FY 2001 Scientific and Technical Reports, Articles, Papers, and Presentations

Compiled by
J.E. Turner Waits
Marshall Space Flight Center, Marshall Space Flight Center, Alabama

March 2002
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National Aeronautics and Space Administration

Marshall Space Flight Center • MSFC, Alabama 35812

March 2002
FOREWORD

In accordance with the NASA Space Act of 1958, the George C. Marshall Space Flight Center (MSFC) has provided for the widest practicable and appropriate dissemination of information concerning its activities and the results thereof.

Since July 1, 1960, when MSFC was organized, the reporting of scientific and engineering information has been considered a prime responsibility of the Center. Our credo has been that “research and development work is valuable, but only if its results can be communicated and made understandable to others.”

The N number shown for the reports listed is assigned by the Center for AeroSpace Information (CASI), Hanover, MD, indicating that the material is unclassified and unlimited and is available for public use. These publications can be purchased from the National Technical Information Service, 5285 Port Royal Road, Springfield, VA 22161. The N number should be cited when ordering.
GEORGE C. MARSHALL SPACE FLIGHT CENTER
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FY 2001 SCIENTIFIC AND TECHNICAL REPORTS,
ARTICLES, PAPERS, AND PRESENTATIONS

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

A high frame rate digital video camera installed on test stands at Stennis Space Center (SSC) has been used to capture images of the aerospike engine plume during test. These plume images are processed in real time to detect and differentiate anomalous plume events. Results indicate that the High-Speed Observer (HSO) system can detect anomalous plume streaking events that are indicative of aerospike engine malfunction.

A video camera and recorder were placed inside the solid rocket booster forward skirt in order to view foam loss events over an area on the external tank (ET) intertank surface. In this Technical Memorandum, a method of processing video images to allow rapid detection of permanent changes indicative of foam loss events on the ET surface was defined and applied to accurately count, categorize, and locate such events.
This document provides a compilation of environments knowledge about the planet Mars. Information is divided into three categories: (1) Interplanetary space environments (environments required by the technical community to travel to and from Mars); (2) atmospheric environments (environments needed to aerocapture, aerobrake, or use aerosist for precision trajectories down to the surface); and (3) surface environments (environments needed to have robots or explorers survive and work on the surface).


This document presents Mars Global Reference Atmospheric Model 2001 Version (Mars–GRAM 2001) and its new features. As with the previous version (Mars–2000), all parameterizations for temperature, pressure, density, and winds versus height, latitude, longitude, time of day, and season (Ls) use input data tables from NASA Ames Mars General Circulation Model (MGCM) for the surface through 80-km altitude and the University of Arizona Mars Thermospheric General Circulation Model (MTGCM) for 80 to 70 km. Mars–GRAM 2001 is based on topography from the Mars Orbiter Laser Altimeter (MOLA) and includes new MGCM data at the topographic surface. A new auxiliary program allows Mars–GRAM output to be used to compute shortwave (solar) and longwave (thermal) radiation at the surface and top of atmosphere. This memorandum includes instructions on obtaining Mars–GRAM source code and data files and for running the program. It also provides sample input and output and an example for incorporating Mars–GRAM as an atmospheric subroutine in a trajectory code.

TM–2001–210963 April 2001
Feasibility Study of Thin Film Thermocouple Piles (MSFC Center Director’s Discretionary Fund Final Report, Project No. 99–41). R.C. Sisk. Microgravity Science and Applications Department. 20010046480N

Historically, thermopile detectors, generators, and refrigerators based on bulk materials have been used to measure temperature, generate power for spacecraft, and cool sensors for scientific investigations. New potential uses of small, low–power, thin film thermopiles are in the area of micro–electromechanical systems since power requirements decrease as electrical and mechanical machines shrink in size.

In this research activity, thin film thermopile devices are fabricated utilizing radio frequency sputter coating and photore sist lift–off techniques. Electrical characterizations are performed on two designs in order to investigate the feasibility of generating small amounts of power, utilizing any available waste heat as the energy source.

A “Kane’s Dynamics” Model for the Active Rack Isolation System, R.D. Hampton,* G.S. Beech, N.N.S. Rao,* J.K. Rupert,* and Y.K. Kim, Engineering Systems Department and *University of Alabama in Huntsville. 20010067152N

Many microgravity space science experiments require vibratory acceleration levels unachievable without active isolation. The Boeing Corporation’s Active Rack Isolation System (ARIS) employs a novel combination of magnetic actuation and mechanical linkages to address these isolation requirements on the International Space Station (ISS). ARIS provides isolation at the rack (International Standard Payload Rack (ISPR)) level.

Effective model-based vibration isolation requires (1) an appropriate isolation device, (2) an adequate dynamic (i.e., mathematical) model of that isolator, and (3) a suitable, corresponding controller. ARIS provides the ISS response to the first requirement. This paper presents one response to the second, in a state space framework intended to facilitate an optimal–controls approach to the third. The authors use “Kane’s Dynamics” to develop a state–space, analytical (algebraic) set of linearized equations of motion for ARIS.


The multipurpose hydrogen test bed (MHTB), with an 18-m³ liquid hydrogen tank, was used to evaluate a combination foam/multilayer combination insulation (MLI) concept. The foam element (Isofoam SS-1171) insulates during ground hold/ascent flight, and allowed a dry nitrogen purge as opposed to the more complex/heavy helium purge subsystem normally required. The 45-layer MLI was designed for an on-orbit storage period of 45 days. Unique MLI features include a variable layer density, larger but fewer double–aluminized Mylar perforations for ascent to orbit venting, and a commercially established roll-wrap installation process that reduced assembly man–hours and resulted in a robust, virtually seamless MLI. Insulation performance was measured during three test series. The spray–on foam insulation (SOFI) successfully prevented purge gas liquefaction within the MLI and resulted in the expected ground hold heat leak of 63 W/m². The orbit hold tests resulted in heat leaks of 0.085 and 0.22 W/m² with warm boundary temperatures of 164 and 305 K, respectively. Compared to the best previously measured performance with a traditional MLI system, a 41-percent heat leak reduction with 25 fewer MLI layers was achieved. The MHTB MLI heat leak is half that calculated for a constant layer density MLI.
This document lists the significant publications and presentations of the Science Directorate during the period January 1–December 31, 2000. Entries in the main part of the document are categorized according to NASA Reports (arranged by report number), Open Literature, and Presentations (arranged alphabetically by title). Also included for completeness is an Appendix (arranged by page number). Most of the articles listed under Open Literature have appeared in refereed professional journals, books, monographs, or conference proceedings. Although many published abstracts are eventually expanded into full papers for publication in scientific and technical journals, they are often sufficiently comprehensive to include the significant results of the research reported. Therefore, published abstracts are listed separately in a subsection under Open Literature. Questions or requests for additional information about the entries in this report should be directed to Dr. A.F. Whitaker (SD01; (256) 544–2481) or to one of the authors.

Two graphite/epoxy cryogenic pressure vessels were evaluated for microcracking. The X–33 LH₂ tank lobe skins were extensively examined for microcracks. Specimens were removed from the inner skin of the X–33 tank for tensile testing. The data obtained from these tests were used to model expected microcrack density as a function of stress. Additionally, the laminate used in the Marshall Space Flight Center (MSFC) Composite Conformal, Cryogenic, Common Bulkhead, Aerogel-Insulated Tank (CBAT) was evaluated. Testing was performed in an attempt to predict potential microcracking during testing of the CBAT.
jets. It is well known that direct measurements using electrodes suffer from large surface resistances, and an electrodeless technique is desired. To address this need, an inductive probing scheme, originally developed for shock tube studies, has been adapted. In this method, the perturbation of an applied magnetic field by a plasma jet induces a voltage in a search coil, which, in turn, can be used to infer electrical conductivity through the inversion of a Fredholm integral equation of the first kind. A 1-in.-diameter probe was designed and constructed, and calibration was accomplished by firing an aluminum slug through the probe using a light-gas gun. Exploratory laboratory experiments were carried out using plasma jets expelled from 15-g shaped charges. Measured conductivities were in the range of 4 kS/m for unseeded octol charges and 26 kS/m for seeded octol charges containing 2-percent potassium carbonate by mass.

The prospects for realizing an integrated pulse detonation propulsion and magnetohydrodynamic (MHD) power system are examined. First, energy requirements for direct detonation initiation of various fuel-oxygen and fuel-air mixtures are deduced from available experimental data and theoretical models. Second, the pumping power requirements for effective chamber scavenging are examined through the introduction of a scavenging ratio parameter and a scavenging efficiency parameter. A series of laboratory experiments were carried out to investigate the basic engineering performance characteristics of a pulse detonation-driven MHD electric power generator. In these experiments, stoichiometric oxy-acetylene mixtures seeded with a cesium hydroxide/methanol spray were detonated at atmospheric pressure in a 1-m-long tube having an i.d. of 2.54 cm. Experiments with a plasma diagnostic channel attached to the end of the tube confirmed the attainment of detonation conditions ($p_2/p_1 \sim 34$ and $D \sim 2,400$ m/sec) and enabled the direct measurement of current density and electrical conductivity ($\sim$6 S/m) behind the detonation wave front. In a second set of experiments, a 30-cm-long continuous electrode Faraday channel, having a height of 2.54 cm and a width of 2 cm, was attached to the end of the tube using an area transition duct. The Faraday channel was inserted in applied magnetic fields of 0.6 and 0.95 T, and the electrodes were connected to an active loading circuit to characterize power extraction dependence on load impedance while also simulating higher effective magnetic induction. The experiments indicated peak power extraction at a load impedance between 5 and 10 $\Omega$. The measured power density was in reasonable agreement with a simple electrodynamic model incorporating a correction for near-electrode potential losses. The time-resolved thrust characteristics of the system were also measured, and it was found that the MHD interaction exerted a negligible influence.
A simple power law model consisting of a single spectral index $(\alpha_s)$ is believed to be an adequate description of the galactic cosmic-ray (GCR) proton flux at energies below $10^{13}$ eV, with a transition at knee energy $(E_k)$ to a steeper spectral index $\alpha_2 > \alpha_1$ above $E_k$. The maximum likelihood procedure is developed for estimating these three spectral parameters of the broken power law energy spectrum from simulated detector responses. These estimates and their surrounding statistical uncertainty are being used to derive the requirements in energy resolution, calorimeter size, and energy response of a proposed sampling calorimeter for the Advanced Cosmic-ray Composition Experiment (ACCESS). This study thereby permits instrument developers to make important trade studies in design parameters as a function of the science objectives, which is particularly important for space-based detectors where physical parameters, such as dimension and weight, impose rigorous practical limits to the design envelope.

Several other important results, such as the relationship between collecting power and detector energy resolution, as well as inclusion of a non-Gaussian detector response function, are presented. These results have many practical benefits in the design phase of a cosmic-ray detector as they permit instrument developers to make important trade studies in design parameters as a function of one of the science objectives. This is particularly important for space-based detectors where physical parameters, such as dimension and weight, impose rigorous practical limits to the design envelope.
order to emphasize necessary features of the design process that are sometimes overlooked. Finally the design process characterization is presented. This is accomplished by considering project technical framework, technical integration, process description (technical integration model, subsystem tree, design/discipline planes, decision gates, and tasks), and the design sequence. Also included in the document are a snapshot relating to process improvements, illustrations of the process, a survey of recommendations from experienced practitioners in aerospace, lessons learned, references, and a bibliography.

TP-2001-211115 June 2001

Since 1750, the number of cataclysmic volcanic eruptions (volcanic explosivity index (VEI) ≥4) per decade spans 2-11, with 96 percent located in the tropics and extra-tropical Northern Hemisphere. A two-point moving average of the volcanic time series has higher values since the 1860's than before, being 8.00 in the 1910's (the highest value) and 6.50 in the 1980's, the highest since the 1910's peak. Because of the usual behavior of the first difference of the two-point moving averages, one infers that its value for the 1990's will measure ≈6.50 ± 1, implying that ≈7 ± 4 cataclysmic volcanic eruptions should be expected during the present decade (2000-2009). Because cataclysmic volcanic eruptions (especially those having VEI ≥5) nearly always have been associated with short-term episodes of global cooling, the occurrence of even one might confuse our ability to assess the effects of global warming. Poisson probability distributions reveal that the probability of one or more events with a VEI ≥4 within the next 10 yr is >99 percent. It is ≈49 percent for an event with a VEI ≥5, and 18 percent for an event with a VEI ≥6. Hence, the likelihood that a climatically significant volcanic eruption will occur within the next 10 yr appears reasonably high.
The next millennium challenges us to produce innovative materials, processes, manufacturing, and environmental technologies that meet low-cost aerospace transportation needs while maintaining U.S. leadership. The pursuit of advanced aerospace materials, manufacturing processes, and environmental technologies supports the development of safer operational, next-generation, reusable, and expandable aeronautical and space vehicle systems. The Aerospace Materials, Processes, and Environmental Technology Conference (AMPET) provided a forum for manufacturing, environmental, materials, and processes engineers, scientists, and managers to describe, review, and critically assess advances in these key technology areas.

The 2000 Microgravity Materials Science Conference was held June 6–8 at the Von Braun Center, Huntsville, Alabama. It was organized by the Microgravity Materials Science Discipline Working Group, sponsored by the Microgravity Research Division (MRD) at NASA Headquarters, and hosted by NASA Marshall Space Flight Center and the Alliance for Microgravity Materials Science and Applications (AMMSA). It was the fourth NASA conference of this type in the microgravity materials science discipline. The microgravity science program sponsored ≈200 investigators, all of whom made oral or poster presentations at this conference. In addition, posters and exhibits covering NASA microgravity facilities, advanced technology development projects sponsored by the NASA Microgravity Research Division at NASA Headquarters, and commercial interests were exhibited. The purpose of the conference was to inform the materials science community of research opportunities in reduced gravity and to highlight the Spring 2001 release of the NASA Research Announcement (NRA) to solicit proposals for future investigations. It also served to review the current research and activities in materials science, to discuss the envisioned long-term goals, and to highlight new crosscutting research areas of particular interest to MRD. The conference was aimed at materials science researchers from academia, industry, and government. A workshop on in situ resource utilization (ISRU) was held in conjunction with the conference with the goal of evaluating and prioritizing processing issues in Lunar and Martian type environments. The workshop participation included invited speakers and investigators currently funded in the material science program under the Human Exploration and Development of Space (HEDS) initiative. The conference featured a plenary session every day with an invited speaker that was followed by three parallel breakout sessions in subdisciplines. Attendance was close to 350 people. Posters were available for viewing during the conference and a dedicated poster session was held on the second day. Nanotechnology, radiation shielding materials, Space Station science opportunities, biomaterials research, and outreach and educational aspects of the program were featured in the plenary talks. This volume, the first to be released on CD-Rom for materials science, is comprised of the research reports submitted by the Principal Investigators at the conference.

This document contains the proceedings of the 33rd annual NASA Aerospace Battery Workshop, hosted by the Marshall Space Flight Center on November 14–16, 2000. The workshop was attended by scientists and engineers from various agencies of the U.S. Government, aerospace contractors, and battery manufacturers, as well as international participation in like kind from a number of countries around the world.

The subjects covered included nickel-hydrogen, lithium-ion, lithium-sulfur, and silver-zinc technologies.

The Tenth Thermal and Fluids Analysis Workshop (TFAWS 99) was held at the Bevill Center, University of Alabama in Huntsville, Huntsville, Alabama, September 13–17, 1999. The theme for the hands-on training workshop and conference was “Tools and Techniques Contributing to Engineering Excellence.” Forty-seven technical papers were presented in four sessions. The sessions were: (1) Thermal Spacecraft/Payloads, (2) Thermal Propulsion/Vehicles, (3) Interdisciplinary Paper, and (4) Fluids Paper. Forty papers were published in these proceedings. The remaining seven papers were not available in electronic format at the time of publication. In addition to the technical papers, there were (a) nine hands-on classes on thermal and flow analyses softwares, (b) twelve short courses, (c) thirteen product overview lectures, and (d) three keynote lectures. The workshop resulted in participation of 171 persons representing NASA Centers, Government agencies, aerospace industries, academia, software providers, and private corporations.
This report documents the development of analytical techniques required for interpreting and comparing space systems electromagnetic interference test data with commercial electromagnetic interference test data using NASA Specification SSP 30237A “Space Systems Electromagnetic Emission and Susceptibility Requirements for Electromagnetic Compatibility.” The PSpice computer simulation results and the laboratory measurements for the test setups under study compare well. The study results, however, indicate that the transfer function required to translate test results of one setup to another is highly dependent on cables and their actual layout in the test setup. Since cables are equipment specific and are not specified in the test standards, developing a transfer function that would cover all cable types (random, twisted, or coaxial), sizes (gauge number and length), and layouts (distance from the ground plane) is not practical.

This science data report describes the Optical Properties Monitor (OPM) experiment and the data gathered during its 9-mo exposure on the Mir space station. Three independent optical instruments made up OPM: an integrating sphere spectral reflectometer, vacuum ultraviolet spectrometer, and a total integrated scatter instrument. Selected materials were exposed to the low-Earth orbit, and their performance monitored in situ by the OPM instruments. Co-investigators from four NASA Centers, five International Space Station contractors, one university, two Department of Defense organizations, and the Russian space company, Energia, contributed samples to this experiment. These materials included a number of thermal control coatings, optical materials, polymeric films, nanocomposites, and other state-of-the-art materials. Degradation of some materials, including aluminum conversion coatings and Beta® cloth, was greater than expected.

The OPM experiment was launched aboard the Space Shuttle on mission STS–81 in January 1997 and transferred to the Mir space station. An extravehicular activity (EVA) was performed in April 1997 to attach the OPM experiment to the outside of the Mir/ Shuttle Docking Module for space environment exposure. OPM was retrieved during an EVA in January 1998 and was returned to Earth on board the Space Shuttle on mission STS–89.
This Contractor Report describes and presents the results of work that was done in an attempt to develop an augmented acceleration technique that would launch small projectiles of known shape, mass, and state to velocities of 10 km/sec and higher. The higher velocities were to be achieved by adding a third stage to a conventional two-stage, light-gas gun and using a modified firing cycle for the third stage. The technique did not achieve the desired results and was modified for use during the development program. Since the design of the components used for the augmented-acceleration, three-stage launcher could be readily adapted for use as a three-stage launcher that used a single-stage acceleration cycle; the remainder of the contract period was spent performing test firings using the modified three-stage launcher. Work with the modified three-stage launcher, although not complete, did produce test firings in which an 0.11-g cylindrical nylon projectile was launched to a velocity of 8.65 km/sec.
ABDILDAYEM, H.A. SD47
FRAZIER, D.O. SD01
PALEY, M.S. USRA/SD47

Polydiacetylene as an All-Optical Picosecond Switch. For presentation at the SPIE Conference, San Diego, CA, July 29–August 2, 2001.

ABDILDAYEM, H.A. USRA/SD47
FRAZIER, D.O. SD01
WITHEROW, W.K. SD47
PALEY, M.S. USRA/SD47
PENN, B.G. SD47
BANKS, C.E. SD47


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FRAZIER, D.O. SD01
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BANKS, C.E. SD47


ABEL, T. Lockheed Martin
MARKOPOULOS, P. Lockheed Martin
LUND, G. Thiokol
PRINCE, A. Thiokol
CLAFLIN, S. Boeing
CARAVELLA, J. Boeing
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DONNELLY, J. Dublin Institute
DRURY, L. Dublin Institute
EGOROV, N. Russian Research Institute
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ET AL.


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HO, G.C. Johns Hopkins
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POLLOCK, C.J. SwRI
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Cummings, J.R. Washington University
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Hasebe, N. Waseda University
ET AL.

Bittker, L. TD40
Bragg-Sitton, S.M. University of Michigan
Litchford, R.J. TD40
Status of the Nuclear-Induced Conductivity Experiment (NICE) Project. For presentation at the 33rd AIAA Plasmadynamics and Lasers Conference and the 14th International Conference on MHD, Maui, HI, May 20–23, 2002.

Blevins, J.A. TD40
Patton, B. TD40
Riys, N.O. TD40
Schmidt, G.R. TD40

Boccioppio, D.J. SD60

Boccioppio, D.J. SD60
Christian, H.J., Jr. SD60
Applications of Satellite Total Lightning Observations. For presentation at the Eighth Scientific Assembly of IMAS, Munich, Germany, July 13, 2001.

Boccioppio, D.J. SD60
Christian, H.J., Jr. SD60
The Future of Satellite-Based Lightning Detection. For presentation at the Eighth Scientific Assembly of IMAS, Munich, Germany, July 13, 2001.

Boccioppio, D.J. SD60
Heckman, S.
Renno, N.O.
Milly, P.C.D.
TRMM/LIS Lightning: Going Beyond Climatological Composites. For presentation at the TRMM Science Meeting, Greenbelt, MD, October 29–November 2, 2000.

Boccioppio, D.J. SD60
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HOWELL, J.T. FD02

CARRUTH, M.R., JR. ED31

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<td>CHANDLER, M.O.</td>
<td>SD50</td>
<td>Plasma and Field Observations at the Day-Side, Equatorial, Magnetopause, Boundary Layers, and Magnetosphere.</td>
<td>For presentation at the AGU Spring Meeting, Boston, MA, April 1, 2001.</td>
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<td>SCHMIDT, W.K.H.</td>
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<td>SPANN, J.F., JR.</td>
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<td>LEPPING, R.P.</td>
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<td>MALONE, T.W.</td>
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<td>BOND, R.</td>
<td>IIT Research Institute</td>
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<td>Optical Lightning Detection From Space.</td>
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Assessment and Accommodation of Thermal Expansion of the Internal Active Thermal Control System Coolant During Launch to On-Orbit Activation of International Space Station Elements. For presentation at the 12th Thermal and Fluids Analysis Workshop, Huntsville, AL, September 10–14, 2001.

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Chandra Observations of Io and the Io Plasma Torus. For presentation at the Two Years of Science With Chandra Symposium, Washington, DC, September 1–7, 2001.

EMRICH, W.J., JR. TD40

Gasdynamic Mirror Fusion Propulsion Experiment. For presentation at the 42d Annual Meeting of the APS Division of Plasma Physics, Quebec, Canada, October 23–27, 2000.

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Natural Hazards of the Space Environment. For publication in Aircraft Survivability, 2000.

FALCONER, D.A. UAH
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Gamma-Ray Bursts—An Update. For presentation at Auburn University, Auburn, AL, April 20–21, 2001.

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The Storm-Time Plasmasphere as Seen by the Extreme Ultraviolet (EUV) Imager on the IMAGE Spacecraft. For presentation at the Fall AGU Meeting, San Francisco, CA, December 15–19, 2000.

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GALLAGHER, D.L. GARBE, G.P. MOORE, J. TALLEY, C. SRS Technologies
Initial Results From the Jovian Electrodynamic Tether Systems (JETS) Study. For presentation at the Forum on Innovative Approaches to Outer Planetary Exploration, Houston, TX, February 21–22, 2001.

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Tornadic Supercells on May 3, 1999 Viewed From Space During an Overpass of the NASA TRMM Observatory. For presentation at the TRMM Science Meeting, Greenbelt, MD, October 29–November 2, 2000.

Tornadoic Supercells on May 3, 1999 Viewed From Space During an Overpass of the NASA TRMM Observatory. For presentation at the TRMM Science Meeting, Greenbelt, MD, October 29–November 2, 2000.


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The Feasibility of a Galileo-Style Tour of the Uranian Satellites. For presentation at the AAS/AIAA Astrodynamics Specialists Conference, Quebec City, Quebec, Canada, July 30–August 2, 2001.

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Focus of NASA's Spaceline 100 Investment Area. For presentation at the Chemical Propulsion Information Agency/Airbreathing Propulsion Subcommittee, Monterey, CA, November 15, 2000.

HUETER, U. TD15
NASA’s Spaceline Investment Area Technology Activities. For presentation at the 10th International Spaceplanes and Hypersonics Systems and Technologies Conference, Kyoto, Japan, April 24-27, 2001.

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JONES, J.E.  TD40
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Imaging the Sunyaev-Zel’dovich Effect in Clusters of Galaxies. For presentation at the High-Energy Astrophysics Division (HEAD) of the AAS, Honolulu, HI, November 6–10, 2000.

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In Situ Chemical Reduction and Oxidation of VOCs in Groundwater (Powerpoint Presentation). For presentation at the First International Conference on Oxidation and Reduction Technologies for In Situ Treatment Soil and Groundwater, Niagra Falls, Canada, June 26–29, 2001.

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Characterization of a Multilayered Dielectric Transmissive Phase Modulator. For presentation at the International Society for Optical Engineers (SPIE) Annual Meeting, San Diego, CA, August 2, 2001.

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Microcosm, Inc.
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SLOUGHI, J.

University of Washington

MARTIN, J.J.
LEWIS, R.A.
CHAKRABARTI, S.
PEARSON, J.B.


MARTIN, J.J.
LEWIS, R.A.
KRAMER, K.
MEYER, K.
SMITH, G.

Lewis Company
Penn State University
Penn State University
Synergistic Tech, Inc.

MCBRAYER, R.O.
THOMAS, D.


MCGILL, P.B. ED33

MEADE, B.R. TD51
TALLEY, D. AFRL
MUELLER, D. Adroit Systems, Inc.
TEW, D. UTRC
GUIDOS, M.J. TD51
DEYMOUR, D. TD51

MEEGAN, C.A. SD50
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MENDE, S.B. University of CA
FREY, H.U. University of CA
GERARD, J.-C. University of Liege
HUBERT, B. University of Liege
FUSELIER, S. Lockheed-Martin
SPANN, J.F., JR. SD50
GLADSTONE, G.R. SwRI
Burch, J.L. SwRI

MINOR, J.L. ED03

MINOR, J.L. ED03

MITROFANOV, I.G.
SANIN, A.B.
ANFIMOV, D.S.
LITVAK, M.L.

BRIGGS, M.S.
PACIESAS, W.S.
PENDLETON, G.N.
PREECE, R.D.
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MONTGOMERY, E.E., IV SD71

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FALCONER, D.A. SD50
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HUDSON, H.
LEMEM, J.R.

MOORE, R.L. SD50
STERLING, A.C. SD50
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LEMEM, J.R.

MOTAKEF, S. Cape Simulations
GRUGEL, R.N. SD47
MAZURUK, K. SD47

NALL, M.E. SD12
NEERGAARD, L.
IIT Research Institute
MALONE, T.W.
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NELSON, K.W.
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ASTP RBCC Activities. For presentation at the SAE World Aviation Congress and Exhibition, San Diego, CA, October 10–12, 2000.

NESMAN, T.E.
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DOUGLAS, M.J.
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NEWTON, R.L.
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DAVIDSON, J.L.
Vanderbilt University

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NUNES, A.C., JR.
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FRAGOMENI, J.M.
Ohio University

OGLESBY, R.J.
SD60
Using Climate Models to Evaluate Mechanisms of Glacial Inception. For presentation at The International Cooperative Effort to Predict and Track the Inceptions of Northern Hemisphere Ice Sheets (INCEPTIONS), Stockholm, Sweden, June 16, 2001.
OSBORNE, R. ERC, Inc.
WEHRMEYER, J. Vanderbilt University
FARMER, R. SECA
TRINH, H.P. TD61
DOBSON, C. TD61
ESKRIDGE, R.E. TD61
CRAMER, J. TD61
HARTFIELD, R. Auburn University


OWEN, C.T. SD45

PADIN, S. Caltech
CARTWRIGHT, J.K. Caltech
MASON, B.S. Caltech
PEARSON, T.J. Caltech
READHEAD, A.C.S. Caltech
SHEPHERD, M.C. Caltech
SIEVERS, J. Caltech
UDOMPRASERT, P.S. Caltech
JOY, M.K. SD50
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PAERELS, F. SD50
WEISSKOPF, M.C. SD50
TENNANT, A.F. SD50
O’DELL, S.L. SD50
SWARTZ, D.A. USRA
KAHN, S.M. SD50
BEHAR, E. SD50
BECKER, W. SD50

Interstellar X-Ray Absorption Spectroscopy of the Crab Pulsar With the LETGS. For presentation at the Two Years of Science With Chandra Symposium, Washington, DC, September 5–7, 2001.

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SUTHERLIN, S. Raytheon


PANDA, B. ED33

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BROMAGE, B.J. SD50
POLETTO, G. SD50
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BROMAGE, G.E. SD50


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PARKS, G.K. University of Washington
CHRISTL, M.J. University of Washington
CHUA, D. University of Washington
FILLINGIM, M. University of Washington
GERMANY, G.A. UAH
SPANN, J.F., JR. SD50


PARNELL, T.A. UAH
ADAMS, J.H., JR. SD50
BINNS, W.R. Washington University
CHRISTL, M.J. SD50
DERRICKSON, J.H. SD50
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HOWELL, L.W. SD50
GREGORY, J.C. UAH
HINK, PL. Washington University
ET AL.


PATEL, S.K. SD50
KOUVELIOTOU, C. SD50
WOODS, P.M. USRA
TENNANT, A.F. SD50
WEISSKOPF, M.C. SD50
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ET AL.

PATTERSON, A.F.

PERRY, J.L.

PETERS, B.R.
REARDON, P.J.
WONG, J.K.
LIGHTSEY, W.D.

PETERS, W.A.
NESBITT, S.W.
BLAKESLEE, R.J.
HEIN, P.
CIFELLI, R.
RUTLEDGE, S.A.
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KOSHAK, W.J.
RYBSKI, P.M.

PHILLIPS, T.
MYSZKA, E.
GALLAGHER, D.L.
ADAMS, M.L.
KOCZOR, R.J.
Lessons Learned From Real-Time, Event-Based Internet Science Communications—Abstract Only. For presentation at the Office of Space Science Education/Outreach Conference, Chicago, IL, September 12–14, 2001.

POLETTI, G.
SUSS, S.T.
BIESECKER, D.
ESSER, R.
GLOECKLER, G.
KO, Y.
ZURBUCHEN, T.

POLITES, M.E.

POLITES, M.E.

POLITES, M.E.
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PORTER, J.G.
FALCONER, D.A.
MOORE, R.L.

POTTER, S.D.
HENELY, M.W.
GUTIERREZ, S.
FIKES, J.C.
CARRINGTON, C.K.
SMITHERMAN, D.V.
GERRY, M.
SUTHERLIN, S.
BEASON, P.

PRINCE, F.A.
PUSEY, M.L.  

QUATTROCHI, D.A.  
LUVALL, J.C.  
RICKMAN, D.L.  
ESTES, M.G., JR.  
LAYMON, C.A.  
CROSSON, W.  
HOWELL, B.F.  
GILLANI, N.V.  

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REILY, J.C. SD74
KEGELY, J. SD74

REUTER, J.L. FD21
REYSQA, R. Boeing

RICHMOND, R.C. SD48
FRIGO, S.P. Argonne National Laboratory
EHRET, C.F. General Chronobionics
Killing of Bacillus Megaterium Spores by X-Rays at the Phosphorus K-Edge. For presentation at the 48th Radiation Research Society, San Juan, PR, April 22, 2001.

RICHMOND, R.C. SD48
KALE, R. Alabama A&M University
PETTENGILL, O. Dartmouth

RICHMOND, R.C. SD48
MAHTANI, H.K. SD48
LU, X. Dartmouth
CHANG, T.Y. Dartmouth
MALAK, H. Microcosm, Inc.

RICKMAN, D.L. SD60

RITTER, J.M. SD72

RITTER, J.M. SD70
SMITH, W.S. SD70

ROBERTSON, F.R. SD60

ROBERTSON, F.R. SD60
FITZJARRALD, D.E. SD60

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SOHN, B.-J. Seoul Nat. University
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MARSHALL, S. U. of North Carolina, Charlotte
OGLESBY, R.J. SD60
ROADS, J.O. SIO/UCSD
SOHN, B.-J. Seoul Nat. University

ROBERTSON, F.R. SD60
MARSHALL, S. U. of North Carolina, Charlotte
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OGLESBY, R.J. SD60
FITZJARRALD, D.E. SD60

ROBERTSON, T. TD40
LITCHFORD, R.J. TD15
PETERS, R. Mercer University
THOMPSON, B. TMET
ROBINSON, M.B.  SD47
LI, D.  SD47
ROGERS, J.R.  SD47
HYERS, R.W.  SD47
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ROBINSON, M.B.  SD47
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SAVAGE, L.  SD47
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ROJAS-OVIEDO, R.  Alabama A&M University
DENG, Z.T.  Alabama A&M University
HARRIS, L.  ED23


ROMAN, J.  ED25


ROMAN, M.C.  FD21


ROTHERMEL, J.  SD60
CUTTEN, D.R.  UAH


ROTHERMEL, J.  SD60
CUTTEN, D.R.  UAH
JOHNSON, S.C.  SD60
JARZEMBSKI, M.A.  SD60


RUF, J.H.  TD64
LEHMANN, M.  Penn State University
PAL, S.  Penn State University
SANTORO, R.J.  Penn State University
WEST, J.S.  TD64

Experimental/Analytical Characterization of the RBCC Rocket-Ejector Mode. For presentation at the JANNAF Interagency Propulsion Committee Joint Meeting, Monterey, CA, November 13–17, 2000.

RUSSELL, C.K.  ED33
ZAGRABELNIJ, A.  Paton Welding Institute


SACKHEIM, R.L.  DA01
RYAN, R.
THREET, E.


SCHAEFER, D.A.  SD44
COBB, S.D.  SD44
FISKE, M.R.  Morgan Research Corp.
SRINIVAS, R.  System Studies & Sim.

Materials Science Research Hardware for Application on the International Space Station: An Overview of Typical

SCHAEFER, D.A. SD40
KING, R. SD40
COBB, S.D. SD40


SCHLAGHECK, R.A. SD44
TRACH, B. Boeing


SCHNEIDER, M.P. FD41
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SCHNEIDER, T.A. ED31
CARRUTH, M.R., JR. ED31
FINCKENOR, M.M. ED31
VAUGHN, J.A. ED31
FERGUUSON, D. Glenn Research Center
HEARD, J. Clarion University


SCHNEIDER, T.A. ED31
CARRUTH, M.R., JR. ED31
VAUGHN, J.A. ED31
EDWARDS, D.L. ED31


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SCHKEIZER, M. USRA
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SZOFORAN, F.R. SD47


SCHKEIZER, M. USRA/SD47
VOLZ, M.P. SD47
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VUJSIC, L.J. Cape Simulations, Inc.
MOTAKEF, S. Cape Simulations, Inc.
SZOFORAN, F.R. SD47


SEGRE, P.N. SD48
LIU, F. University of Pennsylvania
UMBANHOWER, P. Northwestern University
WEITZ, D.A. Harvard University


SEGRE, P.N. SD48
LIU, F. University of Pennsylvania
UMBANHOWER, P. Northwestern University
WEITZ, D.A. Harvard University


SEGRE, P.N. SD48
PRASAD, V. Harvard University
WEITZ, D.A. Harvard University

Glass/Jamming Transition in Colloidal Aggregation. For presentation at the AICHE Conference, Los Angeles, CA, November 12–14, 2000.

SEN, S. USRA
STEFANESCU, D.M. UAH
CATALINA, A.V. USRA
JURETZKO, F.  UAH  SHAH, S.R.  ED33
DHINDAW, B.K.  Indian Institute of Tech.  LEE, J.A.  ED33
CURRERI, P.A.  SD40  BHIAT, B.N.  ED33
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  GREGG, W.  ED22
  MARSH, M.W.  TD61
  GENGGE, G.G.  TD15
  FORBES, J.C.  TD62
  SALVI, A.  MMCC, Inc.
  ET AL.
  Metal Matrix Composites Lox Turbopump Housing Via Novel Toolless Net-Shape Pressure Infiltration Casting Technology. For presentation at the TMS Joint Fall Meeting, Indianapolis, CA, June 11–14, 2001.

SEO, E.S.  ADAMS, J.H., JR.  SD50  SHAPIRO, A.P.  SD72
BASHINDZHAGYAN, G.  Moscow State University  SHAPIRO, A.P.  SD72
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SEUGLING, R.M.  U. of North Carolina, Charlotte  SHAW, E.J.  VS20

SEVER, T.  SD60  SHELDON, R.B.
IRWIN, D.  SD60  CRAVEN, D.L.
SEVER, T.  SD60  SD50
IRWIN, D.  SD60  The UAH Spinning Terrella Experiment: A Laboratory Analog for the Earth’s Magnetosphere. For presentation at the AGU Spring Meeting, Boston, MA, April 1, 2001.

SHAH, S.R.  ED33  SHYY, W.  University of Florida
LEE, J.A.  ED33  PAPILA, N.  University of Florida
BHIAT, B.N.  ED33  VAIDYANATHAN, R.  University of Florida
WELLS, D.N.  ED33  TUCKER, P.K.  TD64
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VAIDYANATHAN, R. University of Florida
TUCKER, P.K. TD64
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DORNEY, D.J. TD64


SIBILLE, L.
SMITH, D.D. SD48
CRONISE, R.
HUNT, A.J.
WOLFE, D.B.
SNOW, L.A.

The Influence of Microgravity on Silica Sol-Gel Formation. For presentation at the International Symposium on Aerogels VI, Albuquerque, NM, October 8–11, 2000.

SIEMON, R.E. Los Alamos National Laboratory
TURCHI, P.J. Los Alamos National Laboratory
BARNES, D.C. Los Alamos National Laboratory
DEGNAN, J. Air Force Research Laboratory
PARKS, P. General Atomics
RYUTOV, D.D. Lawrence Livermore National
THIO, Y.C.F. TD40


SIMS, J. TD52
POPP, C. TD52


SIMS, W.H., III ED18

High-Efficiency Microwave Power Amplifier: From the Lab to Industry. For presentation at IMAPS, Baltimore, MD, October 9–11, 2001.

SIMS, W.H., III ED18


SMALLEY, K.B. Clarkson University
TINKER, M.L. ED21
FISCHER, R.T. ED21


SMITH, D.D. SD48
SIBILLE, L.
IGNONT, E.
SNOW, L.A.

Metal Nanoparticle Aerogel Composites. For presentation at the International Symposium on Aerogels VI, Albuquerque, NM, October 8–11, 2000.

SMITH, E.A. SD01


SMITH, S.B. NWS Meteorological Lab
PACE, D.
GOODMAN, S.J. SD60
BURGESS, D.W.
SMARSH, D.
ROBERTS, R.D.


SMITH, W.S. SD70
STAHL, H.P. SD70


SNELL, E.H. SD48/NRC
JUDGE, R.A. SD48
CRAWFORD, L. SD48


AMSU–A Tropical Cyclone Maximum Sustained Winds and Web Site. For presentation at the Interdepartmental Hurricane Conference, Orlando, FL, March 5–9, 2001.


STALLCUP, M.A.  

STALLCUP, M.A.  
Analysis and Verification of HET 1-m Mirror Deflections Due to Edge Sensor Loading. For presentation at the Optomechanical Design and Engineering Conference, San Diego, CA, July 26–August 3, 2001.

STERLING, A.C.  
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SU, C.-H.  

SU, C.-H.  

SU, C.-H.  

SUESS, S.T.  

SUESS, S.T.  

SUESS, S.T.  
The Generation of Smooth High-Speed Solar Wind From Plume-Interplume Mixing. For presentation at the UVCS Team Meeting, Northeast Harbor, ME, September 27, 2000.

SUESS, S.T.  

SULEIMANOV, V.
GHOSH, K.K.
AUSTIN, R.A.
RAMSEY, B.D.


SUMIDA, J.
FORSYTHE, E.L.
PUSEY, M.L.


SWANSON, G.R.


SZOFRAN, F.R.
VOLZ, M.P.
SCHWEIZER, M.
KAISER, N.
CROELL, A.
DOLD, P.


TAKADA, P.M.
NEWTON, S.
GHOLOSTON, S.


TANANBAUM, H.
WEISSKOPF, M.C.


THIO, Y.C.F.


THIO, Y.C.F.


THIO, Y.C.F.

THIO, Y.C.F. TD40
ESKRIDGE, R.E. TD40
MARTIN, A.K. TD40
SMITH, J.W. TD40
LEE, M.H. TD40


THIO, Y.C.F. TD40
ESKRIDGE, R.E. TD40
MARTIN, A.K. TD40
SMITH, J.W. TD40
LEE, M.H. TD40
RICHESON, J. TD40
SCHMIDT, G.R. TD40
KNAPP, C.E. Los Alamos National Laboratory
KIRKPATRICK, R.C. Los Alamos National Laboratory
ET AL.

Magnetized Target Fusion Driven by Plasma Liners. For presentation at the Invited Colloquium, University of Nevada, Reno, NV, April 27, 2001.

THIO, Y.C.F. TD40
ESKRIDGE, R.E. TD40
MARTIN, A.K. TD40
SMITH, J.W. TD40
LEE, M.H. TD40
KIRKPATRICK, R.C. Los Alamos National Laboratory
KNAPP, C.E. Los Alamos National Laboratory
CASSIBRY, J.T. UAH
ESKRIDGE, R.E. TD40
LEE, M.H. TD40
SMITH, J.W. TD40
MARTIN, A.K. TD40
WU, S-T. UAH
SCHMIDT, G.R. TD40


THIO, Y.C.F. TD40
KNAPP, C.E. Los Alamos National Laboratory
KIRKPATRICK, R.C. Los Alamos National Laboratory

Modeling the Compression of Merged Compact Toroids by Multiple Plasma Jets. For presentation at the 42d Annual Meeting of the APS Division of Plasma Physics, Quebec, Canada, October 23–27, 2000.
ROGERS, J.R. SD48

TROLINGER, J.D. MetroLaser, Inc.
ROGERS, J.R. SD47
WITHEROW, W.K. SD48
COIMBRA, C.F.M. University of Hawaii
RANGEL, R. University of California

SANCHEZ, J.N. FD35

VAISBERG, O.L. GSFC
BURCH, J.L. SwRI
SMIRNOV, V.N. Space Research Institute
AVANOV, L.A. Space Research Institute
MOORE, T.E. GSFC
WAITE, J.H., JR. SwRI
SKALSKY, A.A. Space Research Institute
BORODKOVA, N.L. Space Research Institute
COFFEY, V.N. SD50
GALLAGHER, D.L. SD50

TUCKER, D.S. SD71

TUCKER, D.S. SD71

TUCKER, D.S. SD71

TUCKER, D.S. SD70
NETTLES, A.T. SD70

TUCKER, D.S. SD71
NETTLES, A.T. SD71
Infrared Fibers for Use in Space-Based Smart Structures. For presentation at the Eighth International Conference on Composites Engineering (ICCE/8), Tenerife, Spain, August 5–11, 2001.

TUCKER, S. TD52
HASTINGS, L.J. TD52

UNDERWOOD, D.B. FD35
NONEMAN, S. FD35
VAUGHN, J.A. ED31
SCHNEIDER, T.A. ED31
FINCKENOR, M.M. ED31


VERHAGE, J.M. FD31
BOWER, M.V. UAH


VICKERS, J.H. ED34


VIKRAM, C.S. UAH
WITHEROW, W.K. SD48


VISENTINE, J. Boeing
FINCKENOR, M.M. ED31
ZWIENER, J. AZ Technology


VOLZ, M.P. SD47
SCHWEIZER, M. SD47
KAISER, N. University of Frieberg
COBB, S.D. SD47
VUJISIC, L.J. Cape Simulations, Inc.
MOTAIF, S. Cape Simulations, Inc.
SZOFRAN, F.R. SD47


WALKER, C.B. Pace & Waite
STAHL, H.P. SD70
LLOYD-HART, M.


WALKER, J.L. ED32
RUSSELL, S.S. ED32

WANG, F.C. Raytheon
PETERS, P.N. SD47


WANG, T.-S. TD64
CHEN, Y.-S. Engineering Services, Inc.
LIU, J. Engineering Services, Inc.
MEAD, F.B., JR. Air Force Research Lab


WANG, T.-S. TD64
CHEN, Y.-S. Engineering Sciences, Inc.
LIU, J. Engineering Sciences, Inc.
MYRABO, L.H. Rensselaer Polytechnic Institute
MEAD, F.B., JR. Air Force Research Lab


WANG, T.-S. TD64
WILLIAMS, R.W. TD64
DROEGE, A.R. TD64
D’AGOSTINO, M. TD64
LEE, Y.-C. TD64
DOUGLAS, S. TD64


WATSON, L.A. FD43


WATSON, M.D. ED12
SCOTT, S. Reflexite, Inc.
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**WATSON, M.D.**
**SHAH, S.R.**
**KAUL, R.K.**
**ZHU, S.**
**VANDIVER, T.L.**


**WEFEL, J.P.** Louisiana State University
**ADAMS, J.H., JR.** SD50


**WEISSKOPF, M.C.** SD50

Observations With the Chandra X-Ray Observatory—The First Year. For presentation at the Annual Meeting of the American Physical Society, Starkville, MS, November 3, 2000.

**WEISSKOPF, M.C.** SD50


**WEST, E.A.**
**PORTER, J.G.**
**DAVIS, J.M.**
**GARY, G.A.**
**ADAMS, M.L.**


**WESTPHAL, A.J.**
**WEAVER, B.A.**
**SOLARZ, M.**
**DOMINGUEZ, N.C.**
**ADAMS, J.H., JR.**
**BARBIER, L.M.**
**CHRISTIAN, E.R.**
**MITCHELL, J.W.**
**BINNS, W.R.**


WESTRA, D.G. POIRIER, D.R. HEINRICH, J.C. SUNG, P.K. FELICELLI, S.D.

WHORTON, M.S.


WILLIAMS, E. BLAKESLEE, R.J. BOCCIPPIO, D.J. ET AL.

WILLIAMS, R.W.

WILLIAMS, R.W. SKELLEY, S.E.
WINGARD, C.D.  

WISE, S.A.  

WORLUND, A.L.  

YAMAUCHI, Y.  

YAMAUCHI, Y.  

YOUNG, R.B.  

ZATSEPIN, V.
ADAMS, J.H., JR. SD40
AHN, H.
AMPE, J.
BASHINDZHAGYAN, G. Moscow State University
CASE, G.
ET AL.

ZENG, W.
HORWITZ, J.L.
WU, X.-Y.
CRAVEN, P.D.
RICH, E.J.
MOORE, T.E.
Relationship of Ion Vertical Flows to Topside Electron Temperatures. For presentation at the AGU Spring Meeting, Boston, MA, April 1, 2001.

ZHU, S.
BANKS, C.E.
FRAZIER, D.O.
ILA, D.
MUNTELE, I.
PENN, B.G.
SHARMA, A.

ZHU, S.
SU, C.-H.
COCHRANE, J.C.
LEHOCZKY, S.L.
CUI, Y.
BURGER, A.

ZHU, S.
SU, C.-H.
COCHRANE, J.C.
LEHOCZKY, S.L.
CUI, Y.
BURGER, A.

ZHU, S.
SU, C.-H.
COCHRANE, J.C.
LEHOCZKY, S.L.
CUI, Y.
BURGER, A.

ZHU, S.
SU, C.-H.
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