STAIF-2008 Space Technology & Applications International Forum

February 10-14, 2008 • Hotel Albuquerque • Albuquerque, New Mexico

"Enabling Space Exploration"

Call for Papers

General Chair
Brewster Shaw
The Boeing Company
Houston, TX

General Co-Chair
Harold McFarlane
Idaho National Laboratory
Idaho Falls, ID

Technical and Publicaltion Chair
Mohamed S. El-Genk
University of New Mexico, Albuquerque, NM

Papers are invited in all technical areas of the Space Technology and Applications International Forum (STAIF-2008), organized by the University of New Mexico's Institute for Space and Nuclear Power Studies (ISNPS). STAIF-2008 will be held February 10 - 14, 2008, at the Hotel Albuquerque at Old Town in Albuquerque, New Mexico.

ABSTRACT SUBMISSION: Interested authors are invited to submit abstracts for consideration using the online submission form on the ISNPS website, www.unm.edu/~isnps, or click on any of the submission form links provided next to each session listing throughout this Call for Papers. Deadline for submission of initial abstracts is June 1, 2007. Authors should indicate the STAIF conference, number and title of the technical session in which they wish their abstracts to be considered. Abstracts should include the name(s), phone number(s) and email(s) of all co-authors, and clearly indicate the **motivation and purpose of the work, important results, significance, applications, and briefly summarize approach or methodology.** Acknowledgment of receipt of submitted abstracts will be sent to the primary author (first author listed). Inquiries can be made by email to isnps@unm.edu or by calling (505) 277-0446. The Abstract Submission Form can be found here.

REVIEW AND ACCEPTANCE OF FULL PAPERS: All submitted abstracts will be reviewed by the appropriate STAIF-2008 Technical Program Committee. Abstracts are currently being accepted and authors will be notified as they are accepted. Authors of accepted abstracts will be asked to provide a full manuscript for review and editing by August 1, 2007, or as indicated on the abstract acceptance letter. It is the authors' responsibility to obtain any clearances, i.e internal or ITAR reviews, before submitting their first draft before the deadline of submission. Format instructions for preparing the final paper will be provided to the authors of accepted abstracts and will also be available on the ISNPS web site. Final manuscripts, in a camera-ready form, will be included in the STAIF-2008 proceedings. In addition, final camera-ready abstracts will be included in the abstract book to be distributed to all STAIF-2008 attendees.

STUDENT PAPERS: Student papers will be evaluated for the Manuel Lujan Jr. Student Paper Award, which has a monetary value of $500, to be divided equally if more than one person is selected. **Students who wish to have their contributions considered for this award should state so in the transmittal letter with their *full paper***. To qualify for the award, the student must be the first author, must have done the majority of the research as part of a graduate thesis or dissertation, be a full time student and present the paper at STAIF-2008.

For more information and updates, please consult the STAIF homepage at: http://www.unm.edu/~isnps/staifhome.html.

DEADLINES	
Initial Abstract Submission	June 15, 2007
Response to Author on Status of Abstract Submission	June 27, 2007
First Draft of Full Paper	August 1, 2007
Final Draft of Full Paper, Forms and Final Abstract	October 1, 2007
Published Author Registration*	TBD

*A paid registration must be received with the final camera-ready papers to be published in the STAIF-2008 Proceedings.

TABLE OF CONTENTS AND LINKS TO SESSIONS

A. 12TH CONFERENCE ON THERMOPHYSICS APPLICATIONS IN MICROGRAVITY

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The A-Conference pertains to thermophysical research and technology considered to be important for emerging aerospace applications. Sessions focus on scientific and technology research efforts originating from government, university and commercial research programs. The A-Conference starts with a session on emerging, and perhaps controversial, thermal control issues, and then addresses a variety of topics which include single and two-phase flow technologies, advanced thermal control coatings, convection interfacial mass transfer, and innovative thermal control devices for spacecraft applications.

A01. Current Topics in Thermal Control

Chair: Ted Swanson, NASA Goddard Space Flight Center, Greenbelt, MD, 301-286-7854, Ted.Swanson@nasa.gov
Co-Chair: Tung T. Lam, The Aerospace Corporation, Los Angeles, CA, 310-336-5408, tung.t.lam@aero.org

This opening session consists of invited talks, and possibly a round table discussion, which focus on emerging topics of current interest to the thermal management community. As these may be controversial, it is a presentation only session: no paper will be submitted.

Invitation Only - No Open Submissions

Go to Submission Form

A02. Two-Phase Thermal Control Systems *and* Advanced Thermal Testing Concepts for Conventionally Untestable Spacecraft

Chair: Michael T Pauken, Jet Propulsion Laboratory, Pasadena, CA, 818-354-4242, michael.t.pauken@jpl.nasa.gov
Co-Chair: Scott Garner, Advanced Cooling Technologies, Inc., Lancaster, PA 717-295-6066, Scott.Garner@1-ACT.com

This session solicits papers addressing Two-Phase Thermal Control Systems for existing and future spacecraft systems. Relevant papers may address the design, analysis, testing and/or operation of Two-Phase Thermal Control Systems such as spray cooling, electrohydrodynamic devices, thin film heat transfer, heat pipes, loop heat pipes, capillary pumped loops and mechanically pumped loops with two-phase heat exchangers.

Go to Submission Form

A03. High Capacity Heat Rejection Systems

Chair: Michael Nikitkin, Swales Aerospace, Beltsville, MD, 301 902-4264, mnikitkin@swales.com
Co-Chair: Eric Silk, NASA Goddard Space Flight Center, Greenbelt, MD, 301 286-5534, eric.a.silk@nasa.gov

Recent space initiatives are considering the use of high power density electronics, advanced lasers and nuclear electric propulsion. The power levels that future spacecraft will be dealing with are changing the order of magnitude from kilowatts to hundreds of kilowatts and even more. This change requires some fundamental revision of the Thermal Control System design approach. As there is only one way to get rid of the waste heat in space, to reject it via radiation, the radiator areas will increase so dramatically that they will start dictating application limitations and architecture. A global project such as Prometheus is an excellent example of the case when the heat rejection system is comparable and even exceeds the payload in weight and envelope. Papers in this session will describe different efforts and approaches to create advanced thermal control systems designed for large transport capacity and high heat flux applications. Examples are high transport/high temperature loop heat pipes, high heat flux/high temperature cooling loops and evaporators, and hybrid pumped fluid loops.

Go to Submission Form

A04. Thermal Control Technologies for Future Spacecraft *and* Mechanically Pumped Thermal Loops

Chair: Jeffrey Didion, NASA Goddard Space Flight Center, Greenbelt, MD, 301 286-4363, Jeffrey.R.Didion@nasa.gov
Co-Chair: Glenn.T.Tsuyuki, Jet Propulsion Laboratory, Pasadena, CA, 818 354-2955, Glenn.T.Tsuyuki@jpl.nasa.gov

Two-phase technologies have become the standard tools for spacecraft thermal control. Papers are invited that discuss either recent advancements in these established technologies or address emerging techniques: Examples are: phase-change and sensible heat thermal storage, heat pumps, high conductivity structures and substrates, thermal switches, variable emittance surfaces, novel radiator concepts, cryogenic systems including increased use of cryocoolers for sensor and optics cooling. Papers on issues/scalability of high power thermal systems in microgravity are also invited.

Go to Submission Form

A05. Thermal Control for Lunar and Deep Space Missions

Chair: Charles Dan Butler, NASA Goddard Space Flight Center, Greenbelt, MD, 301 286-8618, Dan.Butler@nasa.gov
Co-Chair: Gani B. Ganapathi, Jet Propulsion Laboratory, Pasadena, CA, 818 354-7449, Gani.B.Ganapathi@jpl.nasa.gov

This session invites papers on novel spacecraft thermal control design, analysis, testing, and advanced technologies for lunar, planetary, and deep space missions. Advanced concepts such as autonomous thermal control and thermal energy management based thermal control are also solicited.

Go to Submission Form

A06. Advances in Spray Cooling

Chair: Eric Silk, NASA Kennedy Space Center, KSC, FL, 301-268-5534, Eric.A.Silk@nasa.gov
Co-Chair: Kirk L. Yerkes, USAF/ Air Force Research Laboratory, Wright-Patterson AFB, OH, kirk.yerkes@wpafb.af.mil

Papers in this session will concentrate on spray cooling research which addresses fundamental thermophysics cooling system design for ground-based, airborne and space applications and platforms. Topics of interest include evaporator design, alternative fluids, large surface area (> 2 cm2) studies, scalability, nozzle design and enhancements to spray cooling.

The next generation of airborne and space based platforms include the development of alternative power systems, advanced Lasers and electronic components. On-board components such as Laser-Diode Arrays (LDA's) and Multi-chip modules (MCM's) require high heat flux thermal management techniques. Technology requirements for these systems include the cooling of high flux heat sources (≥ 100 W/cm2), while maintaining tight temperature control (approx. +/- 2 oC), reliable start-up, shut down, and long term stability. Spray cooling provides the potential for high heat flux (HHF) cooling upwards of 100 W/cm2 using fluorinerts and 1000 W/cm2 for water. It allows for tight temperature control at low coolant fluid flow rates. Spray cooling is one of the most appealing heat acquisition techniques for the thermal management needs of tomorrow's HHF systems.

Go to Submission Form

A07. Advanced Heat Pipe Technologies

Chair: Robert S. Reid, Los Alamos National Laboratory, Los Alamos, NM, 505 667-2626, rsr@lanl.gov
Co-Chair: Angirasa Devarakonda, NASA Ames Research Center, Moffett Field, CA, (650) 604-5719, a_devarakonda@yahoo.com

This session considers the technologies of thermosyphons, heat pipes, loop heat pipes and other related devices. Technical papers are sought on such topics as fluid properties, thermo-chemical compatibility, corrosion resistance, wick structures and development, novel materials, thermal performance tests and life test data. Technical papers addressing single heat pipe modeling and thermal system models that incorporate heat pipes as components are also sought. In addition, papers presenting experimental data on thermal management systems with heat pipes as significant heat transport mechanism are encouraged.

Go to Submission Form

A08. Smart Materials

Chair: Kenneth Shannon, Eclipse Energy Systems, 2345 Anvil Street North, St. Petersburg, FL, 727-344-7300, kshannon@eclipsethinfilms.com
Co-Chair: TBD

Smart coatings and materials are enabling technologies that have a wide range of applicability including spacecraft and instrument thermal control. Of particular interest are technologies that vary their emittance or absorptance in response to a change in the environment. This session focuses on the development, fabrication, integration, testing, flight validation, and application of these smart technologies.

Go to Submission Form

A09. Thermal Management Concepts for Human Space Exploration

Chair: Gary Adamson, Hamilton Sundstrand, Windsor Locks, CT, 860-654-2646, gary.adamson@hs.utc.com
Co-Chair: Steve Rickman, NASA Johnson Space Flight Center, Houston, TX, 281 483-8867, steven.l.rickman@nasa.gov
This session considers the thermal control technologies, both active and passive, necessary for the next generation of human space exploration. Technical papers are sought which cover thermal concepts and technologies applied to any aspect of human space exploration including crew transfer and landing vehicles, lunar and planetary bases and crew space life support. The thermal control systems for exploration will require novel concepts to address issues including a wide range of environmental conditions, lunar and planetary contamination, space and surface gravity effects, heat rejection to high temperatures and reliability.

Go to Submission Form

AB01. ISRU Thermal Control Technologies

Chair: Daniel Nguyen, NASA Goddard Space Flight Center, Greenbelt, MD, 301-286-6600, Daniel.H.Nguyen@nasa.gov
Co-Chair: Uday Hegde, National Center for Space Exploration Research, NASA GRC, Cleveland, OH, 216-433-8744, Uday.G.Hegde@nasa.gov

In-situ Resource Utilization (ISRU) for lunar and other extraterrestrial missions will require novel concepts for thermal control of critical processes during various operations such as regolith handling and preconditioning, oxygen and propellant production, phase separation, and material heating. Relevant papers addressing the design, analysis, testing, and operation of thermal control technologies for regolith heating, reactors, condensers and evaporators, heat pipes, radiators, and cooling loops are solicited. Advanced concepts demonstrating low power, mass, and/or volume are especially of interest.

Go to Submission Form

B. 1ST SYMPOSIUM ON SPACE RESOURCE UTILIZATION

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Maintaining a continued presence off the Earth requires a new approach to supplying the commodities needed. Bringing all the propellants, drinking water, and breathing air from Earth is clearly not sustainable. This Symposium discusses approaches that break the supply chain, enabling the extension of human presence beyond the Earth's gravitational grasp. The 1st Symposium on Space Resource Utilization will include aspects of commodity and material production from a wide range of planetary bodies with usable resources.

As the primary symposium of the AIAA Space Resources Technical Committee, we will be requesting papers on topics of the production of commodities and materials as well as advanced processing techniques. In addition to two sessions for lunar in situ resource utilization (ISRU), a session will host papers for Mars and other solar system bodies. A special session this year will host experts in a panel discussion of the challenges for ISRU, including physical, financial, and political. Collection, handling and processing of dusty surface resources will be hosted in one of the sessions, and the integration of ISRU products with related technologies such as life support, power, and propulsion will be included in another. Continuing a successful series begun in 2007, the symposium will include a session on analog test sites and their implications on human exploration.

B01. Lunar Resource Utilization I

Chair: Edgardo Santiago-Maldonado, NASA Kennedy Space Center, FL, 321-867-8794, edgardo.santiago-maldonado-1@nasa.gov
Co-Chair: Takashi Nakamura, Physical Sciences, Inc., San Ramon, CA, 925 743-1110 ex. 10, nakamura@psicorp.com

This session is soliciting papers that discuss the use of available resources on the Moon. As the first human target for exploration, ISRU on the Moon can greatly reduce the requirement for Earth-launched mass of commodities and materials.

Go to Submission Form

B02. Lunar Resource Utilization II

Chair: Laurent Sibille, ASRC Aerospace Corporation, NASA Kennedy Space Center, FL, 321-867-4422, laurent.sibille-1@nasa.gov
Co-Chair: Kevin Payne, Lockheed Martin Space Systems Company, Denver, CO, 303 977 9010, kevin.s.payne@lmco.com

This session, a continuation of Lunar Resource Utilization I, is soliciting papers that discuss the use of available resources on the Moon. As the first human target for exploration, ISRU on the Moon can greatly reduce the requirement for Earth-launched mass of commodities and materials.

Go to Submission Form

B03. ISRU – Beyond the Moon

Chair: Adam Bruckner, University of Washington, Seattle, WA, 206-543-6143, bruckner@aa.washington.edu
Co-Chair: Christine Iacomini, Paragon Space Development Corporation, Tucson, AZ, 520-903-1000 xt. 24, ciacomini@paragonsdc.com

This session will cover ISRU applications and processes for Mars, asteroids, Jovian moons, and other bodies in the solar system.

Go to Submission Form

B04. Opportunities and Challenges in ISRU

Chair: Chuck Weisbin, Jet Propulsion Laboratory, Pasadena, CA, 818-354-2013, charles.r.weisbin@nasa.gov
Co-Chair: Gerald B. Sanders, NASA Johnson Space Center, Houston, TX, 281-483-9066, gerald.b.sanders@nasa.gov

Incorporation of ISRU may significantly reduce the mass, cost, and risk of lunar exploration, outpost development, and subsequent human missions to Mars. However, as an unproven technology and capability, ISRU raises significant programmatic and architectural

risks in the minds of system architects. This panel session will discuss the technological and political feasibility and issues associated with ISRU providing a significant contribution to the Vision for Space Exploration through topical areas such as engineering readiness, environmental suitability, project cost and schedule, and extensibility from lunar applications to Mars.

Go to Submission Form

B05. Planetary Excavation, Soils, and Dust

Chair: Allen Wilkinson, NASA Glenn Research Center, Cleveland, OH, 216-433-2075, R.A.Wilkinson@nasa.gov
Co-Chair: Dale Boucher, Northern Centre for Advanced Technology, Sudbury, ON, Canada, 705-521-8324, dboucher@norcat.org

This session will encourage work on the characterization of lunar soil and dust and their simulants, as used for lunar Exploration systems tests. Knowledge on soil/simulant strength for excavation and traction and the preparation and validation protocols for working soil test bins is desired. These range from particle size distributions to densification methods to strength measurements in soil test bins. Dust work from particle size distributions to adhesion on potential lunar systems surfaces (fabric, connector, sealing, optical, and sliding surfaces) to corrosivity and abrasivity are of interest.

Go to Submission Form

B06. ISRU Links to Surface Systems

Chair: Kurt Sacksteder, NASA Glenn Research Center, Cleveland, OH, 216-433-2857, Kurt.Sacksteder@NASA.Gov
Co-Chair: Diane Linne, NASA Glenn Research Center, Cleveland, OH, 216-977-7512, diane.l.linne@nasa.gov

One of the key benefits of ISRU is the impact on other commodity-reliant systems such as life support and propulsion. This session will cover these links with other human exploration subsystems.

Go to Submission Form

B07. Analog Test Site Experience

Chair: Mark Henley, The Boeing Company, Topanga, CA, 714-625-6426, mark.w.henley@boeing.com
Co-Chair: TBD

In order to prove the efficacy of these proposed systems and plants, real life simulations need to be performed. This session will discuss lessons learned from experiences and operations at analog test sites where Earth-based testing simulates planetary operations and conditions.

Go to Submission Form

AB01. ISRU Thermal Control Technologies

Chair: Daniel Nguyen, NASA Goddard Space Flight Center, Greenbelt, MD, 301-286-6600, Daniel.H.Nguyen@nasa.gov
Co-Chair: Uday Hegde, National Center for Space Exploration Research, NASA GRC, Cleveland, OH, 216-433-8744, Uday.G.Hegde@nasa.gov

In-situ Resource Utilization (ISRU) for lunar and other extraterrestrial missions will require novel concepts for thermal control of critical processes during various operations such as regolith handling and preconditioning, oxygen and propellant production, phase separation, and material heating. Relevant papers addressing the design, analysis, testing, and operation of thermal control technologies for regolith heating, reactors, condensers and evaporators, heat pipes, radiators, and cooling loops are solicited. Advanced concepts demonstrating low power, mass, and/or volume are especially of interest.

Go to Submission Form

C. 25TH SYMPOSIUM ON SPACE NUCLEAR POWER AND PROPULSION

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Exploring space and extending human presence across the solar system requires the development and application of advanced nuclear power and propulsion capabilities. Today, many space missions depend on nuclear power in the form of radioisotope thermoelectric generators. Tomorrow, advanced radioisotope-based and new fission-based power and propulsion systems will lead the way to future space exploits.

The 25th Symposium on Space Nuclear Power and Propulsion solicits papers on a wide range of topics on the development, integration, and advancement of space nuclear and propulsion systems technologies for enabling unrestricted and sustained access to space. This Symposium takes place at the threshold of a new era. The Vision for Space Exploration (VSE) has set the stage for a renaissance that will inspire the next generation and lead to unprecedented discoveries.

For its silver anniversary, the organizers of the symposium have chosen a nerw arrangement for the technical program, breaking the conference into four tracks, Power, Space Propulsion, Materials and Fuels, and Energy Conversion. Each track has its own set of sessions and session chairs, though there are also track leaders and co-leaders, charged with guiding the overall direction of their tracks. If you have a question about a specific session, it's best to contact the chairs for that session directly, but track leaders are available to answer session related questions, as well.

CT101. Space Nuclear Fission Power Systems & Concepts

Session Chair: David I. Poston, Los Alamos National Laboratory, Los Alamos, NM, 505-667-4336, poston@lanl.gov
Session Co-Chair: Dan Wachs, Idaho National Laboratory, Idaho Falls, ID, 208-533-7604, Daniel.m.wachs@inl.gov

Papers are invited that present engineering design and analysis of fission reactor power systems for use on the surface of the moon or Mars, or for use in space. It is expected that the focus of the paper will be on the reactor, but ir is recommended that papers encompass the complete power system (reactor, control, shield, power conversion, power control and distribution, waste heat rejection, etc.) at some level. In-space concepts may support spacecraft power or nuclear electric propulsion missions. Surface fission power systems may support potential near-term or advanced robotic and human missions. Concepts that could potentially meet both space and surface power requirements are also encouraged.

Go to Submission Form

CT102. Fission Surface Power System Components

Session Chair: Arthur Lou Qualls, UT-Battelle, Oak Ridge, TN, 865-574-0256, quallsal@ornl.gov
Session Co-Chair: TBD

Papers are invited that discuss components of interest to near-term, affordable fission surface power systems in the 10 – 50 kWe power range. Specific topics of interest include component design, testing, experience base, and applicability.

Go to Submission Form

CT103. Integration and Utilization of Surface Fission Energy Sources

Session Chair: J. Boise Pearson, NASA Marshall Space Flight Center, AL, 256-961-0078, j.boise.pearson@nasa.gov
Session Co-Chair: Robert Cataldo, NASA Glenn Research Center, Cleveland, OH, 216-977-7082, Robert.L.Cataldo@nasa.gov

Papers are invited that address issues associated with the integration and utilization of surface fission energy sources on the moon or Mars. Topics of interest include integration of the fission energy source and lander, reactor operational effects on the lander and

nearby regolith, methods for using lunar or Martian regolith to provide partial radiation shielding, effects of ionizing radiation on regolith, potential materials for use in lunar or Martian environments, system requirements, methods for transferring process heat, integrated waste heat rejection systems, and others.

Go to Submission Form

CT104. Near-Term Radioisotope Power Systems: Components, Applications & Missions

Session Chair: Alan Harmon, U.S. Department of Energy, Germantown, MD, 301-903-1167, alan.a.harmon@nasa.gov
Session Co-Chair: Robert Abelson, Jet Propulsion Laboratory, Pasadena, CA, 818-393-1500, Robert.D.Abelson@jpl.nasa.gov

Papers related to potential (or planned) near-term applications and missions for radioisotope systems are solicited. Lunar, Mars, deep space, and other applications or missions are of interest. Radioisotope systems of interest include radioisotope power systems (RPSs) and radioisotope heater units (RHUs). Potential applications of interest include power carts (100 We to several kWe), highly capable rovers, and others.

Go to Submission Form

CT105. Non-Nuclear Testing and Evaluation

Session Chair: James J. Martin, NASA Marshall Space Flight Center, AL, 256-544-6054, jim.j.martin@nasa.gov
Session Co-Chair: David Hervol, Analex Corporation, Cleveland, OH, 216-433-9624, david.s.hervol@nasa.gov

Papers are invited that discuss non-nuclear testing in support of the design, development, qualification, and acceptance of space nuclear systems. Papers that include experimental results are of particular interest. Potential topics include integrated system testing, subsystem testing, component testing, and feasibility testing.

Go to Submission Form

CT106. Space Nuclear Power Systems: Simulation and Modeling

Session Chair: Thomas Marcille, Los Alamos National Laboratory, Los Alamos, NM, 505-667-2762, marcil@lanl.gov
Session Co-Chair: TBD

Advances in simulation and modeling may help enable affordable space fission systems. Papers are invited that discuss state-of-the-art simulation and modeling techniques, and their application to the development of fission surface power or nuclear thermal propulsion systems. Papers that identify high-payoff opportunities to develop new techniques are also encouraged.

Go to Submission Form

CT107. Safety and Reliability

Session Chair: Steven A. Wright, Sandia National Laboratories, Albuquerque, NM, 505-845-3014, sawrigh@sandia.gov
Session Co-Chair: TBD

Papers are encouraged that discuss safety and reliability as applied to the design, development, qualification, launch, and operation of space fission systems. Papers related to the potential utilization of fission surface power systems are particularly encouraged. Potential topics include test and data needs, historical insights, and experimental results.

Go to Submission Form

CT108. Economic and Political Aspects of Space Nuclear Power Systems

Session Chair: Shannon Bragg-Sitton, NASA Marshall Space Flight Center, AL, 256-544-6272, Shannon.M.Bragg-Sitton@nasa.gov
Session Co-Chair: TBD

The development and utilization of space nuclear power systems could be beneficial in many ways. There may also be potential concerns with these systems. Papers are invited in a variety of areas, including the impact of space nuclear power on educating the next generation of nuclear engineers, political benefits and hazards of space nuclear power, the economic impact of a robust space program, and the economic impact of nuclear technology.

Go to Submission Form

CT109. Human Lunar and Mars Mission Power Requirements

Session Chair: Joseph Nainiger, NASA Glenn Research Center, Cleveland, OH, 216-977-7103,Joseph.J.Nainiger@grc.nasa.gov
Session Co-Chair: John Scott, NASA Johnson Space Center, Houston, TX, 281-483-3136, john.h.scott@nasa.gov

Power is essential to the exploration and utilization of the moon and Mars. Papers are invited that address potential power needs, ranging from power requirements for potential early robotic missions to power requirements to support a large, sustained human presence. Both surface and in-transit power requirements are of interest.

Go to Submission Form

CT201. Electric Propulsion Thrusters and Concepts

Session Chair: James Polk, Jet Propulsion Laboratory, Pasadena, CA, 818-354-9275, james.e.polk@jpl.nasa.gov
Session Co-Chair: Ivana Hrbud, Purdue University, West Lafayette, IN, 765-494-3423, ihrbud@purdue.edu

Papers are invited that discuss any aspect of electric propulsion, ranging from component technology (e.g. thrusters) to integrated system design. Technologies and systems applicable to potential near-term robotic missions are of interest, as are technologies and systems potentially applicable to human exploration.

Go to Submission Form

CT202. Advanced Concepts and Technologies

Session Chair: James Powell, Plus Ultra Technologies, Inc., Stony Brook, NY, 631-744-5707, imwol@optonline.net
Session Co-Chair: Terry Kammash, University of Michigan, Ann Arbor, MI, 734-764-0205, tkammash@umich.edu

Nuclear systems can potentially enable the complete exploration and utilization of the solar system. Advanced applications such as terraforming and asteroid deflection can be enabled by these systems. Papers are invited related to all aspects of advanced nuclear systems, including technologies, system design, and potential missions.

Go to Submission Form

CT203. Nuclear Thermal Rockets: Past, Present, and Future

Session Chair: Stanley K. Borowski, NASA Glenn Research Center, Cleveland, OH, 216.977.7091, stanley.k.borowski@nasa.gov
Session Co-Chair: TBD

Papers are sought on Nuclear Thermal Propulsion (NTP) engine design options and in-space transportation system concepts and key technologies for future cargo and crewed missions to the Moon, Mars (NASA's current NTP application focus), and near Earth objects (NEOs), as well as, for fast transit robotic science missions to outer planets. Of particular interest are papers on nearer term, solid core NTP engine designs and concepts that could be available within the next 15-20 years. Potential "state-of-the-art" improvements to "heritage" Rover/NERVA and cermet fuel fast reactor engine designs, including the modeling of these systems, are example topics of interest, as are papers on candidate NTP fuels, engine development and testing strategies. Papers addressing enhanced systems like the "bimodal" NTP concept that can provide high thrust propulsion and auxiliary spacecraft electrical power, and the liquid oxygen-augmented NTP option that can utilize extraterrestrial oxygen or water resources (when they become available) to improve performance are also encouraged. Also, in observance of the 25th anniversary of the Space Nuclear Power and Propulsion Symposium, historical papers are being solicited on the Rover/NERVA, GE-710 and ANL NTP development programs and past accomplishments.

Go to Submission Form

CT204. Nuclear Thermal Rocket Technology and Integration

Session Chair: Steven Howe, Center for Space Nuclear Research, Idaho Falls, ID, 208.526.6103, showe@usra.edu
Session Co-Chair: Rick Ballard, NASA Marshall Space Flight Center, AL, 256-544-7015, richard.o.ballard@nasa.gov

Papers are sought related to specific technologies required for near-term nuclear thermal propulsion systems. Papers associated with system integration, integrated system design, and component or system-level nuclear testing are also of interest.

Go to Submission Form

CT205. Non-Nuclear Testing in Support of Nuclear Thermal Propulsion Development

Session Chair: Bill Emrich, NASA Marshall Space Flight Center, AL, 256-544-7504, bill.emrich@nasa.gov
Session Co-Chair: Steven Dron, Sandia National Laboratories, Albuquerque, NM, 505-845-7126, sbdron@sandia.gov

Non-nuclear testing will be highly useful in the design, development, qualification, acceptance, and utilization of nuclear thermal propulsion (NTP) systems. Papers are invited that address any topic related to non-nuclear testing of NTP systems. Papers that discuss facilities or experimental results are particularly encouraged.

Go to Submission Form

CT301. Fuels and Fuel Pin Design for Space Nuclear Power

Session Chair: Jeffrey Halfinger, BWX Technologies, Inc., Lynchburg, VA, 434-522-5941,jahalfinger@bwxt.com
Session Co-Chair: James E. Werner, Idaho National Laboratory, Idaho Falls, 208.526.8378, james.werner@inl.gov

Papers are invited that discuss any topic related to fissile fuel or fuel pin design for space nuclear power systems. Although fuels and fuel pin designs for near-term systems are of most interest, papers related to advanced fuels and fuel forms are also encouraged.

Go to Submission Form

CT302. Structural Materials for Space Reactor Core Design

Session Chair: Arthur Lou Qualls, UT-Battelle, Oak Ridge, TN, 865-574-0256, quallsal@ornl.gov
Session Co-Chair: Cheryl Bowman, NASA Glenn Research Center, Cleveland, OH, 216-433-8462, cheryl.l.bowman@nasa.gov

Papers are invited that discuss structural materials for space power systems. Potential topics include operating temperature range, compatibility (internal or exposed to exterior), creep, and experience base. Materials for use in potential near-term, affordable systems are of interest, as are structural materials for use in potential advanced systems.

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CT303. Radioisotope Power Options, Production, and Processing

Session Chair: James E. Werner, Idaho National Laboratory, Idaho Falls, 208.526.8378, james.werner@inl.gov
Session Co-Chair: Jeffrey C. King, University of Missouri, Rolla, Rolla, MO, 573-341-6834, kingjc@umr.edu

Over the past 4 decades, radioisotope systems have enabled numerous space missions. However, if not addressed, the worldwide shortage of Pu-238 may limit the extent to which radioisotope systems can be used in the future. This session invites papers related to any topic associated with radioisotopes that are or could be used to power these systems, including Pu-238, alternative isotopes, production of isotopes, and processing of isotopes.

Go to Submission Form

CT304. Advanced Materials and Fuels for Future High Performance Systems

Session Chair: Samim Anghaie, University of Florida, Gainesville, FL, 352-392-8653, anghaie@ufl.edu
Session Co-Chair: Wayne Ohlinger, Bechtel Bettis, Inc., West Mifflin, PA, 412-476-6549, ohlinger@bettis.gov

Advanced materials and fuels could enable extremely high performance space nuclear systems. Papers are invited that discuss advances in materials and fuels, and well as potential applications or system designs that utilize them. Papers providing theoretical or experimental results are particularly encouraged.

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CT401. Terrestrial Programs and Technologies with Space Applications

Session Chair: Samit Bhattacharyya, RenMar Enterprises Inc., Naperville, IL, 630-330-5625, bhatt@renmar.org
Session Co-Chair: William Determan, Hamilton Sundstrand, Canoga Park, CA, 818-586-1902, william.determan@hsr.utc.com

Papers related to the status of past, current or projected terrestrial power technologies and their applicability to space applications are requested. Experimental and/or analytical studies discussing performance and operations are solicited. Of particular interest are papers that describe the use of novel technologies for terrestrial systems and how they could be utilized or adapted for space. Specific examples include terrestrial reactor programs (both US and international) and terrestrial energy conversion technologies in the kWe – MWe power range.

Go to Submission Form

CT402. Dynamic Power I: 100 W Class

Session Chair: Richard K. Shaltens, NASA Glenn Research Center, Cleveland, OH, 216-433-6138, richard.shaltens@grc.nasa.gov
Session Co-Chair: TBD

Papers related to the current development of Stirling, Brayton, and Rankine cycles for 100 watt class power systems are requested. Potential areas of interest include analysis, design, fabrication, testing, and integration. Papers that discuss the current technology readiness and how the technologies are being implemented for actual space missions are encouraged. Topics also include, but are not limited to: radioisotope-fueled dynamic power systems for space or terrestrial applications; solar dynamic power systems for space applications; critical component or technology issues relevant to dynamic power systems; overview papers dealing with history, status, and/or potential for dynamic power systems in space applications; and system integration aspects of using dynamic power systems for space applications.

Go to Submission Form

CT403. Dynamic Power II: Multi-kilowatt

Session Chair: Lee Mason, NASA Glenn Research Center, Cleveland, OH, 216.977.7106, lee.s.mason@nasa.gov
Session Co-Chair: Dennis Pelaccio, The Aerospace Corporation, Los Angeles, CA, 310-336-1504, dennis.g.pelaccio@aero.org

Papers related to the current development of Stirling, Brayton, and Rankine cycles for multi-kilowatt class power systems are requested. Potential areas of interest include analysis, design, fabrication, testing, and integration. Papers that discuss the current technology readiness and how the technologies are being implemented for actual space missions are encouraged. Potential topics also include, but are not limited to: nuclear electric and surface power systems and applications; solar dynamic power systems for space applications; critical component or technology issues relevant to dynamic power systems; overview papers dealing with history, status, and/or potential for dynamic power systems in space applications; and system integration aspects of using dynamic power systems for space applications.

Go to Submission Form

CT404. Thermoelectric Power Conversion Technology and Applications

Session Chair: Bill J. Nesmith, Jet Propulsion Laboratory, Pasadena, CA, 818-354-3478, bill.j.nesmith@jpl.nasa.gov
Session Co-Chair: Jean-Michel Tournier, University of New Mexico, Albuquerque, NM, 505 277-7961, tournier@unm.edu

Papers are solicited that address the performance, design, technical issues, and advances in thermoelectric energy conversion for commercial, terrestrial, and space applications. Specific topics include, but are not limited to: new thermoelectric materials and devices; thermoelectric power generation with either nuclear or non-nuclear sources; spin-off applications to waste heat recovery; commercial power generation; cooling devices; and thermoelectric micro-devices. Topics may also include review of current and projected thermoelectric materials such as SiGe, PbTe, TAGS, BiTe and Skutterudites. Potential areas of interest include analysis, design, fabrication, testing, and integration. Papers that discuss the current technology readiness and how the technologies are being implemented for actual space missions are encouraged.

Go to Submission Form

CT405. Thermal Energy Transport and Heat Rejection Technologies

Session Chair: Donald A. Jaworske, NASA Glenn Research Center, Cleveland, OH, 216-433-2312, donald.a.jaworske@grc.nasa.gov
Session Co-Chair: Robert S. Reid, Los Alamos National Laboratory, Los Alamos, NM, 505-667-2626, rsr@lanl.gov

This session will address relevant technologies applicable to high and low temperature thermal energy transport and heat rejection to a space environment. Single-phase and two-phase heat transport and heat rejection technologies applicable to space power thermal-based systems are subjects of interest to the development of low mass space power systems. Advances in materials, joining, or bonding technologies that significantly reduce a space power system's heat transport or heat rejection subsystem mass or improves its reliability are of interest. Steady state and transient performance analysis of heat transport or heat rejection components or subsystems are of interest as well as investigations of heat transport phenomenon relevant to the performance of a space power thermal-based system. Topics may also include technologies to transport, store, maintain, or dissipate thermal energy. Papers may focus on reactor primary heat transport, power conversion waste heat transport, thermal energy storage, thermal insulation, or space radiators. Potential areas of interest include analysis, design, fabrication, testing, and integration. Papers that discuss the current technology readiness and how the technologies are being implemented for actual space missions are encouraged.

Go to Submission Form

CT406. Radioisotope Power Systems Technology and Development

Session Chair: Patrick Frye, Pratt & Whitney Rocketdyne, Canoga Park, CA, 818-586-0363, patrick.frye@pwr.utc.com
Session Co-Chair: TBD

Papers are invited that present engineering design and analysis related to radioisotope (RPS) technology and development. Papers could address overall technology; performance and technical issues; system/generator design; development; system issues/risks; testing; and applications based on advanced Radioisotope Power Systems (RPS) and Heater Units (RHUs) that meet the needs of future, long-lived spacecraft. Various power levels are needed to span the full range of potential future space exploration and surface power missions, with powers ranging from milliwatts to kilowatts. Topics of interest include, but are not limited to: increased conversion efficiency and specific power; modular or scaling advanced RPSs for mission specific power levels; multi-mission operations in a vacuum, atmosphere, or extreme environments; electromagnetic interference (EMI); reliability and long lifetimes (possibly > 14 years); failure and degradation mechanisms; utilization of both electric power and thermal heat; high g-loads at landing; system modeling and system integration aspects of space applications; critical technology, component, or system issues; or development status. Comparisons of system performance between power conversion approaches, and application of one or more power conversion approaches towards meeting the needs of future science and exploration missions are of interest. Papers addressing RPS systems at the highest power levels would benefit by exploring comparisons with fission based concepts. Papers related to the overall system and mission integration of radioisotope power systems are also requested. Topics may include status of current development projects, strategies for advancing technology readiness, and potential mission applications. Potential areas of interest include review of technology databases, standards for qualifying systems for space, safety and launch approval, and mission operations.

Go to Submission Form

CT407. Heat Acquisition, Thermal Storage, Heat Transport, Materials& Surface Treatments

Session Chair: Donald M. Ernst, Advanced Cooling Technologies, Inc., Lancaster, PA, 717-471-8998, Don.Ernst@1-ACT.com
Session Co-Chair: James L. Sanzi, Sest, Inc., Middleburg Heights, OH, 216-433-5036, James.L.Sanzi@grc.nasa.gov

This session will address relevant technologies applicable to high and low temperature heat rejection to a space environment. All technologies applicable to space power thermal-based systems are subjects of interest for the development of high reliability, low mass space power systems. Innovative methods of acquiring, storing transporting and rejecting thermal energy are of interest. This includes single and two phase heat transport components and their steady state and transient performance analysis relevant to the performance of a space power thermal-based system. Advances in heat acquisition, thermal storage media, new materials of construction, innovative bonding or joining techniques and radiator surface treatments that significantly reduce a space power system's heat transport or heat rejection subsystems mass or improves its reliability are of interest.

Go to Submission Form

CE01. Joint C-/E-Conference Session: Nuclear Technology in Support of Space Colonization

Session Chair: TBD
Session Co-Chair: Anne Garber, NASA Marshall Space Flight Center, AL, 256-544-0665, anne.e.garber@nasa.gov

Nuclear technology has the theoretical potential to enable exploration, utilization, and colonization of the entire solar system. In addition, innovative concepts have been proposed for using nuclear technology to reach several of the nearer star systems within a few hundred years.

This session will explore the potential use of nuclear technology in support of space colonization. Topics of interest include both advanced nuclear power systems and advanced nuclear propulsion systems. Advanced missions, anticipated requirements, and integrated scenarios for colonization are also of interest. Papers that discuss required technologies and options for developing those technologies are also encouraged.

Go to Submission Form

D. 6TH CONFERENCE ON HUMAN / ROBOTIC TECHNOLOGY AND THE VISION FOR SPACE EXPLORATION

John C. Mankins, Program Chair
Artemis Innovation
Ashburn, VA
703-472-9286
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Robert Wegeng, Program Co-Chair
Pacific Northwest National Laboratory
Richland, WA
509-376-2011
robert.wegeng@pnl.gov

Christopher Moore, Program Co-Chair
NASA Headquarters
Washington, DC
202 358-4650
christopher.moore@nasa.gov

This conference will present a broad overview of the plans, programs, and technology development activities that NASA and its international partners are pursuing to enable the Vision for Space Exploration.

Session chairs, and co-chairs to follow. In the interim, if you have any questions, please contact the Program Chairs listed above.

D01. Exploration Technology Opening Session

This session will provide an overview of NASA's exploration programs and technology needs.

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D02. Lunar and Mars Exploration Architecture Studies

This session will discuss plans for the lunar outpost, the human exploration of Mars, and other potential missions for exploration systems.

Go to Submission Form

D03. Technologies for Orion and Ares

This session will discuss projects that are developing technologies for the Orion Crew Exploration Vehicle and the Ares launch vehicles such as thermal protection systems, propulsion, and avionics.

Go to Submission Form

D04. Technologies for the Lunar Lander

This session will discuss projects that are developing technologies for the Lunar Lander such as propulsion, cryogenic propellant storage, precision landing systems, and lightweight structures.

Go to Submission Form

D05. Technologies for the Lunar Outpost

This session will discuss projects that are developing technologies for the lunar outpost such as assembly concepts, environmental control and life support systems, crew habitats, logistics, and supportability.

Go to Submission Form

D06. Technologies for Lunar Surface Operations

This session will discuss projects that are developing technologies to enable advanced lunar surface operations such as robotics, EVA, and in-situ resource utilization.

Go to Submission Form

D07. Technologies for Lunar Surface Power Systems

This session will discuss projects that are developing technologies for power generation and transmission as well as energy storage for the lunar outpost.

Go to Submission Form

D08. Technology Demonstrations and Analogs

This session will discuss ground-based, system-level demonstrations of technologies, and analogs used to simulate operations on the lunar surface.

Go to Submission Form

D09. International Partnerships for Exploration Technology Development

This session will discuss the global exploration strategy, plans for international participation, and projects that international partners are pursuing to support exploration.

Go to Submission Form

D10. Novel Concepts

This session will discuss innovative ideas and advanced concepts to enable new far-term visions for space exploration.

Go to Submission Form

E. 6TH SYMPOSIUM ON SPACE COLONIZATION

KLAUS HEISS, Program Chair
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NARAYANAN RAMACHANDRAN, Program Co-Chair
Jacobs Technology
Huntsville, AL
256-544-8308, Fax: 256-716-4721,
Narayanan.Ramachandran-1@nasa.gov

With the Nation's new directions announced by President Bush, human and robotic exploration missions beyond LEO have now been given significant emphasis in the NASA Vision. This emphasis is pointing toward development of space settlements on the Moon and eventually Mars. Along with these settlements/colonies, more consideration of the construction of large scale infrastructure is needed. With the formation of the new AIAA Technical Committee on Space Colonization in 2002, this dream may move a little closer to reality. The fifth symposium on Space Colonization will focus on what we could be doing on the Moon and the areas of our group's scope, namely, Space Tourism, Space Exploration, Space Bases, Space Resources Utilization (SRU), the exploration of economic opportunities on the Moon to/for Earth,,observations of the Earth, Sun, Solar system and worlds beyond, Space Settlements/Colonies, biotechnology, medicine, large scale processes and technologies, L-5 "O'Neillean/Dyson structures and habitats to "von Braunian" Colonizations of Mars and Other Planetarybodies..

The yearning of people to travel into space, even in short sub-orbital flights, is an important first step towards future space colonization by humans. Eventually, with the apparent improvement in the political reality, improved technologies will enable us to permanently move to new settlements elsewhere in the Solar System within this Century. This process includes space exploration and ensuing space tourism and eventually results in: various national and international space bases in various orbits (e.g., "L-5 spheres) and on planetary bodies (Moon, Phobos/Deimos, Europa, Mars, etc); requires for the economic development of the Moon for cost–effective implementation of exploration, base construction, human settlements in the Solar System; and eventually will result in the terra-forming of planetary bodies such as Mars to give humankind viable new homesteads and future new civilizations expanding beyond our Solar system.

The sessions being organized at this symposium are discussed in more detail below and papers from the entire international community are encouraged. Sessions will concentrate on two broad questions: the "WHY" and then"HOW". The WHY is particularly important, since all too often scientists and engineers get submerged in the much easier issues of the "HOW."

E01. Why Space Colonization – Opening Session I

Chair: Klaus Heiss, High Frontier and The Jamestown Group, Washington DC, 703-535-8774, klaus.heiss@verizon.net
Co-Chair: Narayanan Ramachandran, Jacobs Technology, Huntsville, AL, 256-544-8308, Narayanan.Ramachandran-1@nasa.gov

These papers, consisting of invited talks only, will be given within a two-hour time slot, where specific time allocations will be assigned to each presenter. Overview papers on the focused subjects of why space colonization will be developed and presented by the members of the AIAA/SCTC. There may be one summary/survey paper on each of the six areas of the SCTC interests or other topics of general nature.

Go to Submission Form

E02. How Space Colonization – Opening Session II

Chair: Klaus Heiss, High Frontier and The Jamestown Group, Washington DC, 703-535-8774, klaus.heiss@verizon.net
Co-Chair: Narayanan Ramachandran, Jacobs Technology, Huntsville, AL, 256-544-8308, Narayanan.Ramachandran-1@nasa.gov

These papers, consisting of invited talks only, will be given within a two-hour time slot, where specific time allocations will be assigned to each presenter. Overview papers on the focused subjects of the How of space colonization will be developed and presented by the members of the AIAA/SCTC. There may be one summary/survey paper on each of the six areas of the SCTC interests or other topics of general nature.

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E03. Space Exploration: Why and How?

Chair: Mark Benton, Boeing Space and Intelligence Systems, El Segundo, CA, 310-416-4554, Mark.Benton@boeing.com
Co- Chair: Peter Curreri, NASA Marshall Space Flight Center, AL, 256-544-7763, Peter.A.Curreri@nasa.gov

Papers are sought that focus on exploration of the Moon, Mars and Asteroids. Papers that deal with resources measurement and discovery are preferred. Papers dealing with advanced space transportation and other architecture elements and advanced subsystems technologies that support human exploration of space are welcome. The discovery/reporting of new scientific findings that will provide encouragement to the public for space tourism, space bases, space settlements, and Terraforming are desired.

Go to Submission Form

E04. Space Bases on the Moon: Why and How?

Chair: Paul van Susante, Colorado School of Mines, Golden CO, 720-272-8892, paulvans@mines.edu
Co-Chair: Rob Mueller, NASA Kennedy Space Center, FL, 321-867-2557, rob.mueller@nasa.gov

A "Space Base" will be defined as a permanent facility on the Moon's surface, that includes habitable elements in which humans can live for extended periods without re-supply. The definition here also includes first stage outposts extending all the way to a lunar colony and how to develop from one to the other. Priority will be given to papers exhibiting original concepts, innovative solutions to known environmental risk factors, lunar operations and depth of analysis of technologies and functionalities.

Abstract and paper submissions should contain enough detail for the program committee to evaluate the technical content of the final presentation and paper.

Go to Submission Form

E05. Space Bases on Mars: How, but Why?

Chair: Andrew Gonzales, NASA Ames Research Center, Moffett Field, CA, 650-604-0309, agonzales@mail.arc.nasa.gov
Co-Chair: Subhayu Sen, BAE Systems, Huntsville, AL, 256-544-8264, Subhayu.Sen-1@nasa.gov

A "Space Base" will be defined as a permanent facility on the Moon's surface, that includes habitable elements and in which humans can live for extended periods without re-supply. The definition here also includes first stage outposts extending all the way to a lunar colony and how to develop from one to the other. Priority will be given to papers exhibiting original concepts, innovative solutions to known environmental risk factors, lunar operations and depth of analysis of technologies and functionalities.

Abstract and paper submissions should contain enough detail for the program committee to evaluate the technical content of the final presentation and paper.

Go to Submission Form

E06. Space Settlements/Colonies

Chair: Anita Gale, Space Settlement Design Competitions, Nassau Bay, TX, 281-226-5691, anita.e.gale@boeing.com
Co-Chair: Richard Edwards, Space Settlement Design Competitions, Nassau Bay, TX, 281-226-5530, Dick.Edwards@boeing.com

Papers are invited that describe possible space settlements/colonization concepts/overall systems or architecture studies in space, on the Moon, and/or on Mars. Papers are sought that help to define what resources are needed to support the colonies sited in different locations, with both local space resources and Earth-based resources. Papers are also invited that define optimum habitats, bio-dome design, laboratories, power stations, recreational facilities, manufacturing, greenhouses/farming operations, food production/processing, resource mining operations and materials handling and processing, road building processes, space transport systems, and sociological aspects of setting up settlements off the home planet.

Go to Submission Form

E07. Biotechnology and Medicine for Space Colonization: Why and How?

Chair: TBD
Co-Chair: TBD

This session will address work in the area of biotechnology and health care, both physical and psychological. In particular the serious issues raised in the "Safe Passage" report of 2001 by the Institute of Medicine, which has raised serious questions as to the vialbility of long duration human Space missions beyond the Moon. At the same time the Moon may provide a unique platform to research and find out aboutfundamental issues on the human body and health outside Earth. Contributions may include forecasts for near term biotechnology, the exploitation of endogenous bacteria to produce drugs and to modify physiology and enhance survivability, the memory, and the use of living cells as sensors, processors and communication devices. Contributions are also sought that relate to long term exposure to the interplanetary environment, and social dynamics and psychology issues related to space colonization.

Go to Submission Form

E08. Large Scale Processes and Technologies for Colonization

Chair: Edward McCullough, The Boeing Company, Huntington Beach, CA, 714-934-0625, edward.d.mccullough@boeing.com
Co-Chair: Brad Blair, SysRAND, Idaho Springs, CO, 720-280-5100 planetminer@gmail.com

Papers are invited that describe possible large-scale process and technology concepts, overall systems, or architecture studies in space, on the Moon, and/or on Mars, to include: Definition of the processes and technologies required for the production of large scale infrastructure on planetary surfaces and space using a combination of local space resources and Earth-based resources. Methods for producing modular components on planetary surfaces from local resources, integration of the modules into large scale infrastructure or machines on the planetary surfaces, methods for providing radiation protection, or transporting the modules to space destinations like LEO or Lagrange points for assembly into solar power satellites or [very large ~500m]interplanetary vehicles.. Bootstrapping chemical processing and manufacturing infrastructure and that describe methods of building large scale machinery for mining and building large scale underground facilities for setting up settlements off the home planet. The objective of this session is to demonstrate conceptually, and from an engineering framework, how we become independent of Earth infrastructure and resources as rapidly as feasible, and the necessary infrastructure on the Moon to accomplish this feat.

Go to Submission Form

E09. Terraforming, Domed Ecosystems and Planetary Modification

Chair: Eric E. Rice, Orbital Technologies Corporation, Madison, WI, 608-827-5000 ex. 2730, ricee@orbitec.com
Co-Chair: TBD

This session seeks papers that will consider the physics, biology, and environmental policy issues of developing domed ecosystems on planetary surfaces and the basic idea of planetary Terraforming. Papers solicited include discussions of physical processes that might be used to warm Mars, assessment of its inventory of carbon dioxide, water, and nitrogen, analogous ecosystems on Earth today, the role of advances in biology in creating ecosystems on Mars, elsewhere, and other related topics. Engineering and construction analyses of large domes fabricated from local resources on the Earth, Moon, and Mars are desired.

Go to Submission Form

E10. Major Challenges to and Opportunities for Human Exploration of Space

Chair: John C. Mankins, Artemis Innovation Management Solutions, Ashburn, VA, 703-472-9286, john.c.mankins@artemisinnovation.com
Co-Chair: Mark Benton, Boeing Space and Intelligence Systems, El Segundo, CA, 310-416-4554, Mark.Benton@boeing.com

Experience in space has shown that operations outside the atmosphere and on extraterrestrial surfaces frequently encounter serious challenges--some known or anticipated, and others that appear as surprises. These have included degradation effects on materials, electrical charging, pervasiveness of lunar dust, and greater than expected forces. On the other side, celestial bodies, first and foremost the Moon, also offer unique opportunities not realizable from Earth or in Cis-Lunar Space. There are also potential political, economic, industrial, managerial, and other new challenges that will need to be overcome, but opportunites as well. It is an irrefutable fact that after the glorious achievements of manned Space flight by Russia and the United States in the 1950's and 1960's the Human

exploration of Space has meandered, stagnated indeed retrogressed: whereas we could land man on the Moon in decades past today the US may be able to do so only in 2020 or beyond, a course possibly forsaking opportunities for us and generations to come. This session seeks papers that quantify known or anticipated challenges and opportunites to space operations, propose mitigation techniques, and/or suggest previously unknown opportunites or difficulties that may be encountered as humans expand activities in space and on surfaces of planets, moons, and asteroids. Submissions should contain sufficient detail for the program committee to evaluate the technical content of the final presentation and paper.

Go to Submission Form

E11. A Condominium of Observatories on the Moon

Chair: Walter Pecorella, Istituto Nazionale di Astro-Fisica (INAF), Rome, Italy, + 39 06 355331, walter.pecorella@telespazio.com
Co-Chair: TBD

This session is meant to identify early and major observation programs on and from the Moon. One of the early and primary uses of the Moon has been and is to use the Moon as an ideal platform for observing Earth, the Sun, the Solar system, the Milky Way and the universe. In addition, some observations can only be made from the Moon, e.g. a Cosmic Rays Water Observatory or Radio astronomy trying to "penetrate" behind the current limit given by the CBR images of the early universe.

The Moon is a natural platform in space that has many similar characteristics as free space (e.g. vacuum), but is much safer to work on and allows for regular maintenance and upgrading which placement of telescopes in far away Lagrange points does not, or at least will make it very cumbersome, time consuming and risky, since these are conceptual and as yet unproven in design and operations in a hostile Space environment constantly affected, among others, by Solar climate/weather events. Since by 2020 new telescope capabilities will be required because current telescopes will be at the end of their lifetime and successors will be too large to deploy or extremely complicated and risky to achieve in free space (e.g. interferometry formation flying constellations of telescopes), the lunar surface is an excellent place to construct the next and following generations of telescopes

In 2004 a Condominium of Observatories was proposed as a first logical step toward a sustained presence on the Moon (March 2004 – Washington Academy of Sciences), February 2005 (STAIF – AIAA Space Colonization TC) and again March 2005 – (Washington Academy of Sciences). This in turn stimulated three conferences on Moon Base(s) initiated by the two chairmen in Venice (Italy, May 2005), Washington DC (October 2005) and Moscow (Russia, November 2006). Others have proposed the early establishment of observatories and measurement instruments on the Moon as well, which can be added to the Condominium tasks: e.g. a deployment of seismometers to measure Lunar seismic and meteor impact events to determine the internal structure of the Moon.

Go to Submission Form

E12. The Why: "Market Pull" Moon Development Opportunities and Barriers: Jamestown on the Moon and Beyond

Chair: Piero Spillantini, University of Florence, Florence, Italy, + 39 055 457 2000, spillantini@fi.infn.it
Co-Chair: TBD

Over the past four years members of the SCTC have identified the Moon is as the single, most important "High Ground" as to the strategic interests of the United States in the 21st century and beyond. No other "location" on Earth or in Space comes even close to the overarching, dominant place the Moon has in assuring peace, economic security and resolving conflicts in favor of US interests and free market democracies in the decades and centuries ahead.

The Moon is dominant in (a) Communications, Navigation and Data Base(s) applications and extensions of current Leo, HEO and Geosynchronous infra-structures - a $6 to 10$ billion global industry; (b) Observations, be it Weather, Earth resources, Environmental and Disaster warning and assessment capabilities, Sun-Earth observations, Ocean monitoring etc.; (c) Energy, be it Solar, Nuclear fission or potentially fusion using the ^{3}He sources, for use on the Moon, from the Moon and for Earth; and (d) Habitats and Closed Ecological Life Support Systems, extending mankind's presence from Earth to the Moon and possibly beyond into the Solar system.

Go to Submission Form

E13: Lunar Dust: Practical Issues and Testing

Chair: Michael Dube, NASA Goddard Space Flight Center, Greenbelt, MD, 301-286-0957, Michael.J.Dube@nasa.gov
Co-Chair: Michael Hyatt, NASA Glenn Research Center, Cleveland, OH, 216-433-3248, Michael.J.Hyatt@nasa.gov

Session Focus: This session will consider the characterizations of lunar dust necessary to identify and resolve abrasive problems encountered by mechanical systems during extended exploration of the moon. Understanding physical parameters of lunar dust will be addressed in order to standardize simulants used in abrasive testing. Parameters and approaches to abrasive testing, using simulants primarily at this time, will be considered in order to identify instances of risk to mechanical systems caused by dust during lunar exploration. Identification, as well as rational presumption, of risks will be used to consider approaches to mitigation of risks to mechanical systems caused by lunar dust during exploration.

Go to Submission Form

CE01. Joint C-/E-Conference Session: Nuclear Technology in Support of Space Colonization

Session Chair: TBD
Session Co-Chair: Anne Garber, NASA Marshall Space Flight Center, AL, 256-544-0665, anne.e.garber@nasa.gov

Nuclear technology has the theoretical potential to enable exploration, utilization, and colonization of the entire solar system. In addition, innovative concepts have been proposed for using nuclear technology to reach several of the nearer star systems within a few hundred years.

This session will explore the potential use of nuclear technology in support of space colonization. Topics of interest include both advanced nuclear power systems and advanced nuclear propulsion systems. Advanced missions, anticipated requirements, and integrated scenarios for colonization are also of interest. Papers that discuss required technologies and options for developing those technologies are also encouraged.

Go to Submission Form

EF01. Joint E/F-Conference Session – Near- and Far-Term Technologies

Chair: John Cole, NASA Marshall Space Flight Center, AL, 256 544-4290, john.w.cole@nasa.gov
Co-Chair: Dan Garrison, Barrios Technology, Houston, TX, 281.483.7293, dan.h.garrison@nasa.gov

A joint session is planned with the Colonization Conference where issues will be addressed concerning the use of near-term and far-term technologies and what their effects may be based upon the Moon and Mars programs as well as other efforts that are designed to expand the vision to make us a space-faring nation. Some of these technologies are growing exponentially as a function of time whereas planning activities only treat them as a linear function. This could lead to unusual developments and unexpected break-troughs in technology that should be successfully exploited. This session will identify these issues and, hopefully, how to create successful plans for dealing with the unexpected.

Go to Submission Form

F. 5TH SYMPOSIUM ON NEW FRONTIERS AND FUTURE CONCEPTS

PAUL MURAD, Program Chair
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Washington DC
703-907-2981,
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TONY ROBERTSON, Program Co-Chair
Gravi Atomic Research, LLC
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The global prospective toward space propulsion will aggressively continue moving forward to develop supremacy in space-related technologies creating a more competitive international environment allowing far-term ideas to develop within a more near-term focus. However, without the proper method for assimilating this information, much of these new ideas, technologies, and concepts may be lost. Therefore this forum has the objective of being a venue to expose these worthwhile ideas while maintaining a flow of innovative theories and concepts; and keeping the doors open for advances in more non-conventional approaches that could yield tremendous technological and economic dividends in both investment dollars and potential applications for future generations.

Papers presented at this conference should deal with experiments, theories, and approaches that will help man achieve both a short-term and long-term destinies for space exploration. Short-term objectives support the near-term space initiative for man to return to the Moon and Mars, which implies using tried and proven legacy methods or Heritage Technology. Long-term objectives will lay down the scientific foundation necessary for future generations to extend mankind's reach beyond our solar system. These long-term objectives are more pronounced and designed to stretch the intellectual capabilities and imagination of mankind in advanced technical disciplines. This will broaden our understanding and usage of the space environment for communications, power generation/storage, and propulsion to include investigating current (Relativity & Quantum Mechanics) and advanced theories (String & etc.).

Many of this conference participates are from the engineer community. Therefore, submitted papers should be clearly written in a contemporary language to nurture the current new and future generations of scientists and engineers. When possible, papers should provide a balance between observations, ideas, theories, and experiments. Ideas need to be stated in a meaningful scientific format; theoretical papers need to address identifying supporting experiment(s) since a theory may be useless without experimental verification. Papers addressing credible experiments need not support a specific theory but provide evidentiary data that may support some theoretical approach that is either known or yet to be discovered.

Abstracts and papers should be concise, clear, and original according to the supporting information; theoretical analysis, references provided, and presentations, which should be logical and based upon sound scientific principles. If a departure from the conventional wisdom is claimed, it is the author's responsibility to persuade and clarify this point in a balanced but scientifically convincing manner supported by adequate and acceptable evidence as well as identify experiments for testing their claims.

Authors should submit an abstract (200 words or more) that would be used with the paper per standard STAIF procedure. Foreign authors are required to pre-register by 01 August 2007 and submit final drafts by 01 September 2007.

F01. Opening Session

Chair: Paul Murad, United States Department of Defense, Washington, DC, 703-907-2981, ufoguypaul@yahoo.com
Co-Chair: Glen "Tony" Robertson, Co-Chair, Gravi Atomic Research, LLC, Madison, AL, 256-694-7941, Gravi_Atomic@hotmail.com

Presentations are invited that summarize potential advancements, requirements, applications and maturation needed for various technologies that involve propulsion, power generation/storage, communications and other areas that will review progress, identify anomalies, extend or stretch the conventional wisdom, to inspire the creation of even newer maturing or emerging technologies and explore options that may lead to the innovative use of existing technology that can extend less conventional systems. In addition, we will invite presentations from venture and 'angel' capitalists to find means to sponsor promising research as we move from a government-centric funding scheme to one more dependent upon the private sector.

Go to Submission Form

F02/F03. Taming the Solar System: Advanced Technologies for Terrestrial (Earth, Lunar and Mars) and Future Propulsion and Power Concepts

Chair: Chuck Suchomel, USAF WPAFB, OH, 937-904-8653, Charles.Suchomel@afrl.af.mil
Co-Chair: Frank Mead, AFRL, CA, 661-275-5929, franklin.mead@edwards.af.mil

Papers are solicited that examine diverse, innovative, emerging, disruptive, novel technologies, and the innovative use of existing technologies as well as their extensions, and generalizations to the propulsion, communication and power generation/storage problem. There is also a need to address advanced or future propulsion concepts as well as to explore other approaches that have yet to be thoroughly investigated provided that there is enough theoretical backing and experimental research to warrant further evaluation. Papers, when feasible, should explicitly address experiments whereby novel physical mechanisms involved in the method of operation can be, at least in principle, tested and preferably be put into practice at reasonable cost. Unusual applications are also a concern. The collaborative research community needs to understand the impact of how novel technologies can contribute to treat a wide range of space system. Papers are invited that examine but are not limited to:

Understanding the Environment considering cosmic rays and charged particles that impact propulsion (such as Radiation Shielding Concepts and there application), Earth, Moon & Mars-Based Launchers and other emerging technologies in the context of enhancing the feasibility of future propulsion/power generation. This could include but is not limited to electromagnetic launchers, beamed energy systems or other worthwhile concepts, Innovative and Alternative Space Propulsion and Power Approaches, and
Advances in supporting Technology for Space Propulsion, Power and Communication (such as magnets).

Go to Submission Form

F04. High-Frequency Gravitational Wave Creation, Detection and Space Technology Applications

Chair: R.M.L. Baker, GRAVWAVE, LLC, Playa del Rey, CA, 310 823-4143, robert.baker.jr@ca.rr.com
Co-Chair: TBD

Active discussions continue over the means of detecting, exploiting and generating high-frequency gravitational waves or HFGWs. This represents a high-risk but a very high pay-off technology discipline. HFGWs have been explicitly defined as encompassing the high-frequency (100 kHz to 100 MHz), very high frequency (100 MHz to 100 GHz), and ultra high frequency (greater than 100 GHz) bands. With these thoughts in mind, we would like to focus on the means for evolving this technology with a focus upon gravitational -wave Creation (specifically, generation in the laboratory), Detection and Applications. Space technology applications include global, interplanetary and interstellar communications, propulsion, nuclear-fusion power generation, surveillance, relic HFGW detection from the Big Bang and HFGW optics.

Go to Submission Form

F05. Experimental Results and New Concepts within New, Current, or Older Physical Models

Chair: R. Clive Woods, Louisiana State University, Baton Rouge, LA, (225) 578 5243, cwoods@ece.lsu.edu
Co-Chair: James Woodward, California State University, Fullerton, CA, 714-278-3596, jwoodward@fullerton.edu

These papers should treat ideas and concepts in the basic research realm that examine unique and workable approaches for field propulsion, gravitational effects, the zero-point field and quantum entanglement to achieve massless space propulsion and power. Although these disciplines and concepts may be speculative, the issue should also focus upon requirements to place such concepts on a suitable scientific footing to continue additional investigations if extensive and continued research is to be justified. Moreover, papers should stress the practicality of these concepts and other topics that will have an impact on future propulsion systems. Papers are invited but are not limited to: 1) Experimental Results within Current Physical Models and 2) New Concepts within Current Physical Models.

Go to Submission Form

F06. Innovative Theories and Concepts for Communications

Chair: Gary Stephenson, Seculine Consulting, Redondo Beach, CA, 425 443-8651, seculine@gmail.com
Co-Chair: TBD

This session will deal with theoretical and experimental analyses associated with the potential of quantum theory to provide advanced communication channels for use in space systems. Topics of interest will include, but not be limited to: advances in quantum theory, interpretation, and workable practice with regards to wave function collapse, quantum entanglement, cloning, teleportation, and faster than light (FTL) communications. Capabilities of particular interest would include communication schemes, such as using solitons that avoid the 1/r2 law, support higher bandwidths than possible with classical communications, afford better security, gravitational wave communications, what influence does nanotechnology have upon communications using quantum entanglement or phenomenon that is capable of communications at superluminal speeds. Papers submitted must follow established scientific norms, placing the work in the context of current knowledge, specifying relevant references, identifying assumptions and presenting sound technical and logical arguments that lead to significant conclusions.

Go to Submission Form

F07. Theoretical Considerations in Propulsion

Chair: Eric Davis, Warp Drive Metrics, Austin, TX, 512-342-2187, ewdavis@earthtech.org
Co-Chair: Ray Lewis, Pennsylvania State University, Boalsburg , PA, 814-466-6187, r3l@psu.edu

There is considerable interest in understanding faster than light speed travel and the zero-point field in terms of new physics and other consideration such as the influence of gravity, sensors, field theory and suitable propulsion modes that may impact Einstein's Theory of Relativity. We need to address limitations and assumptions in the Theory of Relativity to improve our understanding of this 4-space, and if applicable higher-dimensional geometric representation. Other more novel future technologies or propulsion concepts not previously covered under previous sessions also warrants discussion here. These may have applications to improve our understanding of how to use space travel to traverse exceptionally long distances and use relativistic speeds for space exploration. A subject of interest would also include shielding against meteorite or debris impacts upon a spacecraft at relativistic conditions. Moreover, what are the current and advanced state-of-the-art in quantum tunneling and our understanding of black holes or wormholes? Papers are also sought that address the possibility that other concepts, largely ignored until now, may exist that warrant further investigations. Papers are also requested to answer questions such as: What would be the requirements for creating a Warp Drive system? How can one create such a propulsion system, if suitable, that duplicates natural phenomena such as producing a transportable black hole? Finally, how is energy extracted from the physical vacuum? Again, these papers must be balanced and follow sound scientific guidelines for acceptance.

Faster-than-Light Travel Through Alternate Spaces
Particle/Quantum/String Physics Models with Potential Propulsion Application

Go to Submission Form

F08./F09. Future Propulsion Models and Concepts

Chair: Gregory V. Meholic, The Aerospace Corporation, El Segundo, CA, 310 336-2919, Greg.V.Meholic@aero.org
Co-Chair: Richard Obousy, Baylor University, Waco, TX, 254-366-6766, Richard_K_Obousy@baylor.edu

This session looks at advanced capabilities to bring them one step closer to reality. This will be based upon our understanding of these concepts and determining the limitations of contemporary technology as well as the needs for new evolving and enabling technologies designed to support this venture. Efforts should focus upon Propulsion Concepts Derived from:

Spacetime Metrics,
Altering Gravity,
Electricity & magnetism,
the Zero-Point Field,
Exotic Matter, and
Other Theories and Models

and the
Fluidic Characteristics of these Propulsion Concepts.

Go to Submission Form

F10. An International Outlook on Far Term Propulsion and Power

Chair: Bernd Binder, Quanics, Salem, BW, Germany, ++497553827390, binder@quanics.com
Co-Chair: Martin Tajmar, ARC Seibersdorf Research GmbH, Seibersdorf, Austria, +43-50550-3142, martin.tajmar@arcs.ac.at

Efforts of looking at unusual concepts and propulsion capabilities have made significant progress in the U.S. We are inviting papers from international specialists that are willing to share their ideas with the international community to make space exploration more of an endeavor that will benefit all of mankind. These papers can be overview papers as well as cover detailed aspects as outlined in the other sections.

Go to Submission Form

EF01. Joint E/F-Conference Session – Near- and Far-Term Technologies

Chair: John Cole, NASA Marshall Space Flight Center, AL, 256 544-4290, john.w.cole@nasa.gov
Co-Chair: Dan Garrison, Barrios Technology, Houston, TX, 281.483.7293, dan.h.garrison@nasa.gov

A joint session is planned with the Colonization Conference where issues will be addressed concerning the use of near-term and far-term technologies and what their effects may be based upon the Moon and Mars programs as well as other efforts that are designed to expand the vision to make us a space-faring nation. Some of these technologies are growing exponentially as a function of time whereas planning activities only treat them as a linear function. This could lead to unusual developments and unexpected break-troughs in technology that should be successfully exploited. This session will identify these issues and, hopefully, how to create successful plans for dealing with the unexpected.

Go to Submission Form

INDEX