is more of an occupational health model. The reduction of risks is the main emphasis for this work. They emphasis is to reduce the risk of decompression sickness (DCS) and acute mountain sickness (AMS). The work in environmental physiology encompasses the following areas: (1) Pressure: hypobaric and hyperbaric (2) Gases: hypoxia and hyperoxia, hypercapnia--closed space issues, inert gas physiology / respiration (3) Temperature: hypothermia and hyperthermia, thermal comfort, Protective clothing diving, aviation, mountaineering, and space (4) Acceleration (5) Noise and Vibration (6) Exercise / Performance (6) Acclimatization / Adaptation: engineering solutions when necessary. This presentation reviews the work done at JSC in the areas of DCS and AMS.
CASI
Acclimatization; Altitude Sickness; Decompression Sickness; Health; Risk; Aerospace Medicine; Barotrauma

53
BEHAVIORAL SCIENCES

Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric research.

20070030897 NASA Dryden Flight Research Center, Edwards, CA, USA
CRM - I Want It My Way!
Henwood, Bart; [2007]; 16 pp.; In English; 2007 Flight Test Safety Workshop, 8-10 May 2007, San Diego, CA, USA; No Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20070030897

This viewgraph presentation provides an overview of crew resource management (CRM). Topics include what makes a good participant in a team process, human perception and response of individual behavior, characteristics of a bad participant, factors that affect performance, CRM assumptions and techniques, and CRM and individuality.
CASI
Personnel Management; Human Relations; Teams; Resources Management; Human Behavior

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*.

20070030241 NASA Johnson Space Center, Houston, TX, USA
Life Support System Technologies for NASA Exploration Missions
Ewert, Michael K.; September 12, 2007; 36 pp.; In English; Original contains color illustrations; No Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20070030241

The Lunar Mars Life Support Test series successfully demonstrated integration and operation of advanced technologies for closed-loop life support systems, including physicochemical and biological subsystems. Increased closure was obtained when targeted technologies, such as brine dewatering subsystems, were added to further process life support system byproducts to recover resources. Physicochemical and biological systems can be integrated satisfactorily to achieve desired levels of closure. Imbalances between system components, such as differences in metabolic quotients between human crews and plants, must be addressed. Each subsystem or component that is added to increase closure will likely have added costs, ranging from initial launch mass, power, thermal, crew time, byproducts, etc., that must be factored into break even analysis. Achieving life support system closure while maintaining control of total mass and system complexity will be a challenge.
Author
Life Support Systems; NASA Programs; Feedback Control; By-Products; Metabolism; Dewatering

20070030822 Wyle Labs., Inc., Houston, TX, USA; NASA Johnson Space Center, Houston, TX, USA
Interpretation of TEPC Measurements in Space Flights for Radiation Monitoring
Kim, Myung-Hee Y.; Nikjoo, Hooshang; Dicello, John F.; Pisacane, Vincent; Cucinotta, Francis A.; [2007]; 1 pp.; In English; 18th Annual NASA Space Radiation Investigators' Workshop, 13-15 July 2007, Rohnert Park, CA, USA
Contract(s)/Grant(s): NCC9-58; No Copyright; Avail.: Other Sources; Abstract Only

For the proper interpretation of radiation data measured in space, the results of integrated radiation transport models were compared with the tissue equivalent proportional counter (TEPC) measurements. TEPC is a simple, time-dependent approach to radiation monitoring for astronauts on board the International Space Station. Another and a newer approach to microdosimetry is the use of silicon-on-insulator (SOI) technology launched on the MidSTAR-1 mission in low Earth orbit (LEO). In the radiation protection practice, the average quality factor of a radiation field is defined as a function of linear energy transfer (LET), Qave(LET). However, TEPC measures the average quality factor as a function of the lineal energy y, Qave(y), defined as the average energy deposition in a volume divided by the average chord length of the volume. The deviation of y from LET is caused by energy straggling, delta-ray escape or entry, and nuclear fragments produced in the detector volume. The response distribution functions of the wall-less and walled TEPCs were calculated from Monte-Carlo track simulations. Using an integrated space radiation model (which includes the transport codes HZETRN and BRYNTRN, and the quantum nuclear interaction model QMSFRG) and the resultant response distribution functions from Monte-Carlo track simulations, we compared model calculations with the walled-TEPC measurements from NASA missions in LEO and

made predictions for the lunar and the Mars missions. Good agreement was found for Qave(y) between the model and measured spectra from past NASA missions. The Qave(y) values for the trapped or the solar protons ranged from 1.9-2.5. This over-estimates the Qave(LET) values which ranged from 1.4-1.6. Both quantities increase with shield thickness due to nuclear fragmentation. The Qave(LET) for the complete GCR spectra was found to be 3.5-4.5, while flight TEPCs measured 2.9-3.4 for Qave(y). The GCR values are decreasing with the shield thickness. Our analysis of the measurements of TEPCs can be used for a proper interpretation of observed data of monitoring the space radiation environment.
Author
Spacecraft Environments; Linear Energy Transfer (LET); Extraterrestrial Radiation; Radiation Transport; Low Earth Orbits; Radiation Protection; Tissues (Biology); Radiation Dosage

61
COMPUTER PROGRAMMING AND SOFTWARE

Includes software engineering, computer programs, routines, algorithms, and specific applications, e.g., CAD/CAM. For computer software applied to specific applications, see also the associated category.

20070030243 NASA Johnson Space Center, Houston, TX, USA
Free Molecular Heat Transfer Programs for Setup and Dynamic Updating the Conductors in Thermal Desktop
Malroy, Eric T.; September 10, 2007; 47 pp.; In English; TFAWS 2007, 10-14 Sep. 2007, Cleveland, OH, USA; Original contains color illustrations; No Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20070030243

The programs, arrays and logic structure were developed to enable the dynamic update of conductors in thermal desktop. The MatLab program FMHTPRE.m processes the Thermal Desktop conductors and sets up the arrays. The user needs to manually copy portions of the output to different input regions in Thermal Desktop. Also, Fortran subroutines are provided that perform the actual updates to the conductors. The subroutines are setup for helium gas, but the equations can be modified for other gases. The maximum number of free molecular conductors allowed is 10,000 for a given radiation task. Additional radiation tasks for FMHT can be generated to account for more conductors. Modifications to the Fortran subroutines may be warranted, when the mode of heat transfer is in the mixed or continuum mode. The FMHT Thermal Desktop model should be activated by using the 'Case Set Manager' once the model is setup. Careful setup of the model is needed to avoid excessive solve times.
Author
Thermal Conductors; Heat Transfer; Computer Programs; Continuums; FORTRAN

20070030310 NASA Langley Research Center, Hampton, VA, USA; Draper (Charles Stark) Lab., Inc., Cambridge, MA, USA
A Hardware-in-the-Loop Simulator for Software Development for a Mars Airplane
Slagowski, Stefan E.; Vican, Justin E.; Kenney, P. Sean; August 20, 2007; 11 pp.; In English; AIAA Modeling and Simulation Technologies Conference and Exhibit, 20-23 Aug. 2007, Hilton Head, SC, USA; Original contains color illustrations
Contract(s)/Grant(s): WBS 160961.01.02.01
Report No.(s): AIAA Paper 2007-6477; Copyright; Avail.: CASI: A03, Hardcopy

Draper Laboratory recently developed a Hardware-In-The-Loop Simulator (HILSIM) to provide a simulation of the Aerial Regional-scale Environmental Survey (ARES) airplane executing a mission in the Martian environment. The HILSIM was used to support risk mitigation activities under the Planetary Airplane Risk Reduction (PARR) program. PARR supported NASA Langley Research Center's (LaRC) ARES proposal efforts for the Mars Scout 2011 opportunity. The HILSIM software was a successful integration of two simulation frameworks, Draper's CSIM and NASA LaRC's Langley Standard Real-Time Simulation in C++ (LaSRS++).
Author
Hardware-in-the-Loop Simulation; Software Engineering; Mars Environment; Mars (Planet); Planetary Aerial Vehicles

20070030850 NASA Langley Research Center, Hampton, VA, USA
The DaveMLTranslator: An Interface for DAVE-ML Aerodynamic Models
Hill, Melissa A.; Jackson, E. Bruce; August 20, 2007; 13 pp.; In English; AIAA Modeling and Simulation Technologies Conference and Exhibit, 20-23 Aug. 2007, Hilton Head, SC, USA; Original contains color illustrations
Report No.(s): AIAA Paper 2007-6890; Copyright; Avail.: CASI: A03, Hardcopy

It can take weeks or months to incorporate a new aerodynamic model into a vehicle simulation and validate the

performance of the model. The Dynamic Aerospace Vehicle Exchange Markup Language (DAVE-ML) has been proposed as a means to reduce the time required to accomplish this task by defining a standard format for typical components of a flight dynamic model. The purpose of this paper is to describe an object-oriented C++ implementation of a class that interfaces a vehicle subsystem model specified in DAVE-ML and a vehicle simulation. Using the DaveMLTranslator class, aerodynamic or other subsystem models can be automatically imported and verified at run-time, significantly reducing the elapsed time between receipt of a DAVE-ML model and its integration into a simulation environment. The translator performs variable initializations, data table lookups, and mathematical calculations for the aerodynamic build-up, and executes any embedded static check-cases for verification. The implementation is efficient, enabling real-time execution. Simple interface code for the model inputs and outputs is the only requirement to integrate the DaveMLTranslator as a vehicle aerodynamic model. The translator makes use of existing table-lookup utilities from the Langley Standard Real-Time Simulation in C++ (LaSRS++). The design and operation of the translator class is described and comparisons with existing, conventional, C++ aerodynamic models of the same vehicle are given.
Author
Aerospace Vehicles; Document Markup Languages; Computerized Simulation; Systems Engineering; Dynamic Models

20070030903 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Wavefront Control Toolbox for James Webb Space Telescope Testbed
Shiri, Ron; Aronstein, David L.; Smith, Jeffery Scott; Dean, Bruce H.; Sabatke, Erin; August 26, 2007; 1 pp.; In English; SPIE Optics and Photonics Conference, 26-30 Aug. 2007, San Diego, CA, USA; Copyright; Avail.: Other Sources; Abstract Only

We have developed a Matlab toolbox for wavefront control of optical systems. We have applied this toolbox to the optical models of James Webb Space Telescope (JWST) in general and to the JWST Testbed Telescope (TBT) in particular, implementing both unconstrained and constrained wavefront optimization to correct for possible misalignments present on the segmented primary mirror or the monolithic secondary mirror. The optical models implemented in Zemax optical design program and information is exchanged between Matlab and Zemax via the Dynamic Data Exchange (DDE) interface. The model configuration is managed using the XML protocol. The optimization algorithm uses influence functions for each adjustable degree of freedom of the optical mode. The iterative and non-iterative algorithms have been developed to converge to a local minimum of the root-mean-square (rms) of wavefront error using singular value decomposition technique of the control matrix of influence functions. The toolkit is highly modular and allows the user to choose control strategies for the degrees of freedom to be adjusted on a given iteration and wavefront convergence criterion. As the influence functions are nonlinear over the control parameter space, the toolkit also allows for trade-offs between frequency of updating the local influence functions and execution speed. The functionality of the toolbox and the validity of the underlying algorithms have been verified through extensive simulations.
Author
Algorithms; James Webb Space Telescope; Optical Equipment; Wave Fronts; Mirrors

20070031028 Universities Space Research Association, Houston, TX, USA
NASA's Core Trajectory Sub-System Project: Using JBoss Enterprise Middleware for Building Software Systems Used to Support Spacecraft Trajectory Operations
Stensrud, Kjell C.; Hamm, Dustin; [2007]; 1 pp.; In English; JBoss World Conference 2008, 13-15 Jan. 2008, Orlando, FL, USA; Copyright; Avail.: Other Sources; Abstract Only

NASA's Johnson Space Center (JSC) / Flight Design and Dynamics Division (DM) has prototyped the use of Open Source middleware technology for building its next generation spacecraft mission support system. This is part of a larger initiative to use open standards and open source software as building blocks for future mission and safety critical systems. JSC is hoping to leverage standardized enterprise architectures, such as Java EE, so that its internal software development efforts can be focused on the core aspects of their problem domain. This presentation will outline the design and implementation of the Trajectory system and the lessons learned during the exercise.
Author
Applications Programs (Computers); Open Source Licensing (Computers); Software Engineering; Spacecraft Trajectories; Prototypes

20070031032 NASA Langley Research Center, Hampton, VA, USA; National Inst. of Aerospace, Hampton, VA, USA
In-Trail Procedure (ITP) Algorithm Design
Munoz, Cesar A.; Siminiceanu, Radu I.; August 2007; 38 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): NCC1-02043; WBS 411931.02.07.07
Report No.(s): NASA/CR-2007-214863; NIA Report No. 2007-06; No Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20070031032

The primary objective of this document is to provide a detailed description of the In-Trail Procedure (ITP) algorithm, which is part of the Airborne Traffic Situational Awareness In-Trail Procedure (ATSA-ITP) application. To this end, the document presents a high level description of the ITP Algorithm and a prototype implementation of this algorithm in the programming language C.
Author
Situational Awareness; Air Traffic; Software Engineering; Airborne/Spaceborne Computers; Computer Programming

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*.

20070030940 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
Humanoids in Support of Lunar and Planetary Surface Operations
Stoica, Adrian; Keymeulen, Didier; March 6, 2006; 7 pp.; In English; IEEE Aerospace Conference, 4-11 Mar. 2006, Big Sky, MT, USA; Original contains black and white illustrations; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/40140

This paper presents a vision of humanoid robots as human's key partners in future space exploration, in particular for construction, maintenance/repair and operation of lunar/planetary habitats, bases and settlements. It integrates this vision with the recent plans for human and robotic exploration, aligning a set of milestones for operational capability of humanoids with the schedule for the next decades and development spirals in the Project Constellation. These milestones relate to a set of incremental challenges, for the solving of which new humanoid technologies are needed. A system of systems integrative approach that would lead to readiness of cooperating humanoid crews is sketched. Robot fostering, training/education techniques, and improved cognitive/sensory/motor development techniques are considered essential elements for achieving intelligent humanoids. A pilot project using small-scale Fujitsu HOAP-2 humanoid is outlined.
Author
Space Exploration; Spacecrews; Robots; Robotics; Lunar Bases; Construction; Maintenance; Habitats

20070030943 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
Acceleration of Stereo Correlation in Verilog
Villalpando, Carlos; September 26, 2006; 5 pp.; In English; 9th Annual Military and Aerospace Programmable Logic Device International Conference, 26-28 Sep. 2006, Washington, DC, USA; Original contains black and white illustrations; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/40144

To speed up vision processing in low speed, low power devices, embedding FPGA hardware is becoming an effective way to add processing capability. FPGAs offer the ability to flexibly add parallel and/or deeply pipelined computation to embedded processors without adding significantly to the mass and power requirements of an embedded system. This paper will discuss the JPL stereo vision system, and describe how a portion of that system was accelerated by using custom FPGA hardware to process the computationally intensive portions of JPL stereo. The architecture described takes full advantage of the ability of an FPGA to use many small computation elements in parallel. This resulted in a 16 times speedup in real hardware over using a simple linear processor to compute image correlation and disparity.
Author
Field-Programmable Gate Arrays; Image Correlators; Stereoscopic Vision; Low Speed

64
NUMERICAL ANALYSIS

Includes iteration, differential and difference equations, and numerical approximation.

20070030189 NASA Langley Research Center, Hampton, VA, USA

POD/MAC-Based Modal Basis Selection for a Reduced Order Nonlinear Response Analysis

Rizzi, Stephen A.; Przekop, Adam; July 09, 2007; 4 pp.; In English; EUROMECH Colloquium 483 - Geometrically Non-Linear Vibrations of Structures, 9-11 Jul. 2007, Porto, Portugal; Original contains color illustrations

Contract(s)/Grant(s): WBS 599489.02.07.07.02.66

Report No.(s): Paper 21; No Copyright; Avail.: CASI: A01, Hardcopy

ONLINE: http://hdl.handle.net/2060/20070030189

A feasibility study was conducted to explore the applicability of a POD/MAC basis selection technique to a nonlinear structural response analysis. For the case studied the application of the POD/MAC technique resulted in a substantial improvement of the reduced order simulation when compared to a classic approach utilizing only low frequency modes present in the excitation bandwidth. Further studies are aimed to expand application of the presented technique to more complex structures including non-planar and two-dimensional configurations. For non-planar structures the separation of different displacement components may not be necessary or desirable.

Derived from text

Orthogonal Functions; Decomposition; Mathematical Models; Nonlinearity; Structural Analysis; Modal Response

20070030207 NASA Glenn Research Center, Cleveland, OH, USA

A Time-Accurate Upwind Unstructured Finite Volume Method for Compressible Flow with Cure of Pathological Behaviors

Loh, Ching Y.; Jorgenson, Philip C. E.; July 2007; 26 pp.; In English; 18th AIAA CFD Conference, 25-28 Jun. 2007, Miami, FL, USA; Original contains color and black and white illustrations

Contract(s)/Grant(s): NAS3-0372; WBS 561581.02.08.03.18.02

Report No.(s): NASA/TM-2007-214918; E-16124; No Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: http://hdl.handle.net/2060/20070030207

A time-accurate, upwind, finite volume method for computing compressible flows on unstructured grids is presented. The method is second order accurate in space and time and yields high resolution in the presence of discontinuities. For efficiency, the Roe approximate Riemann solver with an entropy correction is employed. In the basic Euler/Navier-Stokes scheme, many concepts of high order upwind schemes are adopted: the surface flux integrals are carefully treated, a Cauchy-Kowalewski time-stepping scheme is used in the time-marching stage, and a multidimensional limiter is applied in the reconstruction stage. However even with these up-to-date improvements, the basic upwind scheme is still plagued by the so-called 'pathological behaviors,' e.g., the carbuncle phenomenon, the expansion shock, etc. A solution to these limitations is presented which uses a very simple dissipation model while still preserving second order accuracy. This scheme is referred to as the enhanced time-accurate upwind (ETAU) scheme in this paper. The unstructured grid capability renders flexibility for use in complex geometry; and the present ETAU Euler/Navier-Stokes scheme is capable of handling a broad spectrum of flow regimes from high supersonic to subsonic at very low Mach number, appropriate for both CFD (computational fluid dynamics) and CAA (computational aeroacoustics). Numerous examples are included to demonstrate the robustness of the methods.

Author

Upwind Schemes (Mathematics); Finite Volume Method; Compressible Flow; Aeroacoustics; Computational Fluid Dynamics; Discontinuity

20070031060 Kentucky Univ., Lexington, KY, USA

3D Numerical Simulation of Synthetic Jet in a Crossflow Using a Parallel Unstructured Incompressible Navier-Stokes Solver

Parimi, V. K.; Chen, H.; Huang, L.; Katam, V.; LeBeau, R. P.; Huang, P. G.; Proceedings of the 2004 Workshop on CFD Validation of Synthetic Jets and Turbulent Separation Control; April 2007, pp. 2.7.1 - 2.7.3; In English; See also 20070031059; Original contains color illustrations; Copyright; Avail.: CASI: A01, Hardcopy

Active flow control technologies is growing area of aerodynamic research in the early 21st century. The goal is to prevent boundary layer separation and as such it is often applied to designs of high-lift airfoils. Forced oscillations superimposed on a mean flow which is on the verge of separation point is an effective means to delay boundary-layer separation, such as

blowing or suction techniques. However, the progress in active flow control technologies has often been paced by the development of actuator capabilities. A popular current actuator is the synthetic jet, which has demonstrated capabilities regarding separation control and thrust vectoring. Over the past several decades, both computational fluid dynamics (CFD) algorithms and computer technologies have progressed tremendously. These advances have made unstructured grids more attractive with their ability to smoothly conform to varying flow conditions and complicated boundaries with a single grid. However, challenges remain, including grid generation for a computational domain with complex geometries, well-balanced grid decomposition on distributed system, and efficient parallel performance. In this paper, a 3D numerical simulation of a synthetic jet into a cross flow using a new CFD code called UNCLE is described. UNCLE is a 2D/3D finite volume unstructured unsteady incompressible Navier-Stokes solver. In order to take care of turbulence flow in most realistic cases, F. R. Menter s shear-stress transport (SST) turbulence model [1] is employed to UNCLE. It is designed to study the challenges of using unstructured grid codes on high-performance parallel computers to simulate realistic cases. To increase flexibility in complex geometries, UNCLE may use a variety of grid types, such as triangles, quadrilateral, tetrahedron and hexahedra meshes. In order to achieve good load balance for parallel computing, METIS [2] is used to partition the grid.
Derived from text
Cross Flow; Incompressible Flow; Turbulence Models; Unstructured Grids (Mathematics); Navier-Stokes Equation; Flow Distribution; Boundary Layer Separation; Computational Fluid Dynamics

20070031063 NASA Langley Research Center, Hampton, VA, USA
URANS Application with CFL3D
Rumsey, C. L.; Proceedings of the 2004 Workshop on CFD Validation of Synthetic Jets and Turbulent Separation Control; April 2007, pp. 2.4.1 - 2.4.5; In English; See also 20070031059; Copyright; Avail.: CASI: A01, Hardcopy

This case was run using CFL3D, a multi-zone Reynolds-averaged Navier-Stokes code developed at NASA Langley [1]. It solves the thin-layer form of the Navier-Stokes equations in each of the (selected) coordinate directions. It can use 1-to-1, patched, or overset grids, and employs local time step scaling, grid sequencing, and multigrid to accelerate convergence to steady state. In time-accurate mode, CFL3D has the option to employ dual-time stepping with subiterations and multigrid, and it achieves second order temporal accuracy. CFL3D is a finite volume method. It uses third-order upwind-biased spatial differencing on the convective and pressure terms, and second-order differencing on the viscous terms; it is globally second-order spatially accurate. The flux difference-splitting (FDS) method of Roe is employed to obtain fluxes at the cell faces. It is advanced in time with an implicit three-factor approximate factorization method.
Derived from text
Computational Grids; Reynolds Averaging; Navier-Stokes Equation; Sequencing; Finite Volume Method

20070031066 Universite des Sciences et de la Technologie de Oran, Oran, Algeria
Synthetic Jet in a Crossflow
Azzi, A.; Lakehal, D.; Proceedings of the 2004 Workshop on CFD Validation of Synthetic Jets and Turbulent Separation Control; April 2007, pp. 2.5.1 - 2.5.4; In English; See also 20070031059; Copyright; Avail.: CASI: A01, Hardcopy

This case was run using CFL3D, a multi-zone Reynolds-averaged Navier-Stokes code developed at NASA Langley [1]. It solves the thin-layer form of the Navier-Stokes equations in each of the (selected) coordinate directions. It can use 1-to-1, patched, or overset grids, and employs local time step scaling, grid sequencing, and multigrid to accelerate convergence to steady state. In time-accurate mode, CFL3D has the option to employ dual-time stepping with subiterations and multigrid, and it achieves second order temporal accuracy. CFL3D is a finite volume method. It uses third-order upwind-biased spatial differencing on the convective and pressure terms, and second-order differencing on the viscous terms; it is globally second-order spatially accurate. The flux difference-splitting (FDS) method of Roe is employed to obtain fluxes at the cell faces. It is advanced in time with an implicit three-factor approximate factorization method.
Derived from text
Cross Flow; Computational Grids; Reynolds Averaging; Navier-Stokes Equation; Finite Volume Method

20070031076 NASA Langley Research Center, Hampton, VA, USA
RANS and URANS Application with CFL3D
Rumsey, C. L.; Proceedings of the 2004 Workshop on CFD Validation of Synthetic Jets and Turbulent Separation Control; April 2007, pp. 3.8.1 - 3.8.5; In English; See also 20070031059; Copyright; Avail.: CASI: A01, Hardcopy

This case was run using CFL3D, a multi-zone Reynolds-averaged Navier-Stokes code developed at NASA Langley [1]. It solves the thin-layer form of the Navier-Stokes equations in each of the (selected) coordinate directions. It can use 1-to-1,

patched, or overset grids, and employs local time step scaling, grid sequencing, and multigrid to accelerate convergence to steady state. In time-accurate mode, CFL3D has the option to employ dual-time stepping with subiterations and multigrid, and it achieves second order temporal accuracy. CFL3D is a finite volume method. It uses third-order upwind-biased spatial differencing on the convective and pressure terms, and second-order differencing on the viscous terms; it is globally second-order spatially accurate. The flux difference-splitting (FDS) method of Roe is employed to obtain fluxes at the cell faces. It is advanced in time with an implicit three-factor approximate factorization method.
Derived from text
Computational Grids; Reynolds Averaging; Navier-Stokes Equation; Sequencing; Convergence

20070031084 NASA Langley Research Center, Hampton, VA, USA
A Reduced-Order Model For Zero-Mass Synthetic Jet Actuators
Yamaleev, Nail K.; Carpenter, Mark H.; Vatsa, Veer S.; Proceedings of the 2004 Workshop on CFD Validation of Synthetic Jets and Turbulent Separation Control; April 2007, pp. 1.10.1 - 1.10.4; In English; See also 20070031059; Copyright; Avail.: CASI: A01, Hardcopy

Accurate details of the general performance of fluid actuators is desirable over a range of flow conditions, within some predetermined error tolerance. Designers typically model actuators with different levels of fidelity depending on the acceptable level of error in each circumstance. Crude properties of the actuator (e.g., peak mass rate and frequency) may be sufficient for some designs, while detailed information is needed for other applications (e.g., multiple actuator interactions). This work attempts to address two primary objectives. The first objective is to develop a systematic methodology for approximating realistic 3-D fluid actuators, using quasi-1-D reduced-order models. Near full fidelity can be achieved with this approach at a fraction of the cost of full simulation and only a modest increase in cost relative to most actuator models used today. The second objective, which is a direct consequence of the first, is to determine the approximate magnitude of errors committed by actuator model approximations of various fidelities. This objective attempts to identify which model (ranging from simple orifice exit boundary conditions to full numerical simulations of the actuator) is appropriate for a given error tolerance.
Derived from text
Actuators; Error Analysis; Simulation; Mathematical Models; Fault Tolerance; Flow Regulators; Orifices

20070031086 Office National d'Etudes et de Recherches Aeronautiques, Paris, France
Numerical Simulation of a Synthetic Jet Into A Quiescent Air
Mary, I.; Proceedings of the 2004 Workshop on CFD Validation of Synthetic Jets and Turbulent Separation Control; April 2007, pp. 1.3.1 - 1.3.5; In English; See also 20070031059; Original contains color illustrations; Copyright; Avail.: CASI: A01, Hardcopy

Three different simulations of the case 1 have been carried out in order to assess the influence of the turbulence modelling. Firstly two-dimensional URANS and laminar simulations have been first investigated. As the Reynolds number based on cavity characteristics (like the diaphragm velocity and the exit size of the cavity) is quite small (less than 10000), it is not obvious that an URANS simulation will be better adapted to this flow case than a laminar simulation. Moreover the discontinuities in the geometry of the cavity could create complex flow patterns inside the cavity despite the low value of the Reynolds number. Thus three-dimensional Large Eddy Simulation have been realized for the same two-dimensional geometry in order to evaluate the intensity of the three-dimensional effects inside the cavity.
Derived from text
Three Dimensional Models; Turbulence Effects; Flow Distribution; Simulation

20070031088 Metacomp Technologies, Inc., Agoura, CA, USA
Synthetic Jet 3D Steady Half-Domain Computation Using CFD++
Shariff, S.; Batten, P.; Proceedings of the 2004 Workshop on CFD Validation of Synthetic Jets and Turbulent Separation Control; April 2007, pp. 3.14.1 - 3.14.2; In English; See also 20070031059; Original contains black and white illustrations; Copyright; Avail.: CASI: A01, Hardcopy

This paper briefly explains the details of one of our approaches to Case 3 of the Langley Research Center Workshop on synthetic jets. Here we have performed a three-dimensional simulation of half of the domain. For the suction case, we have prescribed the outflow pressure in the synthetic jet slot. This pressure was then adjusted to produce the appropriate mass flow

through the slot. This work was performed using CFD++, a Navier-Stokes solver for compressible and incompressible flow. CFD++ features a second order Total Variation Diminishing (TVD) discretization based on a multi-dimensional interpolation framework, which is also utilized for the viscous terms. A pre-conditioned HLLC (Harten-Lax-van Leer with Contact wave) Riemann solver is used to provide proper signal propagation physics while preserving positivity and satisfying the entropy condition.
Derived from text
Three Dimensional Models; Navier-Stokes Equation; Incompressible Flow; Compressible Flow; Tvd Schemes; Computation; Computational Fluid Dynamics

65
STATISTICS AND PROBABILITY

Includes data sampling and smoothing; Monte Carlo method; time series analysis; and stochastic processes.

20070030195 NASA Glenn Research Center, Cleveland, OH, USA
Probabilistic Analysis for Comparing Fatigue Data Based on Johnson-Weibull Parameters
Hendricks, Robert C.; Zaretsky, Erwin V.; Vicek, Brian L.; September 04, 2007; 12 pp.; In English; ASME International Design Engineering Technical Conference: 19th Reliability, Stress Analysis, and Failure Prevention Conference (RSAFP) Place RSAFP-1 Considerations in Design Process, 4-7 Sep. 2007, Las Vegas, NV, USA; Original contains black and white illustrations
Contract(s)/Grant(s): WBS 561581.02.07.03
Report No.(s): DET-0C2007-34849; Copyright; Avail.: Other Sources

Probabilistic failure analysis is essential when analysis of stress-life (S-N) curves is inconclusive in determining the relative ranking of two or more materials. In 1964, L. Johnson published a methodology for establishing the confidence that two populations of data are different. Simplified algebraic equations for confidence numbers were derived based on the original work of L. Johnson. Using the ratios of mean life, the resultant values of confidence numbers deviated less than one percent from those of Johnson. It is possible to rank the fatigue lives of different materials with a reasonable degree of statistical certainty based on combined confidence numbers. These equations were applied to rotating beam fatigue tests that were conducted on three aluminum alloys at three stress levels each. These alloys were AL 2024, AL 6061, and AL 7075. The results were analyzed and compared using ASTM Standard E739-91 and the Johnson-Weibull analysis. The ASTM method did not statistically distinguish between AL 6010 and AL 7075. Based on the Johnson-Weibull analysis confidence numbers greater than 99 percent, AL 2024 was found to have the longest fatigue life, followed by AL 7075, and then AL 6061. The ASTM Standard and the Johnson-Weibull analysis result in the same stress-life exponent p for each of the three aluminum alloys at the median or L(sub 50) lives.
Author
Weibull Density Functions; Failure Analysis; Probability Theory; Stress Analysis; Fatigue Tests; Fatigue Life

20070030198 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Efficient Implementation of an Optimal Interpolator for Large Spatial Data Sets
Memarsadeghi, Nargess; Mount, David M.; May 27, 2007; 8 pp.; In English; 2007 International Conference on Computational Science (ICCS 07), 27-30 May 2007, Beijing, China; Copyright; Avail.: CASI: A02, Hardcopy

Scattered data interpolation is a problem of interest in numerous areas such as electronic imaging, smooth surface modeling, and computational geometry. Our motivation arises from applications in geology and mining, which often involve large scattered data sets and a demand for high accuracy. The method of choice is ordinary kriging. This is because it is a best unbiased estimator. Unfortunately, this interpolant is computationally very expensive to compute exactly. For n scattered data points, computing the value of a single interpolant involves solving a dense linear system of size roughly n x n. This is infeasible for large n. In practice, kriging is solved approximately by local approaches that are based on considering only a relatively small'number of points that lie close to the query point. There are many problems with this local approach, however. The first is that determining the proper neighborhood size is tricky, and is usually solved by ad hoc methods such as selecting a fixed number of nearest neighbors or all the points lying within a fixed radius. Such fixed neighborhood sizes may not work well for all query points, depending on local density of the point distribution. Local methods also suffer from the problem that the resulting interpolant is not continuous. Meyer showed that while kriging produces smooth continues surfaces, it has zero order continuity along its borders. Thus, at interface boundaries where the neighborhood changes, the interpolant behaves discontinuously. Therefore, it is important to consider and solve the global system for each interpolant. However, solving such

large dense systems for each query point is impractical. Recently a more principled approach to approximating kriging has been proposed based on a technique called covariance tapering. The problems arise from the fact that the covariance functions that are used in kriging have global support. Our implementations combine, utilize, and enhance a number of different approaches that have been introduced in literature for solving large linear systems for interpolation of scattered data points. For very large systems, exact methods such as Gaussian elimination are impractical since they require 0(n(exp 3)) time and 0(n(exp 2)) storage. As Billings et al. suggested, we use an iterative approach. In particular, we use the SYMMLQ method, for solving the large but sparse ordinary kriging systems that result from tapering. The main technical issue that need to be overcome in our algorithmic solution is that the points' covariance matrix for kriging should be symmetric positive definite. The goal of tapering is to obtain a sparse approximate representation of the covariance matrix while maintaining its positive definiteness. Furrer et al. used tapering to obtain a sparse linear system of the form Ax = b, where A is the tapered symmetric positive definite covariance matrix. Thus, Cholesky factorization could be used to solve their linear systems. They implemented an efficient sparse Cholesky decomposition method. They also showed if these tapers are used for a limited class of covariance models, the solution of the system converges to the solution of the original system. Matrix A in the ordinary kriging system, while symmetric, is not positive definite. Thus, their approach is not applicable to the ordinary kriging system. Therefore, we use tapering only to obtain a sparse linear system. Then, we use SYMMLQ to solve the ordinary kriging system. We show that solving large kriging systems becomes practical via tapering and iterative methods, and results in lower estimation errors compared to traditional local approaches, and significant memory savings compared to the original global system. We also developed a more efficient variant of the sparse SYMMLQ method for large ordinary kriging systems. This approach adaptively finds the correct local neighborhood for each query point in the interpolation process.
Derived from text
Algorithms; Imaging Techniques; Interpolation; Kriging; Linear Systems; Matrices (Mathematics)

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*.

20070030042 Brinks Hofer Gilson and Lione, Chicago, IL, USA
Imaging System
Zou, Y., Inventor; Pan, Z. M., Inventor; 10 Feb. 05; 55 pp.; In English
Contract(s)/Grant(s): NIH-EB000225; NIH-EB002765
Patent Info.: Filed 10 Feb. 05; US-Patent-Appl-SN-11-054 788
Report No.(s): PB2007-108636; No Copyright; Avail.: CASI: A04, Hardcopy

A method and apparatus for reconstruction of a region of interest for an object is provided. The reconstruction of the object may be based on chords which may fill a part, all, or more than all of the region of interest. Using chords for reconstruction may allow for reducing data acquired and/or processing for reconstructing a substantially exact image of the ROI. Moreover, various methodologies may be used in reconstructing the image, such as back-projection-filtration, and modified filtration back-projection.
NTIS
Image Processing; Imaging Techniques; Patent Applications

20070030944 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
General Theory of Relativity: Will It Survive the Next Decade?
Bertolami, Orfeu; Paramos, Jorge; Turyshev, Slava G.; May 30, 2006; 36 pp.; In English; Lasers, Clocks and Drag-Free: Technologies for Future Exploration in Space and Tests of Gravity, 30 May - 1 Jun. 2006, Bremen, Germany; Original contains black and white illustrations; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/40142

The nature of gravity is fundamental to our understanding of our own solar system, the galaxy and the structure and evolution of the Universe. Einstein's general theory of relativity is the standard model that is used for almost ninety years to describe gravitational phenomena on these various scales. We review the foundations of general relativity, discuss the recent progress in the tests of relativistic gravity, and present motivations for high-accuracy gravitational experiments in space. We also summarize the science objectives and technology needs for the laboratory experiments in space with laboratory being the

entire solar system. We discuss the advances in our understanding of fundamental physics anticipated in the near future and evaluate discovery potential for the recently proposed gravitational experiments.
Author
Relativity; Gravitation; Evolution (Development); Cosmology; Galaxies

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*.

20070030267 NASA Langley Research Center, Hampton, VA, USA; Michigan State Univ., East Lansing, MI, USA
Velocity-Field Measurements of an Axisymmetric Separated Flow Subjected to Amplitude-Modulated Excitation
Trosin, Barry James; July 2007; 110 pp.; In English; Original contains color and black and white illustrations
Contract(s)/Grant(s): NNL05AA11H; WBS 561581.02.08.07
Report No.(s): NASA/CR-2007-214889; No Copyright; Avail.: CASI: A06, Hardcopy
ONLINE: http://hdl.handle.net/2060/20070030267

Active flow control was applied at the point of separation of an axisymmetric, backward-facing-step flow. The control was implemented by employing a Helmholtz resonator that was externally driven by an amplitude-modulated, acoustic disturbance from a speaker located upstream of the wind tunnel. The velocity field of the separating/reattaching flow region downstream of the step was characterized using hotwire velocity measurements with and without flow control. Conventional statistics of the data reveal that the separating/reattaching flow is affected by the imposed forcing. Triple decomposition along with conditional averaging was used to distinguish periodic disturbances from random turbulence in the fluctuating velocity component. A significant outcome of the present study is that it demonstrates that amplitude-modulated forcing of the separated flow alters the flow in the same manner as the more conventional method of periodic excitation.
Author
Separated Flow; Axisymmetric Flow; Active Control; Velocity Measurement; Flow Distribution; Turbulence

20070030300 NASA Glenn Research Center, Cleveland, OH, USA
Numerical Technique for Analyzing Rotating Rake Mode Measurements in a Duct With Passive Treatment and Shear Flow
Dahl, Milo D.; Sutliff, Daniel L.; August 2007; 23 pp.; In English; 13th AIAA/CEAS Aeroacoustics Conference, 21-23 May 2007, Rome, Italy; Original contains color and black and white illustrations
Contract(s)/Grant(s): WBS 561581.02.08.03.03.01
Report No.(s): NASA/TM-2007-214966; AIAA Paper 2007-3679; E-16130; No Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20070030300

A technique is presented for the analysis of measured data obtained from a rotating microphone rake system. The system is designed to measure the interaction modes of ducted fans. A Fourier analysis of the data from the rotating system results in a set of circumferential mode levels at each radial location of a microphone inside the duct. Radial basis functions are then least-squares fit to this data to obtain the radial mode amplitudes. For ducts with soft walls and mean flow, the radial basis functions must be numerically computed. The linear companion matrix method is used to obtain both the eigenvalues of interest, without an initial guess, and the radial basis functions. The governing equations allow for the mean flow to have a boundary layer at the wall. In addition, a nonlinear least-squares method is used to adjust the wall impedance to best fit the data in an attempt to use the rotating system as an in-duct wall impedance measurement tool. Simulated and measured data are used to show the effects of wall impedance and mean flow on the computed results.
Author
Ducted Fans; Impedance Measurement; Shear Flow; Wall Flow; Data Systems; Fourier Analysis

20070030896 Institute of Sound and Vibration Research, Southampton, UK
Institute of Sound and Vibration Research
2005; 84 pp.; In English; Copyright; Avail.: Other Sources

The annual report of the Institute of Sound and Vibration Research (ISVR) includes reports in three areas: Research, teaching, and consulting. Research efforts focus on the dynamic, fluid dynamics and acoustics, human sciences, and signal processing and control. Publication lists are included. Teaching programs include undergraduate programs, masters and

postgraduate diploma programs, ISVR short courses, and international collaboration. The final section reports on ISVR consulting efforts and programs at the South of England Cochlear Implant Centre.
CASI
Acoustics; England; Signal Processing; Dynamic Control; Audiology

20070031109 NASA Langley Research Center, Hampton, VA, USA
Vibro-Acoustic Response of Buildings Due to Sonic Boom Exposure: June 2006 Field Test
Klos, Jacob; Buehrle, Ralph D.; September 2007; 329 pp.; In English; Original contains color and black and white illustrations
Report No.(s): NASA/TM-2007-214900; L-19360; No Copyright; Avail.: CASI: A15, Hardcopy
ONLINE: http://hdl.handle.net/2060/20070031109

During the month of June 2006, a series of structural response measurements were made on a house on Edwards Air Force Base (AFB) property that was excited by sonic booms of various amplitudes. Many NASA personnel other than the authors of this report from both Langley Research Center and Dryden Flight Research Center participated in the planning, coordination, execution, and data reduction for the experiment documented in this report. The purpose of this report is to document the measurements that were made, the structure on which they were made, the conditions under which they were made, the sensors and other hardware that were used, and the data that were collected.
Author
Acoustics; Buildings; Field Tests; Sonic Booms; Vibrational Stress; Structural Analysis

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*.

20070030127 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Alignment and Integration Techniques for Mirror Segment Pairs on the Constellation X Telescope
Hadjimichael, Theo; Lehan, John; Olsen, Larry; Owens, Scott; Saha, Timo; Wallace, Tom; Zhang, Will; August 26, 2007; 1 pp.; In English; SPIE Optics and Photonics, 26-30 Aug. 2006, San Diego, CA, USA; Copyright; Avail.: Other Sources; Abstract Only

We present the concepts behind current alignment and integration techniques for testing a Constellation-X primary-secondary mirror segment pair in an x-ray beam line test. We examine the effects of a passive mount on thin glass x-ray mirror segments, and the issues of mount shape and environment on alignment. We also investigate how bonding and transfer to a permanent housing affects the quality of the final image, comparing predicted results to a full x-ray test on a primary secondary pair.
Author
Alignment; Constellation-X; Measure and Integration; Segmented Mirrors

20070030182 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Cryogenic Temperature-Dependent Refractive Index Measurements of CaF2 and Infrasil 301
Frey, Bradley J.; Leviton, Douglas B.; Madison, TImothy J.; August 26, 2007; 1 pp.; In English; SPIE Optics and Photonics, 26-30 Aug. 2007, San Diego, CA, USA; No Copyright; Avail.: Other Sources; Abstract Only

In order to enable high quality lens design using calcium fluoride (CaF2) and Heraeus Infrasil 30 (Infrasil) at cryogenic temperatures, we have measured the absolute refractive index of prisms of these two materials using the Cryogenic, High-Accuracy Refraction Measuring System (CHARMS) at NASA's Goddard Space Flight Center, as a function of both wavelength and temperature. For CaF2, we report absolute refractive index and thermo-optic coefficient (dn/dT) at temperatures ranging from 25 to 300 K at wavelengths from 0.4 to 5.6 micrometers; for Infrasil we cover temperatures ranging from 35 to 300K and wavelengths from 0.4 to 3.6 micrometers. We investigate the interspecimen variability between measurements of two unrelated samples of CaF2, and we also compare our results for Infrasil to previous measurements for

Corning 7980 fused silica. Finally, we provide temperature-dependent Sellmeier coefficients based on our data to allow accurate interpolation of index to other wavelengths and temperatures and compare those results to other data found in the literature.
Author
Calcium Fluorides; Cryogenic Temperature; Refractivity; Temperature Dependence; Lens Design; Optics

20070030187 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Finite Element Analysis of the LOLA Receiver Telescope Lens
Matzinger, Elizabeth; August 26, 2007; 1 pp.; In English; SPIE Optical Engineering and Applications conference, 26-30 Aug. 2007, San Diego, CA, USA; No Copyright; Avail.: Other Sources; Abstract Only

This paper presents the finite element stress and distortion analysis completed on the Receiver Telescope lens of the Lunar Orbiter Laser Altimeter (LOLA). LOLA is one of six instruments on the Lunar Reconnaissance Orbiter (LRO), scheduled to launch in 2008. LOLA's main objective is to produce a high-resolution global lunar topographic model to aid in safe landings and enhance surface mobility in future exploration missions. The Receiver Telescope captures the laser pulses transmitted through a diffractive optical element (DOE) and reflected off the lunar surface. The largest lens of the Receiver Telescope, Lens 1, is a 150 mm diameter aspheric lens originally designed to be made of BK7 glass. The finite element model of the Receiver Telescope Lens 1 is comprised of solid elements and constrained in a manner consistent with the behavior of the mounting configuration of the Receiver Telescope tube. Twenty-one temperature load cases were mapped to the nodes based on thermal analysis completed by LOLA's lead thermal analyst, and loads were applied to simulate the preload applied from the ring flexure. The thermal environment of the baseline design (uncoated BK7 lens with no baffle) produces large radial and axial gradients in the lens. These large gradients create internal stresses that may lead to part failure, as well as significant bending that degrades optical performance. The high stresses and large distortions shown in the analysis precipitated a design change from BK7 glass to sapphire.
Author
Finite Element Method; Lunar Orbiter; Reconnaissance; Lenses; Telescopes; Laser Altimeters; Receivers

20070030221 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Tunable Antireflection Layers for Planar Bolometer Arrays
Brown, Ari-David; Chuss, David; Woolack, Edward; Chervenak, James; Henry, Ross; Wray, James; March 20, 2007; 2 pp.; In English; 45th Annual Robert GOddard Memorial Symposium, 20-21 Mar. 2007, College Park, MD, USA; Original contains black and white illustrations; No Copyright; Avail.: CASI: A01, Hardcopy
ONLINE: http://hdl.handle.net/2060/20070030221

It remains a challenge to obtain high-efficiency coupling of far-infrared through millimeter radiation to large-format detector arrays. The conventional approach of increasing detector coupling is to use reflective backshorts. However, this approach often results in excessive systematic errors resulting from reflections off the backshort edge. An alternate approach to both increasing quantum efficiency and reducing systematics associated with stray light is to place an antireflective coating near the front surface of the array. When incorporated with a resistive layer and placed behind the detector focal plane, the AR coating can serve to prevent optical ghosting by capturing radiation transmitted through the detector. By etching a hexagonal pattern in silicon, in which the sizes of the hexes are smaller than the wavelength of incident radiation, it is possible to fabricate a material that has a controllable dielectric constant, thereby allowing for simple tunable optical device fabrication. To this end, we have fabricated and tested tunable silicon 'honeycomb' AR layers and AR/resistive layer devices. These devices were fabricated entirely out of silicon in order to eliminate problems associated with differential contraction upon detector cooling.
Author
Antireflection Coatings; Bolometers; Planar Structures; Fabrication; Arrays; Layers

20070030861 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
CMOS Active Pixel Sensor Technology and Reliability Characterization Methodology
Chen, Yuan; Guertin, Steven M.; Pain, Bedabrata; Kayaii, Sammy; March 20, 2006; 5 pp.; In English; Government Microcircuit Applications and Critical Technology Conference, 20-23 Mar. 2006, San Diego, CA, USA; Original contains black and white illustrations; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/40169

This paper describes the technology, design features and reliability characterization methodology of a CMOS Active Pixel Sensor. Both overall chip reliability and pixel reliability are projected for the imagers.
Author
CMOS; Pixels; Chips

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*.

20070030043 Department of Defense, Washington, DC USA
2006 Department of Defense Chief Information Officer Strategic Plan, Version 1, The Power of Information Access Share Collaborate
Jan 2006; 30 pp.; In English; Original contains color illustrations
Report No.(s): AD-A468866; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA468866

The Department of Defense is transforming to become a Net-Centric force. This transformation hinges on the recognition that information is one of our greatest sources of power. Information is a strategic component of situational awareness which enables decision makers at all levels to make better decisions faster and act sooner. Ensuring timely and trusted information is available where it is needed, when it is needed, and to those who need it is at the heart of Net-Centricity. As stated in the DoD National Defense Strategy of the USA of America, 'Transforming to a network centric force requires fundamental changes in processes, policy, and culture. Change in these areas will provide the necessary speed, accuracy, and quality of decision-making critical to future success.' From an information perspective, this transformation is embodied in the Net-Centric Global Information Grid (GIG). The DoD Chief Information Officer (CIO) provides the leadership to meet the Net-Centric vision and ultimately delivers the critical enabling capabilities required by the National Defense Strategy against an evolving threat from both internal and external sources. The 2006 DoD ClO Strategic Plan identifies actions that are critical to transforming DoD operations from platform/organization-centric to Net-Centric. This document is intended to provide a common understanding of the near and mid-term actions required to meet the vision and extend Net-Centricity across the Defense Information Enterprise. The actions described and requested encompass the full breadth of the transformation and include doctrine, organization, training, materiel, leadership/education, personnel and facilities (DOTMLPF) implications.
DTIC
Defense Program; Computer Networks; Grid Computing (Computer Networks)

20070030047 NASA Johnson Space Center, Houston, TX, USA
NASA Human Integration Design Handbook (HIDH): Revitalization of Space-Related Human Factors, Environmental and Habitability Data
Russo, Dane; Pickett, Lynn; Tillman, Barry; Foley, Tico; February 12, 2007; 1 pp.; In English; NASA Human Research Program Investigators' Conference, 12-14 Feb. 2007, League City, TX, USA; Original contains color illustrations
Contract(s)/Grant(s): NAS9-02078; No Copyright; Avail.: CASI: A01, Hardcopy
ONLINE: http://hdl.handle.net/2060/20070030047

This chart illustrates the contents for NASA's Human Integration Design Handbook, which is being developed as a new reference handbook for designing systems which accomodate the capabilities and limitations of the human crew.
CASI
Human Factors Engineering; Handbooks; Habitability

20070030230 Research and Technology Organization, Neuilly-sur-Seine, France
Exploring New Command and Control Concepts and Capabilities
April 2007; 310 pp.; In English; Original contains color and black and white illustrations
Report No.(s): RTO-TR-SAS-050; AC/323(SAS-050)TP/50; AC/323(SAS-050)TP/50; Copyright; Avail.: CASI: C01, CD-ROM: A14, Hardcopy

The SAS-050 study group was formed primarily to develop a conceptual model of Command and Control (C2) that could ultimately assist decision makers in understanding C2 concepts and the implications to different approaches to C2. This report provides an in-depth discussion of the SAS-050 Reference Model and the Value View developed by the SAS-050 study group.

Several chapters focus on specific sections of the reference model (C2 Approach, the Information Domain, Individual Characteristics and Behaviours, Team Characteristics and Behaviours, and Decisionmaking, Actions, Effects, and Consequences). These chapters are followed by an explanation of the group s approach to validating the model. The paper discusses key variables and relationships within the model, identifies tools that can explore the nature of the relationships among variables, and describes the results of case studies and peer review conducted to test and identify advantages and limitations of the model.
Author
Command and Control; Control Systems Design; Decision Making; Information Systems

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*.

20070030088 NASA Johnson Space Center, Houston, TX, USA
Debris Removal: An Opportunity for Cooperative Research?
Johnson, Nicholas L.; [2007]; 14 pp.; In English; Space Situational Awareness Conference, 25-26 Oct. 2007, London, UK; Original contains color illustrations; No Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20070030088

Space debris mitigation practices will be insufficient to prevent the continued growth of the Earth satellite population. Removal of orbital debris can improve the reliability of present and future space systems. The challenges of developing an effective, affordable debris removal capability are considerable. The time is right for a new look at space remediation concepts. In concert with or following the current IAA study An international approach to the remediation of the near-Earth space environment will likely be required.
Author
Space Debris; Aerospace Systems; Reliability

20070030108 United Space Alliance, Houston, TX, USA
System Engineering Strategy for Distributed Multi-Purpose Simulation Architectures
Bhula, Dlilpkumar; Kurt, Cindy Marie; Luty, Roger; September 24, 2007; 6 pp.; In English; 58th International Astronautical Congress 2007, 24-28 September, Hyderabad, India; Original contains color illustrations
Contract(s)/Grant(s): NAS9-20000; NNJ06VA01C
Report No.(s): IAC-07-D1.3.08; No Copyright; Avail.: CASI: A02, Hardcopy
ONLINE: http://hdl.handle.net/2060/20070030108

This paper describes the system engineering approach used to develop distributed multi-purpose simulations. The multi-purpose simulation architecture focuses on user needs, operations, flexibility, cost and maintenance. This approach was used to develop an International Space Station (ISS) simulator, which is called the International Space Station Integrated Simulation (ISIS)1. The ISIS runs unmodified ISS flight software, system models, and the astronaut command and control interface in an open system design that allows for rapid integration of multiple ISS models. The initial intent of ISIS was to provide a distributed system that allows access to ISS flight software and models for the creation, test, and validation of crew and ground controller procedures. This capability reduces the cost and scheduling issues associated with utilizing standalone simulators in fixed locations, and facilitates discovering unknowns and errors earlier in the development lifecycle. Since its inception, the flexible architecture of the ISIS has allowed its purpose to evolve to include ground operator system and display training, flight software modification testing, and as a realistic test bed for Exploration automation technology research and development.
Author
Systems Engineering; International Space Station; Simulation; User Requirements; Education; Control Systems Design; Test Stands

20070030178 NASA Johnson Space Center, Houston, TX, USA

Extravehicular Mobility Unit Penetration Probability from Micrometeoroids and Orbital Debris: Revised Analytical Model and Potential Space Suit Improvements

Chase, Thomas D.; Splawn, Keith; Christiansen, Eric L.; September 23, 2007; 21 pp.; In English; 10th Hypervelocity Impact Symposium, 23-27 Sep. 2007, Williamsburg, VA, USA; Original contains color illustrations

Contract(s)/Grant(s): NAS9-97150; NNJ04HA01C

Report No.(s): HVIS 07-138; No Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: http://hdl.handle.net/2060/20070030178

The NASA Extravehicular Mobility Unit (EMU) micrometeoroid and orbital debris protection ability has recently been assessed against an updated, higher threat space environment model. The new environment was analyzed in conjunction with a revised EMU solid model using a NASA computer code. Results showed that the EMU exceeds the required mathematical Probability of having No Penetrations (PNP) of any suit pressure bladder over the remaining life of the program (2,700 projected hours of 2 person spacewalks). The success probability was calculated to be 0.94, versus a requirement of >0.91, for the current spacesuit s outer protective garment. In parallel to the probability assessment, potential improvements to the current spacesuit s outer protective garment were built and impact tested. A NASA light gas gun was used to launch projectiles at test items, at speeds of approximately 7 km per second. Test results showed that substantial garment improvements could be made, with mild material enhancements and moderate assembly development. The spacesuit s PNP would improve marginally with the tested enhancements, if they were available for immediate incorporation. This paper discusses the results of the model assessment process and test program. These findings add confidence to the continued use of the existing NASA EMU during International Space Station (ISS) assembly and Shuttle Operations. They provide a viable avenue for improved hypervelocity impact protection for the EMU, or for future space suits.

Author

Space Suits; Extravehicular Activity; Extravehicular Mobility Units; Meteoroid Protection; Meteoritic Damage; Hypervelocity Impact; Probability Theory; Projectiles; Space Debris

20070030853 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

Coordination of Mars Orbiting Assets to Support Entry, Descent, and Landing (EDL) Activities

Neelon, Joseph G.; Wallace, Mark; Craig, Lynn E.; [2004]; 7 pp.; In English; AAS/AIAA Space Flight Mechanics, 8 Feb. 2004, Maui, HI, USA; Original contains black and white illustrations; Copyright; Avail.: Other Sources

ONLINE: http://hdl.handle.net/2014/40164

NASA policy requires continuous telecommunications with missions during the execution of their critical events, which implies constraints on where missions to other planets may land or inject into orbit. JPL is working to establish a telecommunications network at Mars to provide contact with inbound missions to Mars and assets that have landed on the Martian surface, thus reducing the constraints on where critical events may be performed. Coordination of network assets is required to cover an inbound mission's critical event, such as EDL. This paper describes the development of a tool to evaluate EDL coverage capability of Mars network assets over a specified launch date/arrival date space.

Author

Telecommunication; Mars Missions; Mars Surface; Coordination; Policies

20070030857 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

Access to Space for Technology Validation Missions: Exploring the Possibilities of Suborbital Flight

Herrell, Linda M.; Zhou, Xiaoyan; March 4, 2006; 17 pp.; In English; IEEE Aerospace Conference, Big Sky, Montana, March 4-11, 2006, 4-11 Mar. 2006, Big Sky, MT, USA; Original contains black and white illustrations; Copyright; Avail.: Other Sources

ONLINE: http://hdl.handle.net/2014/40171

This guide is written for the space experimenter seeking an understanding of the issues which will drive a large part of the design of a space experiment - the method of access to space.

Author

Spaceborne Experiments; Aerospace Engineering

20070030902 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Chemicals from Space
May 12, 2007; 1 pp.; In English
Contract(s)/Grant(s): NNG06EO90A; No Copyright; Avail.: Other Sources; Abstract Only

Except for Hydrogen, Helium, and Lithium (which were around from the beginning) all the chemicals that you learned about this year were made in stars. We really are made out of stardust! I'm going to bring you on a tour of the lives of stars to show you how all the chemicals in the Universe were made during different stages of a stars life.
Author
Chemical Elements; Stellar Evolution; Stellar Activity; Stellar Composition

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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.

20070030045 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Prospects for Pulsar Studies with the GLAST Large Area Telescope
Harding, Alice K.; March 29, 2007; 1 pp.; In English; Pulsar Searching and Thai-ming- 207-SKA, 29 Mar. - 5 Apr. 2007, Krabi, Thailand; No Copyright; Avail.: Other Sources; Abstract Only

The Large Area Telescope (LAT) on the Gamma-ray Large Area Space Telescope (GLAST), due to launch in November 2007, will have unprecedented sensitivity and energy resolution for gamma-rays in the range of 30 MeV to 200 GeV. GLAST is therefore expected to provide major advances in the understanding of high-energy emission from rotation-powered pulsars. As the only presently known galactic GeV source class, pulsars will be one of the most important sources for study with GLAST. The main science goals of the LAT for pulsar studies include an increase in the number of detected radio-loud and radio-quiet gamma-ray pulsars, including millisecond pulsars, giving much better statistics for elucidating population characteristics, measurement of the high-energy spectrum and the shape of spectral cutoffs and determining pulse profiles for a variety of pulsars of different age. Further, measurement of phase-resolved spectra and energy dependent pulse profiles of the brighter pulsars should allow detailed tests of magnetospheric particle acceleration and radiation mechanisms, by comparing data with theoretical models that have been developed. Additionally, the LAT will have the sensitivity to allow blind pulsation searches of nearly all unidentified EGRET sources, to possibly uncover more radio-quiet Geminga-like pulsars.
Author
Gamma Ray Telescopes; Gamma Rays; Pulsars; Spaceborne Telescopes; Spaceborne Astronomy; Gamma Ray Astronomy

20070030052 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Polarization of the Cosmic Microwave Background: Are These Guys Serious?
Kogut, Alan; March 13, 2007; 1 pp.; In English; No Copyright; Avail.: Other Sources; Abstract Only

The polarization of the cosmic microwave background (CMB) could contain the oldest information in the universe, dating from an inflationary epoch just after the Big Bang. Detecting this signal presents an experimental challenge, as it is both faint and hidden behind complicated foregrounds. The rewards, however, are great, as a positive detection would not only establish inflation as a physical reality but also provide a model-independent measurement of the relevant energy scale. I will present the scientific motivation behind measurements of the CMB polarization and discuss how recent experimental progress could lead to a detection in the not-very-distant future.
Author
Cosmic Microwave Background Radiation; Polarization; Universe; Detection

20070030053 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Cosmic Microwave Background: COBE and WMAP
Kogut, alan; March 13, 2007; 1 pp.; In English; No Copyright; Avail.: Other Sources; Abstract Only

The cosmic microwave background has proved to be an extremely useful tool for cosmology. I will discuss NASA's COBE and WMAP missions and their contributions to modern precision cosmology.
Author
Cosmic Background Explorer Satellite; Microwave Anisotropy Probe; Precision

20070030097 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Milli-Arcsecond Infrared Observations of the Nova RS Ophiuchi

Barry, Richard K.; Danchi, W. C.; Koresko, C.; Kuchner, M.; Traub, W. A.; Monnier, J. D.; Serabyn, E.; Mennesson, B.; Greenhouse, M. A.; Colavita, M. M.; Lane, B. F.; June 12, 2007; 1 pp.; In English; RS Ophiuchi (2006), 12-14 Jun. 2007, UK; Copyright; Avail.: Other Sources; Abstract Only

We report on infrared interferometric measurements of the 2006 outburst of Nova RS Oph in H, K, and N bands. These measurements, conducted using the Infrared and Optical Telescope Array, the Palomar Testbed Interferometer, and the Keck Interferometer, show a small variation in the 3 mas size if this resolved source during the first 65 days of the outburst. Additionally, using interferometric closure phases, these observations show an unambiguous departure from point symmetry of the object. We also describe simultaneous N-band observations of the nova in two separate milli-arcsecond spatial regimes on day four in which we detect line emission indicating onset of the optically thin phase. These data represent the first science from the Keck Interferometer's nulling mode.

Author

Ophiuchi Clouds; Infrared Telescopes; Infrared Astronomy; Infrared Interferometers

20070030126 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Prospects for Pulsar Studies with the GLAST Large Area Telescope

Harding, Alice K.; May 20, 2007; 1 pp.; In English; Neutron Star Populations, 21-23 May 2007, Greenbank, WV, USA; No Copyright; Avail.: Other Sources; Abstract Only

The Large Area Telescope (LAT) on the Gamma-ray Large Area Space Telescope (GLAST), due to launch in November 2007, will have unprecedented sensitivity and energy resolution for gamma-rays in the range of 30 MeV to 200 GeV. GLAST is therefore expected to provide major advances in the understanding of high-energy emission from rotation-powered pulsars. As the only presently known galactic GeV source class; pulsars will be one of the most important sources for study with GLAST. The main science goals of the LAT for pulsar studies include an increase in the number of detected radio-loud and radio-quiet gamma-ray pulsars, including millisecond pulsars, giving much better statistics for elucidating population characteristics, measurement of the high-energy spectrum and the shape of spectral cutoffs and determining pulse profiles for a variety of pulsars of different age. Further, measurement of phase-resolved spectra and energy dependent pulse profiles of the brighter pulsars should allow detailed tests of magnetospheric particle acceleration and radiation mechanisms, by comparing data with theoretical models that have been developed. Additionally, the LAT will have the sensitivity to allow blind pulsation searches of nearly all unidentified EGRET sources, to possibly uncover more radio-quiet Geminga-like pulsars.

Author

Gamma Ray Telescopes; Pulsars; Gamma Ray Astronomy; Spaceborne Astronomy; Spaceborne Telescopes

20070030128 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Gamma-Ray Bursts: A Mystery Story

Parsons, Ann; February 19, 2007; 1 pp.; In English; Iowa State University Physics and Astronomy Departmental Colloquium, 19-20 Feb. 2007, IA, USA; No Copyright; Avail.: Other Sources; Abstract Only

With the success of the Swift Gamma-Ray Burst Explorer currently in orbit, this is quite an exciting time in the history of Gamma Ray Bursts (GRBs). The study of GRBs is a modern astronomical mystery story that began over 30 years ago with the serendipitous discovery of these astronomical events by military satellites in the late 1960's. Until the launch of BATSE on the Compton Gamma-ray Observatory, astronomers had no clue whether GRBs originated at the edge of our solar system, in our own Milky Way Galaxy or incredibly far away near the edge of the observable Universe. Data from BATSE proved that GRBs are distributed isotropically on the sky and thus could not be the related to objects in the disk of our Galaxy. Given the intensity of the gamma-ray emission, an extragalactic origin would require an astounding amount of energy. Without sufficient data to decide the issue, a great debate continued about whether GRBs were located in the halo of our own galaxy or were at extragalactic - even cosmological distances. This debate continued until 1997 when the BeppoSAX mission discovered a fading X-ray afterglow signal in the same location as a GRB. This discovery enabled other telescopes, to observe afterglow emission at optical and radio wavelengths and prove that GRBs were at cosmological distances by measuring large redshifts in the optical spectra. Like BeppoSAX Swift, slews to new GRB locations to measure afterglow emission. In addition to improved GRB sensitivity, a significant advantage of Swift over BeppoSAX and other missions is its ability to slew very quickly, allowing x-ray and optical follow-up measurements to be made as early as a minute after the gamma-ray burst trigger rather than the previous 6-8 hour delay. Swift afterglow measurements along with follow-up ground-based observations, and theoretical work have allowed astronomers to identify two plausible scenarios for the creation of a GRB: either through core collapse of super massive stars or colliding compact objects in distant galaxies. The pieces of the puzzle are beginning to fall

into place and yet the story isn't quite finished. I will frame the history of gamma-ray bursts as a mystery story and will end with a description of what we still don't know and what we'll have to do to get the next clues.
Author
Gamma Ray Bursts; Gamma Ray Astronomy; Stellar Radiation

20070030129 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Molecules and Dust in the Humunculus: Ejecta of Eta Carinae
Gull, T.; May 14, 2007; 1 pp.; In English; International Astrophysics and Astrochemistry Conference, 14-18 May 2007, Paris, France; No Copyright; Avail.: Other Sources; Abstract Only

In the 18401s, Eta Carinae ejected massive amounts of nitrogen-rich, carbon- and oxygen-poor material which we see as the hourglass-shaped Homunculus. With the Hubble Space Telescope Imaging Spectrograph, we detected multiple shells in line of sight, the most massive and intriguing being at -513 km/s. Numerous lines of Fe I, Fe II, Ni II, Cr II, Sc II, Sr II, Ti II, V II, etc are identified as well as nearly a thousand H2 lines. The metals have energy level populations consistent with 760K and excited by photons < 8.5eV. We have now identified CH, CH+, OH, and NH at the same velocity, but at 60K, suggesting stratification in the outer ejecta. Analysis of the interior, photoionized emission hourglass structure, known as the Little Homunculus, indicates He, N overabundances and C, 0 underabundances (approximately 1/80 solar). A skirt of neutral and partially ionized gas lies between the lobes of the hourglasses. A portion is seen as the Strontium Filament, a metal- ionized, neutral hydrogen structure. Relative abundances of TiNi are 1/80 solar, CrNi are 1/20 solar. This complex of ejecta appears to have been ejected by a massive star(s) at the end of the hydrogen-burning phase when convection led to overproduction of nitrogen at the expense of carbon and oxygen. Given the underabundances of carbon and oxygen, the chemistry of this system is quite different to the normal ISM, leading to a nitrogen- dominated chemistry. What little C and 0 that is formed is immediately taken up by SiO and Al0 molecules leading to a very different gas/dust ratio than the normal ISM. Dust in this ejecta is abundance, but known to be very grey in character. Observations with HST/STIS and VLT/UVES will be presented along with simple physical models and CLOUD modeling. Insight by the participants will be solicited.
Author
Ejecta; Metals; Nitrogen; Oxygen; Dust; Massive Stars; Stellar Mass; Variable Stars; Stellar Envelopes; Stellar Luminosity; Stellar Evolution; Binary Stars

20070030131 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Gamma Ray Burst Discoveries by the SWIFT Mission
Gehrels, Neil; June 03, 2007; 1 pp.; In English; GRB Workshop, 3-9 Jun. 2007, Aspen, CO, USA; No Copyright; Avail.: Other Sources; Abstract Only

Gamma-ray bursts are among the most fascinating occurences in the cosmos. They are thought to be the birth cries of black holes throughout the universe. The NASA SWIFT mission, in orbit since November 2004, is an innovative multiwavelenth observaroty designed to determine the origin of bursts and use them to probe the early Universe. Recent results from the mission will be presented. The long-standing mstery of short GRBs is beginning to be solved in a most interesting direction. High redshift bursts have been detected to redshift z=6.3 leading to a better understanding of star formation rates at early times. GRBs have been found with giant X-ray flares occurring in their afterglow.The very nearby GRB 060218 triggered obsevations within minutes of the full light curve of an odd suupernova Type Ic.
Author
Gamma Ray Bursts; Swift Observatory; Space Missions; Cosmology

20070030181 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Suzaku Observations of the Broad-Line Radio Galaxy 3C390.3
Sambruna, rita; May 14, 2007; 1 pp.; In English; International Workshop Simbol-X: The Hard X-ray Universe in Focus, 14-16 May 2007, Bologna, Italy; No Copyright; Avail.: Other Sources; Abstract Only

We present the results of a 100~ks Suzaku observation of the BLRG 3C390.3. The observations were performed to attempt to disentangle the contributions to the X-ray emission of this galaxy from an AGN and a jet component, via variability and/or the spectrum. The source was detected at high energies up to 80 keV, with a complex 0.3--80~keV spectrum. Preliminary analysis of the data shows significant flux variability, with the largest amplitudes at higher energies. Deconvolution of the spectrum shows that, besides a standard Seyfert-like spectrum dominating the 0.3--8keV emission, an

additional, hard power law component is required, dominating the emission above 10 keV. We attribute this component to a variable jet.
Author
Radio Galaxies; Active Galactic Nuclei; X Ray Astronomy; Observation

20070030200 NASA Goddard Space Flight Center, Greenbelt, MD, USA
GLAST Large Area Telescope - Design and Optimization of Anti-Coincidence Detector
Moiseev, Alexander; March 2007; 1 pp.; In English; No Copyright; Avail.: Other Sources; Abstract Only

The gamma-ray Large Area Telescope (GLAST) with LAT as its main instrument is now in the final stage of integration into the spacecraft and is scheduled for launch in November 2007. The Anti-Coincidence Detector (ACD) is one of the key telescope systems, providing much of the charged particle background rejection. Taking into account the required large ACD detecting area (more than 8 sq m) and high efficiency of relativistic single charged particle detection (greater than 0.9997 over the entire ACD area), the design was very challenging. It included the choice of conceptual design, extensive Monte Carlo simulations and trade-offs of the experimental techniques, supported by numerous bench tests, custom electronics, careful mechanical design and extensive mechanical/environmental tests, precision fabrication and finally the decisive step- final integration and system-level tests. Currently the LAT (with ACD integrated) is integrated into the spacecraft and undergoing the numerous spacecraft-level tests
Author
Gamma Ray Telescopes; Performance Tests; Monte Carlo Method; Design Optimization; Mechanical Engineering; Environmental Tests; Charged Particles; Relativistic Particles

20070030201 NASA Goddard Space Flight Center, Greenbelt, MD, USA
GISMO, a 2 mm Bolometer Camera Optimized for the Study of High Redshift Galaxies
Staguhn, J.; March 23, 2007; 1 pp.; In English; Origins of Galaxies, 23-29 Mar. 2007, Innsbruck, Austria
Contract(s)/Grant(s): NNG06EO90A; No Copyright; Avail.: Other Sources; Abstract Only

The 2mm spectral range provides a unique terrestrial window enabling ground based observations of the earliest active dusty galaxies in the universe and thereby allowing a better constraint on the star formation rate in these objects. We present a progress report for our bolometer camera GISMO (the Goddard-IRAM Superconducting 2-Millimeter Observer), which will obtain large and sensitive sky maps at this wavelength. The instrument will be used at the IRAM 30 m telescope and we expect to install it at the telescope in 2007. The camera uses an 8 x 16 planar array of multiplexed TES bolometers, which incorporates our recently designed Backshort Under Grid (BUG) architecture. GISMO will be very efficient at detecting sources serendipitously in large sky surveys. With the background limited performance of the detectors, the camera provides significantly greater imaging sensitivity and mapping speed at this wavelength than has previously been possible. The major scientific driver for the instrument is to provide the IRAM 30 m telescope with the capability to rapidly observe galactic and extragalactic dust emission, in particular from high-zeta ULI RGs and quasar s, even in the summer season. The instrument will fill in the SEDs of high redshift galaxies at the Rayleigh-Jeans part of the dust emission spectrum, even at the highest redshifts. Our source count models predict that GISMO will serendipitously detect one galaxy every four hours on the blank sky, and that one quarter of these galaxies will be at a redshift of zeta 6.5.
Author
Red Shift; Sky Surveys (Astronomy); Bolometers; Cameras; Emission Spectra; Imaging Techniques; Star Formation Rate; Active Galaxies; Detection

20070030246 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Mini-Survey of SDSS OIII AGN with Swift
Angelina, Lorella; George, Ian; July 02, 2007; 1 pp.; In English; X-ray Surveys Conference, 2-6 Jul. 2007, Rodos, Greece; Copyright; Avail.: Other Sources; Abstract Only

There is a common wisdom that every massive galaxy has a massive block hole. However, most of these objects either are not radiating or until recently have been very difficult to detect. The Sloan Digital Sky Survey (SDSS) data, based on the [OIII] line indicate that perhaps up to 20% of all galaxies may be classified as AGN a surprising result that must be checked with independent data. X-ray surveys have revealed that hard X-ray selected AGN show a strong luminosity dependent evolution and their luminosity function (LF) shows a dramatic break towards low Lx (at all z). This is seen for all types of AGN, but is stronger for the broad-line objects. In sharp contrast, the local LF of (optically-selected samples) shows no such break and no differences between narrow and broad-line objects. Assuming both hard X-ray and [OIII] emission are fair

indicators of AGN activity, it is important to understand this discrepancy. We present here the results of a mini-survey done with Swift on a selected sample of SDSS selected AGN. The objects have been sampled at different L([OIII]) to check the relation with the Lx observed with Swift.
Author
Active Galactic Nuclei; Galaxies; X Rays; Sky Surveys (Astronomy)

20070030250 NASA Goddard Space Flight Center, Greenbelt, MD, USA
The Stellar Imager (SI) Project: Resolving Stellar Surfaces, Interiors, and Magnetic Activity
Carpenter, Kenneth G.; Schrijver, K.; Karovska, M.; May 28, 2007; 1 pp.; In English; 1st Space Astronomy: The UV Window to the Univese National UV Astronomy (NUVA), 28 May - 1 Jun. 2007, Madrid, Spain; Copyright; Avail.: Other Sources; Abstract Only

The Stellar Imager (SI) is a UV/Optical. Space-Based Interferometer designed to enable 0.1 milli-arcsec (mas) spectral imaging of stellar surfaces and, via asteroseismology, stellar interiors and of the Universe in general. The ultra-sharp images of SI will revolutionize our view of many dynamic astrophysical processes by transforming point sources into extended sources, and snapshots into evolving views. The science of SI focuses on the role of magnetism in the Universe, particularly on magnetic activity on the surfaces of stars like the Sun. Its prime goal is to enable long-term forecasting of solar activity and the space weather that it drives. SI will also revolutionize our understanding of the formation of planetary systems, of the habitability and climatology of distant planets, and of many magneto-hydrodynamically controlled processes in the Universe. In this paper we discuss the science goals, technology needs, and baseline design of the SI mission.
Author
Stellar Interiors; Astrophysics; Climatology; Forecasting; Asteroseismology; Magnetic Properties; Habitability

20070030852 Naval Observatory, Washington, DC, USA
Extending the ICRF into the Infrared: 2MASS - UCAC Astrometry
Zacharias, Norbert; McCallon, Howard L.; Kopan, Eugene; Cutri, Roc M.; July 22, 2000; 8 pp.; In English; IAU XXC, Joint Discussion 16, 22 Jul. 2003, Sydney, Australia; Original contains black and white illustrations; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/40162

An external comparison between the infrared 2MASS and the optical UCAC positions was performed, both being on the same system, the ICRS. About 48 million sources in common were identified. Random errors of the 2MASS catalog positions are about 60 to 70 mas per coordinate for the Ks = 4 to 14 range, increasing to about 100 to 150 mas for saturated and very faint stars. Systematic position differences between the 2 catalogs are very small, about 5 to 10 mas as a function of magnitude and color, with somewhat larger errors as a function of right ascension and declination. The extension of the ICRF into the infrared has become a reality.
Author
Infrared Radiation; Ion Cyclotron Radiation; Astrometry; Radio Frequency Heating; Plasma Heating

20070030927 Paul Scherrer Inst., Wuerenlingen, Switzerland
The XMM-Newton Extended Survey of the Taurus Molecular Cloud (XEST)
Guedel, M.; Briggs, K. R.; Arzner, K.; Audard, M.; Bouvier, J.; Feigelson, E. D.; Franciosini, E.; Glauser, A.; Grosso, N.; Micela, G.; Monin, J.-L.; Montmerle, T.; Padgett, D. L.; Palla, F.; Pillitteri, I.; Rebull, L.; Scelsi, L.; Silva, B.; Skinner, S. L.; Stelzer, B.; Telleschi, A.; Astronomy and Astrophysics; June 2007; Volume 468, pp. 353-377; In English; Original contains black and white illustrations
Contract(s)/Grant(s): NNG05GF92G; Copyright; Avail.: Other Sources
ONLINE: http://dx.doi.org/10.1051/0004-6361:20065724

The Taurus Molecular Cloud (TMC) is the nearest large star-forming region, prototypical for the distributed mode of low-mass star formation. Pre-main sequence stars are luminous X-ray sources, probably mostly owing to magnetic energy release. Aims. The XMM-Newton Extended Survey of the Taurus Molecular Cloud (EST) presented in this paper surveys the most populated =5 square degrees of the TMC, using the XMM-Newton X-ray observatory to study the thermal structure, variability, and long-term evolution of hot plasma, to investigate the magnetic dynamo, and to search for new potential members of the association. Many targets are also studied in the optical, and high-resolution X-ray grating spectroscopy has been obtained for selected bright sources. Methods. The X-ray spectra have been coherently analyzed with two different thermal models (2-component thermal model, and a continuous emission measure distribution model). We present overall

correlations with fundamental stellar parameters that were derived from the previous literature. A few detections from Chandra observations have been added. Results. The present overview paper introduces the project and provides the basic results from the X-ray analysis of all sources detected in the XEST survey. Comprehensive tables summarize the stellar properties of all targets surveyed. The survey goes deeper than previous X-ray surveys of Taurus by about an order of magnitude and for the first time systematically accesses very faint and strongly absorbed TMC objects. We find a detection rate of 85% and 98% for classical and weak-line T Tau stars (CTTS resp. WTTS), and identify about half of the surveyed protostars and brown dwarfs. Overall, 136 out of 169 surveyed stellar systems are detected. We describe an X-ray luminosity vs. mass correlation, discuss the distribution of X-ray-to-bolometric luminosity ratios, and show evidence for lower X-ray luminosities in CTTS compared to WTTS. Detailed analysis (e.g., variability, rotation-activity relations, influence of accretion on X-rays) will be discussed in a series of accompanying papers.
Author
Pre-Main Sequence Stars; Star Formation; X Ray Astrophysics Facility; X Ray Sources; X Ray Spectra; Stellar Systems

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ASTROPHYSICS

Includes cosmology; celestial mechanics; space plasmas; and interstellar and interplanetary gases and dust.

20070030046 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Binary Black Holes, Numerical Relativity, and Gravitational Waves
Centrella, Joan; February 27, 2007; 1 pp.; In English; No Copyright; Avail.: Other Sources; Abstract Only

The final merger of two black holes releases a tremendous amount of energy, more than the combined light from all the stars in the visible universe. This energy is emitted in the form of gravitational waves, and observing these sources with gravitational wave detectors such as LISA requires that we know the pattern or fingerprint of the radiation emitted. Since black hole mergers take place in regions of extreme gravitational fields, we need to solve Einstein's equations of general relativity on a computer in order to calculate these wave patterns. For more than 30 years, scientists have tried to compute these wave patterns. However, their computer codes have been plagued by problems that caused them to crash. This situation has changed dramatically in the past 2 years, with a series of amazing breakthroughs. This talk will take you on this quest for these gravitational wave patterns, showing how a spacetime is constructed on a computer to build a simulation laboratory for binary black hole mergers. We will focus on the recent advances that are revealing these waveforms, and the dramatic new potential for discoveries that arises when these sources will be observed by LISA
Author
Black Holes (Astronomy); Gravitational Waves; Computer Programs; Relativity; Space-Time Functions

20070030095 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Constraining Galaxy Evolution Using Observed UV-Optical Spectra
Heap, Sally; April 16, 2007; 1 pp.; In English; New Quests in Stellar Astrophysics II: The Ultraviolet Properties of Evolved Stellar Populations, 16-20 Apr, 2007, Puerto Vallarta, Mexico; No Copyright; Avail.: Other Sources; Abstract Only

Our understanding of galaxy evolution depends on model spectra of stellar populations, and the models are only as good as the observed spectra and stellar parameters that go into them. We are therefore evaluating modem UV-optical model spectra using Hubble's Next Generation Spectral Library (NGSL) as the reference standard. The NGSL comprises intermediate-resolution (R is approximately 1000) STIS spectra of 378 stars having a wide range in metallicity and age. Unique features of the NGSL include its broad wavelength coverage (1,800-10,100 A) and high-S/N, absolute spectrophotometry. We will report on a systematic comparison of model and observed UV-blue spectra, describe where on the HR diagram significant differences occur, and comment on current approaches to correct the models for these differences.
Author
Astronomical Models; Galaxies; Stellar Models; Galactic Evolution; Ultraviolet Spectra

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LUNAR AND PLANETARY SCIENCE AND EXPLORATION

Includes planetology; selenology; meteorites; comets; and manned and unmanned planetary and lunar flights. For spacecraft design or space stations see *18 Spacecraft Design, Testing and Performance*.

20070030184 NASA Johnson Space Center, Houston, TX, USA
Reducing the Risk of Human Missions to Mars Through Testing
Drake, Bret G.; July 2007; 60 pp.; In English; Original contains color illustrations
Report No.(s): NASA/TM-2007-214761; JSC 63726; S-1011; No Copyright; Avail.: CASI: A04, Hardcopy
ONLINE: http://hdl.handle.net/2060/20070030184

The NASA Deputy Administrator charted an internal NASA planning group to develop the rationale for exploration beyond low-Earth orbit. This team, termed the Exploration Blueprint, performed architecture analyses to develop roadmaps for how to accomplish the first steps beyond Low-Earth Orbit through the human exploration of Mars. Following the results of the Exploration Blueprint study, the NASA Administrator asked for a recommendation on the next steps in human and robotic exploration. Much of the focus during this period was on integrating the results from the previous studies into more concrete implementation strategies in order to understand the relationship between NASA programs, timing, and resulting budgetary implications. This resulted in an integrated approach including lunar surface operations to retire risk of human Mars missions, maximum use of common and modular systems including what was termed the exploration transfer vehicle, Earth orbit and lunar surface demonstrations of long-life systems, collaboration of human and robotic missions to vastly increase mission return, and high-efficiency transportation systems (nuclear) for deep-space transportation and power. The data provided in this summary presentation was developed to begin to address one of the key elements of the emerging implementation strategy, namely how lunar missions help retire risk of human missions to Mars. During this process the scope of the activity broadened into the issue of how testing in general, in various venues including the moon, can help reduce the risk for Mars missions.
Author
Risk; Manned Mars Missions; Mars Exploration; Manned Space Flight; Flight Tests; Test Facilities

20070030304 NASA Langley Research Center, Hampton, VA, USA
Thermal Model Correlation for Mars Reconnaissance Orbiter
Amundsen, Ruth M.; Dec, John A.; Gasbarre, Joseph F.; July 09, 2007; 13 pp.; In English; 37th International Conference on Environmental Systems (ICES), 9-12 Jul. 2007, Chicago, IL, USA; Original contains color and black and white illustrations
Contract(s)/Grant(s): WBS 441261,94,93,91,94
Report No.(s): 07ICES-17; No Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20070030304

The Mars Reconnaissance Orbiter (MRO) launched on August 12, 2005 and began aerobraking at Mars in March 2006. In order to save propellant, MRO used aerobraking to modify the initial orbit at Mars. The spacecraft passed through the atmosphere briefly on each orbit; during each pass the spacecraft was slowed by atmospheric drag, thus lowering the orbit apoapsis. The largest area on the spacecraft, most affected by aeroheating, was the solar arrays. A thermal analysis of the solar arrays was conducted at NASA Langley Research Center to simulate their performance throughout the entire roughly 6-month period of aerobraking. A companion paper describes the development of this thermal model. This model has been correlated against many sets of flight data. Several maneuvers were performed during the cruise to Mars, such as thruster calibrations, which involve large abrupt changes in the spacecraft orientation relative to the sun. The data obtained from these maneuvers allowed the model to be well-correlated with regard to thermal mass, conductive connections, and solar response well before arrival at the planet. Correlation against flight data for both in-cruise maneuvers and drag passes was performed. Adjustments made to the model included orientation during the drag pass, solar flux, Martian surface temperature, through-array resistance, aeroheating gradient due to angle of attack, and aeroheating accommodation coefficient. Methods of correlation included comparing the model to flight temperatures, slopes, temperature deltas between sensors, and solar and planet direction vectors. Correlation and model accuracy over 400 aeroheating drag passes were determined, with overall model accuracy better than 5 C.
Author
Mars Reconnaissance Orbiter; Thermal Analysis; Mathematical Models; Correlation; Solar Arrays

20070030312 NASA Langley Research Center, Hampton, VA, USA

Performance of a Borehole XRF Spectrometer for Planetary Exploration

Kelliher, Warren C.; Carlberg, Ingrid A.; Elam, W. T.; WIllard-Schmoe, Ella; July 30, 2007; 7 pp.; In English; 2007 Denver X-Ray Conference, 30 Jul. - 3 Aug. 2007, Colorado Springs, CO, USA; Original contains color illustrations

Contract(s)/Grant(s): NNL05AA49C; WBS 627795.04.09.02; Copyright; Avail.: CASI: A02, Hardcopy

We have designed and constructed a borehole XRF Spectrometer (XRFS) as part of the Mars Subsurface Access program. It will be used to determine the composition of the Mars regolith at various depths by insertion into a pre-drilled borehole. The primary performance metrics for the instrument are the lower limits of detection over a wide range of the periodic table. Power consumption during data collection was also measured. The prototype instrument is complete and preliminary testing has been performed. Terrestrial soil Standard Reference Materials were used as the test samples. Detection limits were about 10 weight parts-per-million for most elements, with light elements being higher, up to 1.4 weight percent for magnesium. Power consumption (excluding ground support components) was 12 watts.

Author

Boreholes; X Ray Fluorescence; Spectrometers; Space Exploration; Planetary Geology; Mars Surface

20070030313 NASA Langley Research Center, Hampton, VA, USA

Tunable Optical Filters for Space Exploration

Crandall, Charles; Clark, Natalie; Davis, Patricia P.; August 26, 2007; 10 pp.; In English; 2007 SPIE Photonics and Optics Conference, 26-30 Aug. 2007, San Diego, CA, USA; Original contains color illustrations

Contract(s)/Grant(s): WBS 699152.04.05.05.04; Copyright; Avail.: CASI: A02, Hardcopy

Spectrally tunable liquid crystal filters provide numerous advantages and several challenges in space applications. We discuss the tradeoffs in design elements for tunable liquid crystal birefringent filters with special consideration required for space exploration applications. In this paper we present a summary of our development of tunable filters for NASA space exploration. In particular we discuss the application of tunable liquid crystals in guidance navigation and control in space exploration programs. We present a summary of design considerations for improving speed, field of view, transmission of liquid crystal tunable filters for space exploration. In conclusion, the current state of the art of several NASA LaRC assembled filters is presented and their performance compared to the predicted spectra using our PolarTools modeling software.

Author

Liquid Crystals; Optical Filters; Space Exploration; Tunable Filters; Technology Utilization

20070030826 NASA Johnson Space Center, Houston, TX, USA

Sintering of Lunar and Simulant Glass

Cooper, Bonnie L.; [2007]; 9 pp.; In English; STAIF 2008, 10-14 Feb. 2008, Albuquerque, NM, USA; Original contains color and black and white illustrations

Contract(s)/Grant(s): NNJ05H105C; No Copyright; Avail.: CASI: A02, Hardcopy

ONLINE: http://hdl.handle.net/2060/20070030826

Most oxygen-extraction techniques are temperature-dependent, with higher temperatures resulting in higher oxygen yield. An example is hydrogen reduction, in which the optimum process temperature is 1050 C. However, glass-rich lunar soil begins to show the effects of sintering at temperatures of 900 C or lower. Sintering welds particles together due to viscous relaxation of the glass in the sample. One approach to avoid problems related to sintering, such as difficulty in removing waste material from the reactor, is to keep the soil in motion. One of several methods being studied to accomplish this is fluidized-bed processing techniques, in which the grains are kept in motion by the action of flowing reductant gas. The spent material can be removed from the chamber while still fluidized, or the fluidizing motion can continue until the material has cooled below approx. 500 C. Until end-to-end prototypes are built that can remove the heated soil, the most practical option is to keep the bed fluidized while cooling the waste material. As ISRU technology advances, another option will become valuable, which is to intentionally sinter the material to a great enough extent that it becomes a brick. The free iron in lunar soil is magnetic, and ferromagnetic bricks can be manipulated by robotic systems using electromagnetic end effectors. Finally, if an electromagnetic field is applied to the soil while the brick is being formed, the brick itself will become a magnet. This property can be used to create self-aligning bricks or other building materials that do not require fasteners. Although sintering creates a challenge for early lunar surface systems, knowledge gained during prototype development will be valuable for the advanced lunar outpost.

Author

Glass; Lunar Surface; Sintering; Robotics; Fluidized Bed Processors; Hydrogen

20070030854 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

Architecting Space Exploration Campaigns: A Decision-Analytic Approach

Baker, Erin; Morse, Elisabeth L.; Gray, Andrew A.; Easter, Robert W.; March 3, 2006; 20 pp.; In English; IEEE Aerospace Conference, 4-21 Mar. 2006, Big Sky, MT, USA; Original contains black and white illustrations; Copyright; Avail.: Other Sources

ONLINE: http://hdl.handle.net/2014/40136

This paper shows the benefits of Decision Analysis techniques for campaign design and evaluation. Important concepts of decision analysis are reviewed through the lens of designing a campaign to find exploitable equatorial water on Mars. The method developed herein is general to any search campaign. The paper concludes with a discussion of the challenges and opportunities in applying similar techniques to other types of campaigns.

Author

Decision Theory; Space Exploration; Equatorial Regions; Mars Surface

20070030856 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

Design Tools for Cost-Effective Implementation of Planetary Protection Requirements

Hamlin, Louise; Belz, Andrea; Evans, Michael; Kastner, Jason; Satter, Celeste; Spry, Andy; March 4, 2006; 7 pp.; In English; IEEE Aerospace Conference, Big Sky, Montana, March 4-11, 2006, 4-11 Mar. 2006, Big Sky, MT, USA; Original contains black and white illustrations; Copyright; Avail.: Other Sources

ONLINE: http://hdl.handle.net/2014/40173

Since the Viking missions to Mars in the 1970s, accounting for the costs associated with planetary protection implementation has not been done systematically during early project formulation phases, leading to unanticipated costs during subsequent implementation phases of flight projects. The simultaneous development of more stringent planetary protection requirements, resulting from new knowledge about the limits of life on Earth, together with current plans to conduct life-detection experiments on a number of different solar system target bodies motivates a systematic approach to integrating planetary protection requirements and mission design. A current development effort at NASA's Jet Propulsion Laboratory is aimed at integrating planetary protection requirements more fully into the early phases of mission architecture formulation and at developing tools to more rigorously predict associated cost and schedule impacts of architecture options chosen to meet planetary protection requirements.

Author

Planetary Protection; Viking Mars Program; Solar System; Mission Planning; Life Sciences; Cost Effectiveness; Mars Missions

20070030858 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

A Strategy to Integrate Probabilistic Risk Assessment into Design and Development Processes for Aerospace Based pon Mars Exploration Rover Experiences

Nunes, Jeffery; Paulos, Todd; Everline, Chester J.; Dezfuli, Homayoon; May 15, 2006; 11 pp.; In English; International Conference on Probabilistic Safety Assessment and Management, 15-19 May 2006, New Orleans, LA, USA; Original contains black and white illustrations; Copyright; Avail.: Other Sources

ONLINE: http://hdl.handle.net/2014/40170

This paper will discuss the Probabilistic Risk Assessment (PRA) effort and its involvement with related activities during the development of the Mars Exploration Rover (MER). The Rovers were launched 2003.June.10 (Spirit) and 2003.July.7 (Opportunity), and both have proven very successful. Although designed for a 90-day mission, the Rovers have been operating for over two earth years. This paper will review aspects of how the MER project integrated PRA into the design and development process. A companion paper (Development of the Mars Exploration Rover PRA) will describe the MER PRA and design changes from those results.

Author

Mars Exploration; Roving Vehicles; Risk; Probability Theory

20070030938 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

Lunar Laser Ranging Science: Gravitational Physics and Lunar Interior and Geodesy

Williams, James G.; Turyshev, Slava G.; Boggs, Dale H.; Ratcliff, J. Todd; July 18, 2004; 7 pp.; In English; 35th COSPAR Scientific Assembly, 18-24 Jul. 2006, Paris, France; Original contains black and white illustrations; Copyright; Avail.: Other Sources

ONLINE: http://hdl.handle.net/2014/40167

Laser pulses fired at retroreflectors on the Moon provide very accurate ranges. Analysis yields information on Earth, Moon, and orbit. The highly accurate retroreflector positions have uncertainties less than a meter. Tides on the Moon show strong dissipation, with Q=33+/-4 at a month and a weak dependence on period. Lunar rotation depends on interior properties; a fluid core is indicated with radius approx.20% that of the Moon. Tests of relativistic gravity verify the equivalence principle to +/-1.4x10(exp -13), limit deviations from Einstein's general relativity, and show no rate for the gravitational constant G/G with uncertainty 9x10(exp -13)/yr.

Author

Lunar Rangefinding; Lunar Retroreflectors; Gravitational Effects; Earth Orbits; Geodesy; Reaction Kinetics; Laser Ranging

20070031025 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Conceptual Design of the TPF-O SC Bus

Purves, Lloyd R.; August 26, 2007; 1 pp.; In English; SPIE International Symposium on Optics and Photonics, 26-30 Aug. 2007, San Diego, CA, USA; No Copyright; Avail.: Other Sources; Abstract Only

One option under current study for the Terrestrial Planet Finder-Occulter (TPF-O) observatory shares some key features of the Hubble Space Telescope (HST). Both are space telescopes with a primary mirror aperture of around 2.4 meters and designed to observe in the visible to near infrared range of wavelengths, with the major difference in science capability being that TPF-O has an areal FOV on the order of 100 times larger than that of HST. This larger FOV, whose science camera is also expected to provide fine guidance, and other mission differences, mean that most TPF-O SC bus subsystems will have very different requirements than those of HST. Unlike HST in LEO, TPF-O is designed to operate in an orbit around the Sun-Earth lagrange 2 (SEL2) point. The longer communications range to SEL2 and the large FOV require much higher performance data processing and communications than HST. Maintaining a SEL2 orbit requires TPF-O, unlike HST, to have a propulsion system. TPF-O will have a specialized tracking system that allows the formation flying occulter to maintain its required position. However, despite these additional features, the velocity required for reaching SEL2 and the limited capabilities of affordable launch vehicles require TPF-O to have a compact and low-mass design relative to HST. Finally, TPF-O may utilize a modular design to reduce development cost and, if it required, allow servicing using approaches different from those of HST.

Author

Terrestrial Planets; Occultation; Spaceborne Telescopes; Bus Conductors; Lagrangian Equilibrium Points

20070031102 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

Mars Rovers, Past and Future

Muirhead, Brian K.; March 6, 2004; 7 pp.; In English; IEEE Aerospace Conference, 6-13 Mar. 2004, Big Sky, MT, USA; Original contains black and white illustrations; Copyright; Avail.: Other Sources

ONLINE: http://hdl.handle.net/2014/40163

This paper discusses the history of planetary rovers, including research vehicles, from the initial concepts in the early 1960's to the present. General characteristics and their evolution are discussed including mission drivers, technology limitations, controls approach, mobility and overall performance. Special emphasis is given to the next generation mission of rovers, the Mars Science Laboratory rover. This vehicle is being designed for a 2009 launch with the capability to operate over 80% of the surface of Mars for a full Martian year (687 days). It is designed to visit numerous sites, with a science payload capable of making measurements that will enable understanding the past or present habitability of Mars.

Author

Roving Vehicles; Mars (Planet); Research Vehicles; Mars Surface; Habitability

92
SOLAR PHYSICS

Includes solar activity, solar flares, solar radiation and sunspots. For related information see *93 Space Radiation*.

20070030199 NASA Goddard Space Flight Center, Greenbelt, MD, USA
A New Source of Space Weather Data
Kaiser, Michael L.; April 23, 2007; 1 pp.; In English; Space Weather Week Workshop, 23-27 Apr. 2007, Boulder, CO, USA; No Copyright; Avail.: Other Sources; Abstract Only

The twin STEREO spacecraft were launched on October 26,2006 and, after spending several weeks in alignment orbits, became operational in heliocentric orbits on January 2 1,2007. The spacecraft are now in orbits similar to Earth's and are separating from each other at a rate of about 45 degrees per year as viewed from the sun. The STEREO spacecraft are each equipped with a complement of EUV, and white light imagers as well as particles and fields in situ instruments and a radio burst tracker. In addition to full resolution data downloaded once per day, each spacecraft broadcasts a real time telemetry 'beacon' stream containing compressed images and typically one minute averages of solar wind measurements and radio intensities. These real time data streams are received by a mix of NOAA and NASA-managed tracking stations and the data is transmitted by these stations to the STEREO Science Center at NASA Goddard Space Flight Center where they are processed into useable parameters with a latency of less than five minutes from receipt. As the two spacecraft recede from the sun-Earth line, triangulation of the imaging and radio measurements should allow better estimate of the speed and direction of coronal mass ejections, allowing a more precise estimate of their arrival at Earth. In situ particles and fields measurements, particularly for the spacecraft (Behind) trailing Earth in its orbit, will sample the solar wind that will eventually co-rotate around to the sun-Earth line. Late in the prime mission when the spacecraft are very far (>90 degrees) from the sun-Earth line, observations from the Behind spacecraft, will be particularly valuable for providing a preview of active regions well beyond the sun's East limb (as seen from Earth). Continually updated STEREO space weather data can be viewed and downloaded at http:/lstereo-ssc.nascom.nasa.govldata/beacon/.
Author
Solar Wind; Space Weather; Sun; Solar Terrestrial Interactions; Stereo (Observatory); Space Missions

93
SPACE RADIATION

Includes cosmic radiation; and inner and outer Earth radiation belts. For biological effects of radiation on plants and animals see *51 Life Sciences*; on human beings see 52 Aerospace Medicine. For theory see *73 Nuclear Physics*.

20070030118 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Lateral Diffusion Length Changes in HgCdTe Detectors in a Proton Environment
Hubbs, John E.; Marshall, Paul W.; Marshall, Cheryl J.; Gramer, Mark E.; Maestas, Diana; Garcia, John P.; Dole, Gary A.; Anderson, Amber A.; [2007]; 8 pp.; In English; IEEE NREC, July 2007, USA; Original contains black and white illustrations; Copyright; Avail.: CASI: A02, Hardcopy

This paper presents a study of the performance degradation in a proton environment of very long wavelength infrared (VLWIR) HgCdTe detectors. The energy dependence of the Non-Ionizing Energy Loss (NIEL) in HgCdTe provides a framework for estimating the responsivity degradation in VLWIR HgCdTe due to on orbit exposure from protons. Banded detector arrays that have different detector designs were irradiated at proton energies of 7, 12, and 63 MeV. These banded detector arrays allo~vedin sight into how the fundamental detector parameters degraded in a proton environment at the three different proton energies. Measured data demonstrated that the detector responsivity degradation at 7 MeV is 5 times larger than the degradation at 63 MeV. The comparison of the responsivity degradation at the different proton energies suggests that the atomic Columbic interaction of the protons with the HgCdTe detector is likely the primary mechanism responsible for the degradation in responsivity at proton energies below 30 MeV.
Author
Mercury Cadmium Tellurides; Diffusion Length; Proton Energy; Irradiation; Energy Dissipation

20070030926 NASA Johnson Space Center, Houston, TX, USA

Comparison of Integrated Radiation Transport Models with TEPC Measurements for the Average Quality Factors in Spaceflights

Kim, Myung-Hee Y.; Nikjoo, Hooshang; Dicello, John F.; Pisacane, Vincent; Cucinotta, Francis A.; [2007]; 2 pp.; In English; 2007 IEEE Nuclear Science Symposium (NSS), 28 Oct. - 3 Nov. 2007, Honolulu, HI, USA; Original contains color illustrations

Contract(s)/Grant(s): NCC9-58; Copyright; Avail.: CASI: A01, Hardcopy

The purpose of this work is to test our theoretical model for the interpretation of radiation data measured in space. During the space missions astronauts are exposed to the complex field of radiation type and kinetic energies from galactic cosmic rays (GCR), trapped protons, and sometimes solar particle events (SPEs). The tissue equivalent proportional counter (TEPC) is a simple time-dependent approach for radiation monitoring for astronauts on board the International Space Station. Another and a newer approach to Microdosimetry is the use of silicon-on-insulator (SOI) technology launched on the MidSTAR-1 mission in low Earth orbit (LEO). In the radiation protection practice, the average quality factor of a radiation field is defined as a function of linear energy transfer (LET), Q(sub ave)(LET). However, TEPC measures the average quality factor as a function of the lineal energy y, Q(sub ave)(y), defined as the average energy deposition in a volume divided by the average chord length of the volume. Lineal energy, y, deviates from LET due to energy straggling, delta-ray escape or entry, and nuclear fragments produced in the detector volume. Monte Carlo track structure simulation was employed to obtain the response of a TEPC irradiated with charged particle for an equivalent site diameter of 1 micron of wall-less counter. The calculated data of the energy absorption in the wall-less counter were compiled for various y values for several ion types at various discrete projectile energy levels. For the simulation of TEPC response from the mixed radiation environments inside a spacecraft, such as, Space Shuttle and International Space Station, the complete microdosimetric TEPC response, f(y, E, Z), were calculated with the Monte Carlo theoretical results by using the first order Lagrangian interpolation for a monovariate function at a given y value (y = 0.1 keV/micron 5000 keV/micron) at any projectile energy level (E = 0.01 MeV/u to 50,000 MeV/u) of each specific radiation type (Z = 1 to 28). Because the anomalous response has been observed at large event sizes in the experiment due to the escape of energy out of sensitive volume by delta-rays and the entry of delta-rays from the high-density wall into the low-density gas-volume cavity, Monte Carlo simulation was also made for the response of a walled-TEPC with wall thickness 2 mm and density 1 g/cm(exp 3). The radius of cavity was set to 6.35 mm and a gas density 7.874 x 10(exp -5) g/cm(exp 3). The response of the walled- and the wall-less counters were compared. The average quality factor Q(sub ave)(y) for trapped protons on STS-89 demonstrated the good agreement between the model calculations and flight TEPC data as shown. Using an integrated space radiation model (this includes the transport codes HZETRN and BRYNTRN, the quantum nuclear interaction model QMSFRG) and the resultant response distribution functions of walled-TEPC from Monte-Carlo track simulations, we compared model calculations with walled-TEPC measurements from NASA missions in LEO and made predictions for the lunar and the Mars missions. The Q(sub ave)(y) values for the trapped or the solar protons ranged from 1.9-2.5. This over-estimates the Qave(LET) values which ranged from 1.4-1.6. Both quantities increase with shield thickness due to nuclear fragmentation. The Q(sub ave)(LET) for the complete GCR spectra was found to be 3.5-4.5, while flight TEPCs measured 2.9-3.4 for Q(sub ave)(y). The GCR values are decreasing with the shield thickness. Our analysis for a proper interpretation of data supports the use of TEPCs for monitoring space radiation environment.

Author

Aerospace Environments; Extraterrestrial Radiation; Mathematical Models; Q Factors; Radiation Transport; Simulation; Space Missions

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Reliability-Based Electronics Shielding Design Tools

Wilson, J. W.; O'Neill, P. J.; Zang, T. A.; Pandolf, J. E.; Tripathi, R. K.; Koontz, Steven L.; Boeder, P.; Reddell, B.; Pankop, C.; July 23, 2007; 5 pp.; In English; 2007 IEEE Nuclear and Space Radiation Effects Conference, 23-27 July 2007, Honolulu, HI, USA; Original contains color and black and white illustrations; Copyright; Avail.: CASI: A01, Hardcopy

Shielding design on large human-rated systems allows minimization of radiation impact on electronic systems. Shielding design tools require adequate methods for evaluation of design layouts, guiding qualification testing, and adequate follow-up on final design evaluation.

Author

Radiation Shielding; Reliability Analysis; Extraterrestrial Radiation; Optimization; Electronic Equipment; Constellation Program

Subject Term Index

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