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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.”
GEORGE C. MARSHALL SPACE FLIGHT CENTER  
Marshall Space Flight Center, Alabama  

FY 2005 SCIENTIFIC AND TECHNICAL REPORTS, ARTICLES, PAPERS, AND PRESENTATIONS

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Monitoring the atmospheric composition of a crewed spacecraft cabin is central to successfully expanding the breadth and depth of first-hand human knowledge and understanding of space. Highly reliable technologies must be identified and developed to monitor atmospheric composition. This will enable crewed space missions that last weeks, months, and eventually years. Atmospheric composition monitoring is a primary component of any environmental control and life support system. Instrumentation employed to monitor atmospheric composition must be inexpensive, simple, and lightweight and provide robust performance. Such a system will ensure an environment that promotes human safety and health, and that the environment can be maintained with a high degree of confidence. Key to this confidence is the capability for any technology to operate autonomously, with little intervention from the crew or mission control personnel. A study has been conducted using technologies that, with further development, may reach these goals.


Launch vehicles consume large quantities of propellant quickly, causing the mass properties and structural dynamics of the vehicle to change dramatically. Currently, structural load assessments account for this change with a large collection of structural models representing various propellant fill levels. This creates a large database of models complicating the delivery of reduced models and requiring extensive work for model changes. Presented here is a method to account for these mass changes in a more efficient manner. The method allows for the subtraction of propellant mass as the propellant is used in the simulation. This subtraction is done in the modal domain of the vehicle generalized model. Additional computation required is primarily for constructing the used propellant mass matrix from an initial propellant model and further matrix multiplications and subtractions. An additional eigenvalue solution is required to uncouple the new equations of motion; however, this is a much simpler calculation starting from a system that is already substantially uncoupled. The method was successfully tested in a simulation of Saturn V loads. Results from the method are compared to results from separate structural models for several propellant levels, showing excellent agreement. Further development to encompass more complicated propellant models, including slosh dynamics, is possible.


Quartz crystal microbalances (QCMs) are commonly used to measure the rate of deposition of molecular species on a surface. The measurement is often used to select materials with a low outgassing rate for applications where the material has a line of sight to a contamination-sensitive surface. A quantitative, in situ calibration of the balance, or balances, using a pure material for which the enthalpy of sublimation is known, is described in this Technical Memorandum. Supporting calculations for surface dwell times of deposited materials and the effusion cell Claisen factor are presented along with examples of multiple QCM measurements of outgassing from a common source.


Many microgravity space-science experiments require vibratory acceleration levels that are 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.

Effective model-based vibration isolation requires: (1) An isolation device, (2) an adequate dynamic; i.e., mathematical, model of that isolator; and (3) a suitable, corresponding controller. This Technical Memorandum documents the validation of that high-fidelity dynamic model of ARIS.

The verification of this dynamics model was achieved by utilizing two commercial off-the-shelf (COTS) software tools: Deneb’s ENVISION®, and Online Dynamics’ Autolev™. ENVISION is a robotics software package developed for the automotive industry that employs three-dimensional computer-aided design models to facilitate both forward and inverse kinematics analyses. Autolev is a DOS-based interpreter designed, in general, to solve vector-based mathematical problems and specifically to solve dynamics problems using Kane’s method.

The simplification of this model was achieved using the small-angle theorem for the joint angle of the ARIS actuators. This simplification has a profound effect on the overall complexity of the closed-form solution while yielding a closed-form solution easily employed using COTS control hardware.
This Technical Memorandum describes the development of several high-strength aluminum (Al) alloys that are compatible with hydrogen peroxide (H₂O₂) propellant for NASA Hypersonic-X (Hyper-X) vehicles’ fuel tanks and structures. The yield strengths for some of these Al-magnesium-based alloys are more than 3 times stronger than the conventional 5254–H112 Al alloy, while maintaining excellent H₂O₂ compatibility similar to class 1 5254 alloy. The alloy development strategy is to add scandium, zirconium, and other transitional metals with unique electrochemical properties, which will not act as catalysts, to decompose the highly concentrated 90 percent H₂O₂. Test coupons are machined from sheet metals for H₂O₂ long-term exposure testing and mechanical properties testing. In addition, the ability to weld the new alloys using friction stir welding has also been explored. The new high-strength alloys could represent an enabling material technology for Hyper-X vehicles, where flight weight reduction is a critical requirement.

This Technical Memorandum covers revolutionary ideas for space radiation shielding that would mitigate mission costs while limiting human exposure, as studied in a workshop held at Marshall Space Flight Center at the request of NASA Headquarters. None of the revolutionary new ideas examined for the first time in this workshop showed clear promise. The workshop attendees felt that some previously examined concepts were definitely useful and should be pursued. The workshop attendees also concluded that several of the new concepts warranted further investigation to clarify their value.

The International Space Station (ISS) uses high-efficiency particulate air filters to remove particulate matter from the cabin atmosphere. Known as bacteria filter elements (BFEs), there are 13 elements deployed on board the ISS’s U.S. segment in the flight 4R assembly level. The preflight service life prediction of 1 yr for the BFEs is based upon engineering analysis of data collected during developmental testing that used a synthetic dust challenge. While this challenge is considered reasonable and conservative from a design perspective, an understanding of the actual filter loading is required to best manage the critical ISS program resources. Testing was conducted on BFEs returned from the ISS to refine the service life prediction. Results from this testing and implications to ISS resource management are provided.


In the late 1980s, microgravity researchers began to voice their concern that umbilical-transmitted energy could significantly degrade the acceleration environment of microgravity
space science experiments onboard manned spacecraft. Since umbilicals are necessary for many experiments, control designers began to seek ways to compensate for these “indirect” disturbances.

Hampton et al. used the Kane’s method to develop a model of the active rack isolation system (ARIS) that includes (1) actuator control forces, (2) direct disturbance forces, and (3) indirect, actuator-transmitted disturbances. Their model does not, however, include the indirect, umbilical-transmitted disturbances. Since the umbilical stiffnesses are not negligible, these indirect disturbances must be included in the model. Until the umbilicals have been appropriately included, the model will be incomplete.

This Technical Memorandum presents a nonlinear model of ARIS with umbilicals included. Model verification was achieved by utilizing two commercial-off-the-shelf software tools. Various forces and moments were applied to the model to yield simulated responses of the system. Plots of the simulation results show how various critical points on an ARIS-outfitted international standard payload rack behave under the application of direct disturbances, indirect disturbances, and control forces. Simulations also show system response to a variety of initial conditions.

TM—2005–213902 July 2005
Method for Determination of <5 ppm Oxygen in Sodium Samples. R.S. Reid, J.J. Martin, and G.L. Schmidt*. Propulsion Research Center, Space Transportation Directorate and *New Mexico Institute of Mining and Technology.

Alkali metals used in pumped loops or heat pipes must be sufficiently free of nonmetallic impurities to ensure long heat rejection system life. Life issues are well established for alkali metal systems. Impurities can form ternary compounds between the container and working fluid, leading to corrosion. This Technical Memorandum discusses the consequences of impurities and candidate measurement techniques to determine whether impurities have been reduced to sufficiently low levels within a single-phase liquid metal loop or a closed two-phase heat transfer system, such as a heat pipe. These techniques include the vanadium wire equilibration, neutron activation analysis, plug traps, distillation, and chemical analysis. Conceptual procedures for performing vanadium wire equilibration purity measurements on sodium contained in a heat pipe are discussed in detail.

TM—2005–214007 July 2005

Human exploration and utilization of space requires habitats to provide appropriate conditions for working and living. These conditions are provided by environmental control and life support systems (ECLSS) that ensure appropriate atmosphere composition, pressure, and temperature; manage and distribute water, process waste matter, provide fire detection and suppression; and other functions as necessary.

The tables in appendix I of NASA RP–1324 “Designing for Human Presence in Space” summarize the life support functions and processes used onboard U.S. and U.S.S.R/Russian space habitats. These tables have been updated to include information on thermal control methods and to provide additional information on the ECLS systems.

TM—2005–214008 August 2005

The International Space Station (ISS) Environmental Control and Life Support System includes equipment specifically designed to actively remove trace chemical contamination from the cabin atmosphere. In the U.S. on-orbit segment, this function is provided by the trace contaminant control subassembly (TCCS) located in the atmosphere revitalization subsystem rack housed in the laboratory module, Destiny. The TCCS employs expendable adsorbent beds to accomplish its function leading to a potentially significant life cycle cost over the life of the ISS. Because maintaining the TCCSs proper can be logistically intensive, its performance in flight has been studied in detail to determine where savings may be achieved. Details of these studies and recommendations for improving the TCCS’s process economics without compromising its performance or crew health and safety are presented and discussed.

TM—2005–214061 September 2005

Contaminated air, whether in a crewed spacecraft cabin or terrestrial work and living spaces, is a pervasive problem affecting human health, performance, and well-being. The need for highly effective, economical air quality processes spans a wide range of terrestrial and space flight applications. Typically, air quality control processes rely on adsorption-based processes. Most industrial packed-bed adsorption processes use activated
carbon. Once saturated, the carbon is either dumped or regen-
ated. In either case, the dumped carbon and concentrated waste
streams constitute a hazardous waste that must be handled safely
while minimizing environmental impact. Thermal catalytic
oxidation processes designed to address waste handling issues
are moving to the forefront of cleaner air quality control and
process gas decontamination processes. Careful consideration
in designing the catalyst substrate and reactor can lead to more
complete contaminant destruction and poisoning resistance.
Maintenance improvements leading to reduced waste handling
and process downtime can also be realized. Performance of a
prototype thermal catalytic reaction based on ultrashort waste
channel, monolith catalyst substrate design, under a variety
of process flow and contaminating loading conditions, is dis-
cussed.

TM—2005–214184 September 2005
In-Space Propulsion: Connectivity to In-Space Fabrication
and Repair. L. Johnson, D. Harris, A. Trausch, G.L.
Matloff,* T.Taylor,***and K. Cutting***. In-Space propul-
sion Technology Office, Space Transportation Programs/
Projects Office, *New York City College of Technology,
**BAE Systems, and ***Gray Research.

The connectivity between new in-space propulsion tech-
nologies and the ultimate development of an in-space fabrica-
tion and repair infrastructure are described in this Technical
Memorandum. A number of advanced in-space propulsion
technologies are being developed by NASA, many of which
are directly relevant to the establishment of such an in-space
infrastructure. These include aerocapture, advanced solar-elec-
tric propulsion, solar-thermal propulsion, advanced chemical
propulsion, tethers, and solar photon sails. Other, further term
technologies have also been studied to assess their utility to the
development of such an infrastructure.

TM—2005–214186 September 2005
Advanced Sensor Concepts (MSFC Director’s Fund Final
Report, Project No. 03-11). D.C. Alhorn, D.E. Howard, and
D.A. Smith. Instrument and Payload Systems Department,
Engineering Directorate.

The Advanced Sensor Concepts project was conducted
under the Center Director’s Discretionary Fund at the Marshall
Space Flight Center. Its objective was to advance the technology
originally developed for the Glovebox Integrated Microgravity
Isolation Technology project. The objective of this effort was
to develop and test several new motion sensors. To date, the
investigators have invented seven new technologies during this
endeavor and have conceived several others. The innovative ba-
sic sensor technology is an absolute position sensor. It employs
only two active components, and it is simple, inexpensive, reli-
able, repeatable, lightweight, and relatively unobtrusive. Two
sensors can be utilized in the same physical space to achieve
redundancy. The sensor has micrometer positional accuracy and
can be configured as a two- or three-dimensional sensor. The
sensor technology has the potential to pioneer a new class of
linear and rotary sensors. This sensor is the enabling technology
for autonomous assembly of modular structures in space and
on extraterrestrial locations.

TM—2005–214189 September 2005
Space Shuttle Pad Exposure Period Meteorological Param-
eters STS–1 Through STS–107. B.G. Overbey and B.C.
Roberts. Spacecraft and Vehicle Systems Department,
Engineering Directorate.

During the 113 missions of the Space Transportation Sys-
tem (STS) to date, the Space Shuttle fleet has been exposed to
the elements on the launch pad for ≈4,195 days. The Natural
Environments Branch at Marshall Space Flight Center archives
atmospheric environments to which the Space Shuttle vehicles
are exposed. This Technical Memorandum (TM) provides a
summary of the historical record of the meteorological condi-
tions encountered by the Space Shuttle fleet during the pad
exposure period. Parameters included in this TM are temper-
ature, relative humidity, wind speed, wind direction, sea
level pressure, and precipitation. Extremes for each of these
parameters for each mission are also summarized. Sources
for the data include meteorological towers and hourly surface
observations. Data are provided from the first launch of the

Spotless days are examined as a predictor for the size and timing of a sunspot cycle. For cycles 16–23 the first spotless day for a new cycle, which occurs during the decline of the old cycle, is found to precede minimum amplitude for the new cycle by about ≈34 mo, having a range of 25–40 mo. Reports indicate that the first spotless day for cycle 24 occurred in January 2004, suggesting that minimum amplitude for cycle 24 should be expected before April 2007, probably sometime during the latter half of 2006. If true, then cycle 23 will be classified as a cycle of shorter period, inferring further that cycle 24 likely will be a cycle of shorter than average minimum and maximum amplitudes and faster than average rise, peaking sometime in 2010.


A multimegawatt-class nuclear fission powered closed cycle magnetohydrodynamic space power plant using a helium/xenon working gas has been studied, to include a comprehensive system analysis. Total plant efficiency was expected to be 55.2 percent including preionization power. The effects of compressor stage number, regenerator efficiency, and radiation cooler temperature on plant efficiency were investigated. The specific mass of the power generation plant was also examined. System specific mass was estimated to be 3 kg/kWe for a net electrical output power of 1 MWe, 2–3 kg/kWe at 2 MWe, and ≤2 kg/kWe at >3 MWe. Three phases of research and development plan were proposed: (1) Phase I—proof of principle, (2) Phase II—demonstration of power generation, and (3) Phase III—prototypical closed loop test.


A computational method for the analysis of longitudinal-mode liquid rocket combustion instability has been developed based on the unsteady, quasi-one-dimensional Euler equations where the combustion process source terms were introduced through the incorporation of a two-zone, linearized representation: (1) A two-parameter collapsed combustion zone at the inject face, and (2) a two-parameter distributed combustion zone based on a Lagrangian treatment of the propellant spray. The unsteady Euler equations in inhomogeneous form retain full hyperbolicity and are integrated implicitly in time using second-order, high-resolution, characteristic-based, flux-differencing spatial discretization with Roe-averaging of the Jacobian matrix. This method was initially validated against an analytical solution for nonreacting, isentropic duct acoustics with specified admittances at the inflow and outflow boundaries. For small amplitude perturbations, numerical predictions for the amplification coefficient and oscillation period were found to compare favorably with predictions from linearized small-disturbance theory as long as the grid exceeded a critical density (≥100 nodes/wavelength). The numerical methodology was then exercised on a generic combustor configuration using both collapsed and distributed combustion zone models with a short nozzle admittance approximation for the outflow boundary. In these cases, the response parameters were varied to determine stability limits defining resonant coupling onset.
This document contains the proceedings of the Fifth International Symposium on Liquid Space Propulsion, held October 27–30, 2003, in Chattanooga, TN. The International Liquid Space Propulsion Symposia provide the principal forum for all aspects of liquid rocket propulsion. The aim of the symposium series is to gather international experts in the field of liquid rocket engines on a regular basis for presentations and discussions of the current status of research and development. Besides an exchange of information about future trends, it also fortifies existing cooperation and acts as a nucleus to establish networks to enhance international scientific collaboration in the liquid rocket propulsion area.

The objective of this Technical Interchange Meeting was to increase the quantity and quality of technical, cost, and programmatic data used to model the impact of investing in different technologies. The focus of this meeting was the Technology Tool Box (TTB), a database of performance, operations, and programmatic parameters provided by technologists and used by systems engineers. The TTB is the data repository used by a system of models known as the Advanced Technology Lifecycle Analysis System (ATLAS). This report describes the result of the November meeting, and also provides background information on ATLAS and the TTB.

As a space faring nation, we are at a critical juncture in the evolution of space exploration. NASA has announced its Vision for Space Exploration, a vision of returning humans to the Moon, sending robots and eventually humans to Mars, and exploring the outer solar system via automated spacecraft. However, mission concepts have become increasingly complex, with the potential to yield a wealth of scientific knowledge. Meanwhile, there are significant resource challenges to be met. Launch costs remain a barrier to routine space flight; the ever-changing fiscal and political environments can wreak havoc on mission planning; and technologies are constantly improving, and systems that were state of the art when a program began can quickly become outmoded before a mission is even launched. This Conference Publication describes the workshop and featured presentations by world-class experts presenting leading-edge technologies and applications in the areas of power and propulsion; communications; automation, robotics, computing, and intelligent systems; and transformational techniques for space activities. Workshops such as this one provide an excellent medium for capturing the broadest possible array of insights and expertise, learning from researchers in universities, national laboratories, NASA field Centers, and industry to help better our future in space.
On Structural Design of a Mobile Lunar Habitat With Multi-Layered Environmental Shielding. M. Rais-Rohani. NASA's Faculty Fellowship Program, Mississippi State University.

This report presents an overview of a Mobile Lunar Habitat (MLH) structural design consisting of advanced composite materials. The habitat design is derived from the cylindrical-shaped U.S. Lab module aboard the International Space Station (ISS) and includes two lateral ports and a hatch at each end that geometrically match those of the ISS Nodes. Thus, several MLH units can be connected together to form a larger lunar outpost of various architectures. For enhanced mobility over the lunar terrain, the MLH uses six articulated insect-like robotic, retractable legs enabling the habitat to fit aboard a launch vehicle. The carbon-composite shell is sandwiched between two layers of hydrogen-rich polyethylene for enhanced radiation shielding. The pressure vessel is covered by modular double-wall panels for meteoroid impact shielding supported by externally mounted stiffeners. The habitat’s structure is an assembly of multiple parts manufactured separately and bonded together. Based on the geometric complexity of a part and its material system, an appropriate fabrication process is proposed.


Single-crystal super alloys are commonly used for components in the hot sections of contemporary jet and rocket engines. Due to the anisotropic nature of single-crystal materials, the use of existing isotropic fracture mechanics calculations leads to errors in stress intensity factors. The difference can be substantial.

Presented in this report is the solution for calculating stress intensity factors in generally anisotropic materials using the M-integral. Included are examples of this solution applied to Brazilian disk crack growth specimens.
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CRAVEN, P.D. XD12
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NUTH, J.A. UAB
ET AL.

ABYZOV, S.S. Winogradsky Institute of Microbiology RAS
GERASIMENKO, L.M. Winogradsky Institute of Microbiology RAS
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REGLERO, V. GACE

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ROZANOV, A.Y. Paleontological Institute of Russian Academy of Sciences

BAGDIGIAN, R.M. SV10
CLOUD, D. Hamilton Sundstrand Space Systems Intl.

BAILEY, M.D. NP22
Template for Systems Engineering Tools Trade Study—Abstract Only. For presentation at the 1st International Conference on Innovation and Integration in Aerospace Sciences, Queen’s University Belfast, Northern Ireland, August 4–5, 2005.

BAIZE, D. Langley Research Center
BARANIK, M. U.S. Navy
CRONIN, M. ZIN Technologies Inc.
GONDA, J. Mitre Corp.
KOELBL, T. ED13
NARINS, M. FAA
SMITH, A. Rannoch Corp.

BALDRIEGE, T. IS05

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KOUVELIOTOU, C. XD12
ET AL.

Unraveling the Origin of Short Gamma-Ray Bursts—
Abstract Only. For publication in the Nature Journal.

BARTHELMY, S.D. GSFC
CANNIZZO, J.K. GSFC/University of Maryland
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ET AL.

Discovery of an Afterglow Extension of the Prompt Phase
of Two Gamma Ray Bursts Observed by Swift—Abstract

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BODIFORD, M.P. SD40
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GILLEY, S.D. Tec-Masters, Inc.
EVANS, B.W. Teledyne Brown Eng.

Back to the Future: A Historical Perspective of Lunar and
Martian In Situ Fabrication and Repair—Abstract Only.
For presentation at the 1st Space Exploration Conference:
Continuing the Voyage of Discovery, Orlando, FL, January
30–February 2, 2005.

BASSLER, J.A. SD40
BODIFORD, M.P. SD40
FISKE, M.R. Morgan Research Corp.
STRONG, J.D. Morgan Research Corp.

Are we There Yet?—Developing In Situ Fabrication and
Repair (ISFR) Technologies to Explore and Live on the
Moon and Mars—Abstract Only. For presentation at the 1st
Space Exploration Conference: Continuing the Voyage of

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PANOV, A.D. Moscow State University
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BASHINDZHAGYAN, G.L. Moscow State University
CHANG, J. Max Plank Institute for Solar Systems/
Purple Mountain Observatory
CHRISTL, M. XD12


BEMPORAD, A. Universita’ di Firenze
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EDWARDS, D.L. EM50


BEST, J. FD41
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The text provided seems to be a collection of abstracts, papers, and presentations from various conferences. The text is not a coherent document and appears to be a list of individual contributions without a unified theme or context. Each entry includes the name of the author(s), their affiliation, and the title of the presentation or research. The dates and locations of the presentations and conferences are also mentioned. The text is not formatted into paragraphs, likely due to the nature of abstracts and technical reports. Each entry is a self-contained unit of information, making it difficult to extract a single coherent block of text from the document. The text is dense with technical terms and is likely intended for an audience familiar with the fields of space exploration, planetary science, and related engineering disciplines.

BONAMENTE, M. UAH
LIEU, R. UAH
MITTAZ, P.D. UAH
KAASTRA, J.S. SRON Utrecht
NEVALAINEN, J. Harvard-Smithsonian


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BURNS, L. RAYTHEON
DECKER, L. EV13

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Day, G. Boeing Phantom Works

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Tabb, D. EV50
TATARA, J.D. Qualis Corp.
MASON, P.K. Hamilton Sundstrand
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ROBBINS, J. University of Missouri-Rolla
KHARKOVSKY, S. University of Missouri-Rolla
HEPBURN, F.L. EM20
ZOUGHI, R. University of Missouri-Rolla

CASE, J.T. University of Missouri-Rolla
ROBBINS, J. University of Missouri-Rolla
KHARKOVSKY, S. University of Missouri-Rolla
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ZOUGHI, R. University of Missouri-Rolla

CECIL, D. UAH
GOODMAN, S.J. XD11
BOCCIPPIO, D.J. XP11
ZIPSER, E.J. University of Utah
NESBITT, S.W. Colorado State University

CHANDLER, F. The Boeing Company
GRAYSON, G. The Boeing Company
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CHANG, H. XD42/UAH
SMITH, D.D. XD42/University of Mexico

CHANG, H. XD42/UAH
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FULLER, K.A. National Space Science and Technology Center
DIMMOC, J.O. UAH
GREGORY, D.A. UAH
FRAZIER, D.O. XD42

CHANG, J. Purple Mountain Laboratory
SCHMIDT, W.K.H. Max-Planck-Institut für Aeronomie
ADAMS, J.H. XD12
AHN, H.S. University of Maryland
BASHINDZHAGYAN, G.L. Moscow State University
BATKOV, K.E. Moscow State University
CHRISTL, M. Louisiana State University
FAZELY, A.F. Southern University
GANEL, O. University of Maryland

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BENGTSON, R. University of Texas at Austin
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CHANG-DIAZ, F. XDB2
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CHUNG, Y.T. The Boeing Company
LO, W. The Boeing Company
FOWLER, S.B. XP01
TOWNER, R. Jacobs Sverdrup


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MCNAMARA, H.A. EV13

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LORENZINI, E.C. Harvard-Smithsonian Center for Astrophysics
GRAMER, D.J. Orbital Technologies Corp.
HOFFMAN, J.H. The University of Texas
MAZZOLENI, A.P. North Carolina State University

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ANILKUMAR, A.V. Vanderbilt University
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MAURELLIS, A.N. Space Research Organization Netherlands
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CROSSON, W.L. XD11
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BURKS, J. National Weather Service Forecast Office
GOODMAN, S.J. XD11
BUECHLER, D. The Global Hydrology and Climate Center
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DARROUZET, F. Belgian Institute for Space Aeronomy
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DECREAU, P. Laboratoire de Physique et Chimie de l’Environnement

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DANDOURAS, I. Centre d’Etude Spatiale des Rayonnements

MATSUI, H. Space Science Center
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ANDRE, M. Swedish Institute of Space Physics

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BOHLEN, J.W. Northrop Grumman Integrated Systems
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A New Family of Ionic Liquids 1-Amino-3-Alkyl-1,2,3-Triazolium Nitrates—Abstract Only. For publication in the Journal of Chemical Crystallography.

DUARTE, L.A. EV10

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Blevins, J.A. XD22
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ECCLES, W. XD20

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ELSNER, R.F. XD12
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Chandra X-Ray Observatory Observations of the Jovian System—Abstract Only. For presentation at the Six Years of Science With Chandra Symposium Chandra X-Ray Center, Cambridge, MA, November 2–4, 2005.

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STAHL, H.P. XD30
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KEITH, E.L. Retired

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FISHMAN, G.J. XD12

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PENDLETON, G. Dynetics Corp.

FLACHBART, R.H. ER23
HASTINGS, L.J. ER23
HEDAYAT, A. ER23
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TUCKER, S.P. Alpha Technology Inc.

FLYNN, K. NP60
GUBERT, M. NP60

FOOTE, J.P. XD21
LITCHFORD, R.J. XD21

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FORD, P.G. MIT Kavli Institute for Astrophysics and Space Research
ELSNER, R.F. XD12

FRADY, G. ER41

FRAZIER, D.O. SD40
PALEY, M.S. SD40/AZ Tech
STRONG, J.D. Morgan Research Corp.

FREUNDLICH, A. University of Houston
IGNATIEV, A. University of Houston
HORTON, C. University of Houston
DUKE, M. Colorado School of Mines
CURRERI, P.A. XD40
SIBILLE, L. BAE Systems

GAENSLER, B.M. Harvard-Smithsonian Center for Astrophysics
KOUVELIOTOU, C. Harvard-Smithsonian Center for Astrophysics
GELFAND, J.D. Stanford University/National Radio Astronomy Observatory
TAYLOR, G.B. Ben Gurion University
EICHLER, D. University of Amsterdam
WIJERS, R.A.M.J. Stanford University
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RAMIREZ-RUIZ, E. Ben Gurion University
LYUBARSKY, Y.E. ET AL.
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Introduction to Particle Acceleration in the Cosmos—Abstract Only. For publication in the Acceleration in Astrophysical Plasma in Geospace and Beyond.

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Strong Pitch-Angle diffusion of the Ring Current Ions Induced by Electromagnetic Ion Cyclotron Waves—Abstract Only. For presentation at the American Geophysical Union Fall Meeting, San Francisco, CA, December 5–9, 2005.

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<th>Last Name</th>
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Kinetic Roughening and Energetics of Tetragonal Lysozyme Crystal Growth: A Preliminary Atomic Force Microscopy Investigation—Abstract Only. For publication in ACTA Crystallographica D.

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FERRARI, D. Lockheed Martin
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Ion Milling of Sapphire—Abstract Only. For publication in Electrochemical and Solid-State Letters and American Institute of Physics.

GRIFFEY, A.M. IS04


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High Tensile Strength Amalgams for In-Space Repair and Fabrication—Abstract Only. For presentation at the Continuing the Voyage of Discovery—1st Space Exploration Conference, Orlando, FL, February 2–4, 2005.
GRUGEL, R.N. SD46
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SPIVEY, R. Tec-Masters
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GUDIMENKO, Y. ITL Inc.
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Protection of Conductive and Non-Conductive Advanced Polymer-Based Paints From Highly Aggressive Oxidative Environments—Abstract Only. For presentation at the 5th International Symposium on Polymer Surface Modification, Toronto, Canada, June 20–22, 2005.

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LAL, R.B. XD40

Pyroelectric Ceramics for Infrared Detection Applications—Final Paper. For publication in Materials Science.

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HARMSSEN, E. XD11
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GOROSABEL, J. Instituto de Astrofisica de Andalucia
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Millimeter Wave Detection of Localized Anomalies in the Space Shuttle External Fuel Tank Insulating Foam—Final Paper. For publication in the Institute of Electronical and Electronics.

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Electrodynamic Tether as a Thruster for MXER Studies—Abstract Only. For presentation at and publication in the proceedings of the 53rd JANNAF Propulsion Meeting/2nd Liquid Propulsion Subcommittee/1st Spacecraft Propulsion Joint Meeting, Monterey, CA, December 5–8, 2005.

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Oriented Connectivity-Based Method for Segmenting Solar Loops—Abstract Only. For publication in Pattern Recognition.

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MOBASHER, B. Space Telescope Science Institute
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GOROSABEL, J. Space Telescope Science Institute
ROL, E. University of Hertfordshire/University of Amsterdam
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DELL’ANTONIO, I. Brown University/National Optical Astronomy Observatory
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<td>Space Shuttle Main Engine Testing and Analysis Approach to External Debris Environments—Abstract Only. For presentation at the 53rd JPM/2nd LPS/SP Joint Meeting—JANNAF, Monterey, CA, December 5–8, 2005.</td>
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<tr>
<td>KINNEY, T.</td>
<td>Qualis Corp.</td>
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<td>MACLEOD, T.C.</td>
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<td>Characteristics of Ferroelectric Logic Gates Using a Spice-Based Model—Abstract Only. For presentation at the International Meeting on Ferroelectricity, Foz do Igacu, Brazil, September 5–9, 2005, and publication in the Ferroelectrics Journal.</td>
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<td>PHILLIPS, T.A.</td>
<td>EI51</td>
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<td>HO, F.D.</td>
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Analysis of Surface Charging for a Candidate Solar Sail Mission Using NASCAP-2K—Final Paper. For presentation at the 9th Spacecraft Charging Technology Conference, Tsukuba, Japan, April 4–8, 2005.

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PICON, A.J. UPRM
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RICKMAN, D.L. XD11


PIKUTA, E.V. XD12
ITOH, T. RIKEN BioResource Center
HOOVER, R.B. XD12

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PITTMAN, J.V. XD11/USRA
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PITTMAN, J.V. XD11/USRA
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PITTMAN, J.V. XD11/USRA
MYRABO, L.N. Rensselaer Polytechnic Institute

POOLE, E. XD21
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PUSEY, M.L. XD42
POOLE, E. XD21
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MACGORMAN, D.R. New Mexico Institute of Mining and Technology


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Interannual Variability of Tropical Rainfall as Seen from TRMM—Abstract Only. For presentation at and publication in the proceedings of the 5th International Scientific Conference on the Global Energy and Water Cycle, Orange County, CA, June 18–24, 2005.

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RODRIGUEZ, H. The Boeing Company
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ROLIN, T.D. EI42
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Composition, Temperature, Partial Pressures Data for Cd0.8Zn0.2Te by Optical Absorption Measurements—Abstract Only. For publication in the Journal of Crystal Growth.

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WEISSKOPF, M.C. XD12
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WEISSKOPF, M.C. SD50
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WEEKS, D.J. NP60
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Thermodynamic Conditions Favorable to Superlative Thunderstorm Updraft, Mixed Phase Microphysics, and Lightning Flash Rate—Abstract Only. For publication in the Atmospheric Research Special Issue.

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EVANS, S.W. EM50

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Microwave and Millimeter Wave Testing for the Inspection of the Space Shuttle Spray on Foam Insulation (SOFI) and the Acreage Heat Tiles—Final Paper. For publication in The American Institute of Physics.
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K.A. Narmore, Compiler

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