Space Technology and Applications International Forum (STAIF-2007)

"Space Renaissance: Inspiring the Next Generation"

CALL FOR PAPERS

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Los Alamos National Laboratory
Los Alamos, NM

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University of New Mexico, Albuquerque, NM

Papers are invited in all technical areas of the Space Technology and Applications International Forum (STAIF-2007), organized by the University of New Mexico's Institute for Space and Nuclear Power Studies (ISNPS). STAIF-2006 will be held February 11 - 15, 2007, 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 May 26, 2006. 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-2007 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, 2006, 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-2007 proceedings. In addition, final camera-ready abstracts will be included in the abstract book to be distributed to all STAIF-2007 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-2007.

For more information and updates, please consult the ISNPS webpage at: http://www.unm.edu/~isnps

DEADLINES	
Initial Abstract Submission	June 16, 2006
Response to Author on Status of Abstract Submission	June 30, 2006
First Draft of Full Paper	August 1, 2006
Final Draft of Full Paper, Forms and Final Abstract	October 1, 2006
Published Author Registration*	TBD

*A paid registration must be received with the final camera-ready papers to be published in the STAIF-2007 Proceedings.

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A. 11TH CONFERENCE ON THERMOPHYSICS APPLICATIONS IN MICROGRAVITY

TED SWANSON, Program Chair
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TUNG T. LAM, Program Co-Chair
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tung.t.lam@aero.org

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

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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 which focus 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.

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A02. Thermal Control Technologies for Future Spacecraft

Chair: Jeffrey Didion, NASA Goddard Space Flight Center, Greenbelt, MD, 301 286-4363, Jeffrey.R.Didion@nasa.gov
Co-Chair: Kirk Yerkes, USAF / Air Force Research Laboratory, Wright-Patterson AFB, OH, 937-255-5721, kirk.yerkes@wpafb.af.mil

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.

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A03. Two-Phase Thermal Control Systems

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.

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A04 Thermal Control for Lunar and Deep Space Missions

Chair: Dan Butler, NASA Goddard Space Flight Center, Greenbelt, MD, 301 286-8618, Dan.Butler@nasa.gov

Co-Chair: Eric Sunada, Jet Propulsion Laboratory, Pasadena, CA, 818 354-1543, eric.t.sunada@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.

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A05. Smart Materials and Coatings for Thermal Control

Chair: Donya Douglas, NASA Goddard Space Flight Center, Greenbelt, MD, 301 286-6952, Donya.M.Douglas@nasa.gov
Co-Chair: William J. Biter, Sensortex, Inc., Kennett Square, PA, 610 444-2383, wjbiter@sensortex.com

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.

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A06. 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.

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A07. 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 cm^2) 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/cm^2), 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/cm^2 using fluorinerts and 1000 W/cm^2 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.

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A08. Heat Pipe Technologies

Chair: Bob Reid, Los Alamos National Laboratory, Los Alamos, NM, 505 667-2626, rsr@lanl.gov
Co-Chair: Dr. D. Angirasa, NASA Glenn Research Center, Cleveland, OH, 216 433-3914, 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.

C. 24TH SYMPOSIUM ON SPACE NUCLEAR POWER AND PROPULSION

GARRY BURDICK, Program Chair
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Pasadena, CA
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MICHAEL HOUTS, Program Co-Chair
NASA Marshall Space Flight Center
Huntsville, AL
256-544-8136, Fax: 256-544-6696,
michael.g.houts@nasa.gov

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 24th 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.

C01. Opening Session

Chair: Garry Burdick, Jet Propulsion Laboratory, Pasadena, CA, 818-354-3441, garry.m.burdick@jpl.nasa.gov
Co-Chair: Michael G. Houts, NASA Marshall Space Flight Center, AL, 256-544-8136, michael.g.houts@nasa.gov

Session will address timely topics and most recent developments and mission accomplishments by inviting speakers from government, industry, and academia to participate in a panel and allowing good interaction with attendees through Q&A, and interactive discussion.

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C02. Reactor Systems Concepts for Surface Power

Chair: Robert L. Cataldo, NASA Glenn Research Center, Cleveland, OH, 216-977-7082, Robert.L.Cataldo@nasa.gov
Co-Chair: Steven Dron, Sandia National Laboratories, Albuquerque, NM, 505-845-7126, sbdron@sandia.gov

Papers are invited that present engineering design and analysis of fission reactor power systems for use on the surfaces of the Moon, planets and other extraterrestrial bodies. Options for adapting in-space reactor power system concepts and technologies for surface applications are particularly sought. Surface fission power systems may support potential near-term or advanced robotic and human missions. Power levels of interest cover a broad range from kilowatts to 100's of kilowatts. In addition to performance analyses for particular reactor concepts, papers evaluating various technologies for use in surface application are also sought. Trade comparisons between nuclear reactor power systems and alternative systems (e.g., solar power systems) are additionally welcomed and encouraged.

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C03. Terrestrial Programs and Technologies with Space Application

Chair: James E. Werner, Idaho National Laboratory, Idaho Falls, ID, 208-526-8378, James.Werner@inl.gov
Co-Chair: Lloyd Jollay, BWX T Y-12, Oak Ridge, TN, 865-241-1872, jollayl@y12.doe.gov

Papers are invited that present engineering design and analysis of fission reactor power systems and technologies for use by commercial/terrestrial applications that can also be used in space.

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C04. Ongoing Radioisotope-Enabled Missions

Chair: Ralph McNutt, The Johns Hopkins University, Laurel, MD, 443-778-5435**,** ralph.mcnutt@jhuapl.edu
Co-Chair: Jacklyn Green, Jet Propulsion Laboratory, Pasadena, CA, 818-354-4028, jacklyn.r.green@jpl.nasa.gov

Invited papers on past and present space missions enabled by radioisotope power systems and heat sources.

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C05. Electric Propulsion Systems Concepts

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

Papers are invited that address all aspects of radioisotope-powered and fission-powered electric propulsion technologies and their application to interplanetary science missions. Topics of interest include, but are not limited to: thruster design and development, life modeling and testing, potential missions with cost and performance trades, and spacecraft integration and design. Of special interest are technologies that promise a near-term capability with sufficient life and performance.

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C06. Advanced Concepts and Technologies

Chair: Steven Howe, Center for Space Nuclear Research, Idaho Falls, ID, 208-526-6103, showe@csnr.usra.edu
Co-Chair: Jim Martin, NASA Marshall Space Flight Center, Huntsville, AL, 256-544-6054, jim.j.martin@nasa.gov

Papers are sought that examine advanced propulsion and power concepts for ambitious exploration of the solar system and beyond. Of particular interest are high-performance propulsion systems offering high specific impulse and high specific power/engine thrust-to-weight ratio through application of nuclear energy (e.g., fission, fusion, antiparticle annihilation, isomer decay, hybrid combinations, etc.). However, innovative non-nuclear concepts that achieve comparable levels of performance (e.g., solar and beamed energy) are also welcomed. Compact advanced power sources for surface exploration, spacecraft operations and propulsion are also of interest. Topics include, but are not limited to: the key physics issues involved in development of these concepts; their key enabling technologies; mission performance; and vehicle design studies. Also of interest are papers addressing the potential for commercial space applications enabled by these concepts.

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C07. Materials for Space Nuclear Power and Propulsion Systems

Chair: Wayne Ohlinger, Bechtel Bettis, Inc., Upper St. Clair, PA, 412 476-6549**,** ohlinger@bettis.gov or wlobp@aol.com
Co-Chair: Robert Hickman, NASA Marshall Space Flight Center, Huntsville, AL, 256-544-8578**,** robert.r.hickman@nasa.gov

Papers are sought that report progress in development of advanced materials for space nuclear power and propulsions systems and characterization of their performance under the severe conditions imposed by these applications. Service environmental factors imposed upon candidate materials include high temperatures, high radiation fluences and dose rates, high stresses and adverse chemical environments. Reports of work related to reactor, plant, energy conversion and related (thermal and electric) propulsion systems are of interest.

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C08. Space Nuclear Reactor Power Systems & Concepts

Chair: David I. Poston, Los Alamos National Laboratory, Los Alamos, NM, 505-667-4336, poston@lanl.gov
Co-Chair: Bill J. Nesmith, Jet Propulsion Laboratory, Pasadena, CA, 818 354-3478, bill.j.nesmith@jpl.nasa.gov

Papers are invited that present engineering design and analysis of fission reactor power systems for use in space or on the surfaces of the Moon, planets and other extraterrestrial bodies. It is expected that the focus of the paper will be on the reactor, but it is recommended that papers encompass the complete power system (reactor, control, shield, power conversion) 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. Power levels of interest cover a broad range from a few kilowatts to 100's of kilowatts electric (or thermal powers up to few megawatts if the paper does not encompass power conversion). In addition to performance analyses for particular reactor concepts, papers evaluating various technologies for use in space and/or surface application are also sought. Trade comparisons between nuclear reactor power systems and alternative systems (e.g., solar power systems) are additionally welcomed and encouraged.

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C09. Nuclear Thermal Rockets: Past, Present, and Future

Chair: Stanley Borowski, NASA Glenn Research Center, Cleveland, OH, 216-977-7091, Stanley.K.Borowski@nasa.gov
Co-Chair: Russell Joyner, Pratt & Whitney Rocketdyne, West Palm Beach, FL, 561-796-3159, claude.joyner@pw.utc.com

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 primary NTP application focus), and near Earth asteroids (NEA), as well as, for robotic science missions to other extraterrestrial targets. Of particular interest are papers on nearer term, solid core NTP engine designs and concepts that could be available within the next 15-25 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 requirements and possible testing strategies. Papers that address evolutionary (e.g., lunar-to-Mars) or multi-mission NTP space transportation system concepts, exploit use of existing chemical engine and stage technology and maximize hardware commonality and/or modularity (e.g., through the use of clustered small engines) are strongly encouraged. Also of interest are papers on 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 in-situ resources (when they become available) to improve performance.

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C10. Dynamic Power I : < Kilowatt Class

Chair: Richard K. Shaltens, NASA Glenn Research Center, Cleveland, OH, 216-433-6138, richard.shaltens@grc.nasa.gov
Co-Chair: Patrick Frye, Pratt & Whitney Rocketdyne, Canoga Park, CA, 818-586-0363, patrick.frye@pwr.utc.com

Papers are invited that deal with the technology, design and development of Brayton, Rankine and Stirling power conversion cycles for use into a < Kilowatt electric range for space power systems. Specific topics 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.

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C11. Thermoelectric Power Conversion Technology and Applications

Chair: Ben Heshmatpour, Teledyne Energy Systems Inc., Hunt Valley, MD, 410-891-2291, ben.heshmatpour@teledynees.com
Co-Chair: Jean-Pierre Fleurial, Jet Propulsion Laboratory, Pasadena, CA, 818-354-4144, jean-pierre.fleurial@jpl.nasa.gov

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 compounds and engineered nanostructured materials; novel thermoelectric 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, etc.

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C12. Radioisotope Power Systems Applications

Chair: Robert Abelson, Jet Propulsion Laboratory, Pasadena, CA, 818-393-1500, robert.abelson@jpl.nasa.gov
Co-Chair: Bob Wiley, U.S. Department of Energy, Washington, DC, 301-903-2884, Robert.Wiley@hq.doe.gov

Papers specifically solicited for this session address the range of applications that can be enabled by radioisotope power systems (RPSs).

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C13. Nuclear Thermal Rocket Technology and Integration

Chair: Rick Ballard, NASA Marshall Space Flight Center, Huntsville, AL, 256-544-7015, richard.o.ballard@nasa.gov
Co-Chair: Stanley V. Gunn, Rocketyne (retired), Chatsworth, CA, 818-341-9503, svgunn@aol.com

Papers specifically solicited for this session address the development and integration of a nuclear thermal rocket at the system and subsystem level. Specific NTR subsystems include: Propellant Feed - Supplies propellant from the tank to the power-head subsystem under pressure. Constituent components include valves, ducts and turbomachinery; Powerhead - Produces and transfers thermal energy to the propellant. Constituent components include the pressure vessel, propellant inlet plenum, and reactor assembly; Nozzle - Produces thrust by expanding heated propellant through a divergent nozzle section. Constituent components include a regeneratively cooled throat section and a radiatively cooled nozzle extension; Instrumentation and Avionics - Performs NTR system control and health management. Constituent components include the engine controller, sensors, clamps, harnesses, sense lines, etc; Ancillary subsystems - Other subsystems supporting but not critical to primary system operation. These subsystems can include purges, decay heat management, power generation and thrust augmentation; Externals - Other components that do not specifically support the function of one of the above listed subsystems, but provides a function at the system level. This includes the gimbal bearing, ancillary lines, etc.

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C14. Non-Nuclear Testing and Evaluation

Chair: Melissa Van Dyke, NASA Marshall Space Flight Center, Huntsville, AL, 256-544-5720, melissa.k.vandyke@nasa.gov
Co-Chair: Jon Carmack, Idaho National Laboratory, Idaho Falls, ID, 208 526 6360, jon.carmack@inl.gov

Papers related to realistic non-nuclear testing of space nuclear systems are encouraged. Specific topics include testing in support of the Project Prometheus Program, testing in support of the Flight TOPAZ and Thermionic Systems Evaluation Test (TSET) program, and testing in support of radioisotope system development and utilization. Papers that include experimental results are especially encouraged.

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C15. High-Power Electric Propulsion Systems

Chair: Michael R. LaPointe, NASA Marshall Space Flight Center, Huntsville, AL, 256-544-2648, michael.r.lapointe@nasa.gov
Co-Chair: James Polk, Jet Propulsion Laboratory, Pasadena, CA, 818-354-9275, james.e.polk@jpl.nasa.gov

High power electric propulsion is an integral component of the in-space transportation infrastructure supporting the multi-decade *Vision for U. S. Space Exploration*. Electric propulsion power levels are expected to grow from a few to several tens of kilowatts for solar system robotic and near-Earth missions, to several hundred kilowatts for lunar cargo delivery, up to several megawatts to tens of megawatts for Mars cargo delivery and crewed exploration. This call invites papers related to the research, development, testing, and transition to flight of high power pulsed or steady-state electric propulsion systems. Topics of interest include, but are not limited to: the design and operation of power conversion systems for electric thrusters or thruster arrays; electric propulsion power management and distribution systems; electric propulsion thermal management systems; the design and performance of component, subsystem, and system technologies for individual thrusters or high power thruster arrays; concepts for innovative electric propulsion systems, including electrodeless thrusters; analytic and numerical simulations of high power electric thruster or propulsion system performance; analytic or numerical simulations of high power electric propulsion mission scenarios; and overview papers of current or planned program activities in high power electric propulsion.

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C16. Integration and Utilization of Surface Fission Energy Sources

Chair: Steve Gaddis, NASA Marshall Space Flight Center, Huntsville, AL, 256-544-6632**,** Stephen.W.Gaddis@msfc.nasa.gov
Co-Chair: John Scott, NASA Johnson Space Flight Center, Houston, TX, 281-483-3136**,** john.h.scott@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 transport, potential materials for use in lunar or Martian environments, system requirements, methods for transferring process heat, integrated waste heat rejection systems, and others. Systems optimized for providing electrical power and systems optimized for providing both electrical power and thermal energy are of interest. Papers that discuss relevant experimental results or other data are of particular interest, as are those on power distribution and control systems that would work with a surface fission energy source.

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C17. Thermal Energy Transport and Heat Rejection Technology

Chair: Donald M. Ernst, Advanced Cooling Technologies, Inc., Lancaster, PA, 717-295-6061, Don.Ernst@1-ACT.com
Co-Chair: Scott Downing, Hamilton Sundstrand United Technologies, Rockford, IL, (815) 394-2811, scott.downing@hs.utc.com

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 subsystems 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.

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C18. Space Reactor Shield Design Methods and Technologies

Chair: J. Boise Pearson, NASA Marshall Space Flight Center, Huntsville, AL, 256-961-0078**,** j.boise.pearson@nasa.gov
Co-Chair: Shannon Bragg-Sitton, Los Alamos National Laboratory, Los Alamos, NM, 256-544-6272, Shannon.M.Bragg-Sitton@nasa.gov

Radiation shielding for space systems has long been a concern a challenge and a necessary evil. The advent of two NASA projects, Constellation and Prometheus, has created an increased awareness in the need to increase the effectiveness and efficacy of radiation

shielding for both manned and unmanned flight. The ability to adequately protect both humans and hardware and to minimize the effective cost penalties of mass and volume will be a crucial element of future space missions. This session will focus on the new and existing shield materials, systems engineering and design considerations to increase shielding efficacy, and requirements for radiation shielding to meet future mission needs.

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C19. Space Nuclear Power Systems: Simulation and Modeling

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

Papers are invited that present engineering design and analysis of fission reactor power systems for use in space or on the surfaces of the Moon, planets and other extraterrestrial bodies. It is expected that the focus of the paper will be on the reactor, but it is recommended that papers encompass the complete power system (reactor, control, shield, power conversion) 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. Power levels of interest cover a broad range from a few kilowatts to 100's of kilowatts electric (or thermal powers up to few megawatts if the paper does not encompass power conversion). In addition to performance analyses for particular reactor concepts, papers evaluating various technologies for use in space and/or surface application are also sought. Trade comparisons between nuclear reactor power systems and alternative systems (e.g., solar power systems) are additionally welcomed and encouraged.

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C20. Dynamic Power II: > Kilowatt Class

Chair: Lee Mason, NASA Glenn Research Center, Cleveland, OH, 216-977-7106**,** Lee.Mason@grc.nasa.gov
Co-Chair: Tim Bauch, Hamilton Sundstrand, Rockford, ILL, 815-226-5301, tim.bauch@hs.utc.com

Papers are invited that deal with the technology, design and development of Brayton, Rankine and Stirling power conversion cycles for use into a > Kilowatt electric range for space power systems. Specific topics 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.

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C21. Safety and Reliability

Chair: Joseph Sholtis, Sholtis Engineering & Safety Consulting, Tijeras, NM, 505-281-4358, sholtis@aol.com
Co-Chair: Larry DeFillipo, SAIC, Reston, VA, 703-318-4603, defillipol@saic.com

Papers are solicited on all aspects of space nuclear safety from a system, program or mission perspective. Topics include, but are not limited to: programmatic safety policies, philosophies, procedures, processes, guidelines, and criteria, as well as design & operational safety requirements or specifications important for space nuclear safety; system safety insights, perspectives, and practices applicable to space nuclear systems and missions; safety analyses, assessments, and evaluations of space nuclear systems or missions; modeling and simulation tools; verification and testing; and safety/risk communications, including public perceptions, concerns, and confidence in space nuclear systems/missions and ways to enhance information flow to and from the public.

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C22. Non-Nuclear Testing in Support of Nuclear Thermal Propulsion Development

Chair: Wayne, Bordelon, NASA Marshall Space Flight Center, Huntsville, AL, 256-544-5720, wayne.bordelon@nasa.gov
Co-Chair: Patrick McDaniel, Sandia National Laboratories, Albuquerque, NM, 505 284-8352, pjmcdan@sandia.gov

Papers related to realistic non-nuclear testing of space nuclear systems, particularly nuclear thermal propulsion systems, are encouraged. Specific topics include testing in support of the Prometheus Power and Propulsion Program, testing in support of the Flight TOPAZ and Thermionic Systems Evaluation Test (TSET) program, and testing in support of radioisotope system development and utilization. Papers that include experimental results in support of the development of nuclear thermal propulsion fuels and materials using non-nuclear approaches are especially encouraged.

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C23. Human Lunar and Mars Mission Power and Propulsion Requirements

Chair: TBD
Co-Chair: Henry W. Brandhorst, Auburn University, Auburn, AL, 334-844-5894, brandhh@mail.auburn.edu

President Bush announced the NASA Vision for Space Exploration in January 2004, and with it the new NASA initiative to send humans back to the Moon and on to the surface of Mars. To achieve these long-term exploration goals, these missions will require power and propulsion capabilities beyond the technological state-of-the-art to meet requirements for reliability, safety, lifetime, and performance. NASA will also be seeking technologies that can reduce life-cycle cost. Papers are requested that explore the requirements for transportation propulsion, as well as surface and in-space power systems supporting human exploration of the Moon and Mars. Also of interest are papers that explore techniques and methodologies to identify these requirements. Papers exploring technologies that could meet these requirements while reducing life-cycle cost are also welcome.

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C24. Radioisotope Power Systems Technology and Development

Chair: Patrick Frye, Pratt & Whitney Rocketdyne, Canoga Park, CA, 818-586-0363, patrick.frye@pwr.utc.com
Co-Chair: Jaime Reyes, Lockheed Martin Space Systems Company, King of Prussia, PA, 610 354-1553, Jaime.M.Reyes@lmco.com

Papers are invited that present engineering design and analysis, related to radioisotope power system (RPS) technology and development. Papers could address; overall technology, performance, and technical issues; system/generator design, development, and 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, the different power levels would range from hundreds of milliwatts, tens of watts, multi-hundred watts, multi-kilowatts to tens of 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 over 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 for space applications; critical technology, component, and 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 as well. Papers addressing RPS systems at the highest power levels would benefit by exploring comparisons with fission based concepts.

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C25. Fission Surface Power Component Technology Development

Chair: Lee Mason, NASA Glenn Research Center, Cleveland, OH, 216-977-7106**,** Lee.Mason@grc.nasa.gov
Co-Chair: TBD

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D. 5TH CONFERENCE ON HUMAN / ROBOTIC TECHNOLOGY AND THE NATIONAL 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
NASA Headquarters
Washington, DC
202 358-1401
robert.wegeng-1@nasa.gov

Christopher Moore, Program Co-Chair
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Session descriptions, chairs, and co-chairs to follow. In the interim, please contact the Program Chairs listed above.

D01. Human & Robotic Technology Opening Session

D02. Architecture Studies

D03. Advanced Operations & In Situ Resource Utilization

D04. Advanced Materials, Structures & Mechanisms

D05. Novel Concepts – I

D06. Advanced Avionics & Software

D07. The Human System

D08. Environmental Control and Life Support Technologies and Systems

D09. Advanced Thermal Technologies and Systems

D10. Novel Concepts – II

D11. Advanced Propulsion Technologies and Systems

D12. Advanced Power Technologies and Systems

D13. Advanced Protection Technologies and Systems

E. 5TH SYMPOSIUM ON SPACE COLONIZATION

EDWARD MCCULLOUGH, Program Chair
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ALEX IGNATIEV, Program Co-Chair
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ignatiev@uh.edu

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 eventual development of space settlements on the Moon and Mars. Along with these future 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), Space Settlements/Colonies, biotechnology, medicine, large scale processes and technologies and Mars and Other Planetary Terraforming.

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 residences 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 orbit (e.g., ISS) and on planetary bodies (Moon, Mars, etc); requires SRU for cost–effective implementation of exploration, base construction, human settlements in the Solar System; and eventually results in the terra-forming of Mars to give humankind a viable second home.

The sessions being organized at this symposium are discussed in more detail below and papers from the entire international community are encouraged.

E01. Space Colonization – Opening Session I

Chair: Edward McCullough, The Boeing Company, Huntington Beach, CA, 714-934-0625, edward.d.mccullough@boeing.com
Co-Chair: Alex Ignatiev, University of Houston, TX, 713-743-8215, ignatiev@uh.edu

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 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.

E02. Space Colonization – Opening II Session

Chair: Edward McCullough, The Boeing Company, Huntington Beach, CA, 714-934-0625, edward.d.mccullough@boeing.com
Co-Chair: Alex Ignatiev, University of Houston, TX, 713-743-8215, ignatiev@uh.edu

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 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.

E03. Space Exploration

Chair: Robert Cassanova, USRA/NASA Institute for Advanced Concepts, Atlanta, GA, 404-347-9633, bcass@niac.usra.edu
Co-Chair: Mark Benton, Boeing Space and Intelligence Systems, El Segundo, CA, 310-416-4554 Mark.Benton@boeing.com

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.

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E04. Space Bases on the Moon

Chair: Klauss Heiss, High Frontier, Washington DC, 703-535-8774, klaus.heiss@verizon.net
Co-Chair: Paul van Susante, Colorado School of Mines, Golden CO, 720-272-8892, paulvans@mines.edu

For the purpose of this technical session, 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. Priority will be given to papers exhibiting original concepts, innovative solutions to known environmental risk factors, and depth of analysis of technologies and functionalities. Submissions should contain enough detail for the program committee to evaluate the technical content of the final presentation and paper.

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E05. Space Resource Utilization on the Moon

Chair: William E. Larson, NASA Kennedy Space Center, FL, 321-867-8747, William.E.Larson@nasa.gov
Co-Chair: Gerald B. Sanders, NASA Johnson Space Center, Houston, TX, 281-483-9066, gerald.b.sanders1@jsc.nasa.gov

This session will address work in the area of utilization of the mineral and other resources of the Moon in space or at the Moon. Contributions may include architectures, systems and technologies, as well as performance and economic analyses of the application of mining, processing space resources, use of space resources (Solar) to support activities on the Moon and near vicinity. Papers are solicited on the following topics: propellant production and storage; silicon, iron, aluminum, and other metal production; building material developments (slag, ceramics, concrete, etc.); agriculture using lunar soil; and water or other volatile recovery from the lunar soils/surface. Resource access, beneficiation, separation, and material handling and product storage would also be desired.

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E06. Space Resource Utilization on Mars

Chair: Larry Clark, LMCO PO Box 179, Denver CO, 303 977 3818
larry.d.clark@lmco.com
Co-Chair: Adam Bruckner , University of Washington, Seattle, WA, 206-543-6143, bruckner@aa.washington.edu

This session will address work in the area of utilization of the resources of Mars and asteroids. Contributions may include architectures, systems and technologies, as well as performance and economic analyses of the application of mining and processing space resources to support activities on Mars and in space. Papers are solicited on the following topics: propellant production; silicon, iron, aluminum, and other metal production; hydrocarbon syntheses; building material developments (slag, ceramics, concrete, etc.); agriculture using Martian soil; gas separation/purification; and water recovery from the Martian soils/surface/sub-surface (drilling) and from the atmosphere. Resource access, beneficiation, separation, and material handling and product storage would also be desired.

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E07. 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.

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E08. Biotechnology and Medicine for Space Colonization

Chair: Diana Jennings, USRA/NASA Institute for Advanced Concepts, Atlanta, GA, 404-347-9633, djennings@niac.usra.edu
Co-Chair: Ronald E. Turner, NIAC/ANSER, Arlington, VA, 703 416-3264, ron.turner@anser.org

This session will address work in the area of biotechnology and health care, both physical and psychological. Contributions may include forecasts for near term biotechnology, the exploitation of endogenous bacteria to produce drugs and to modify physiology and enhance survivability, the use of biological machines for mems technology, biologically based electronics, biomimetic systems for autonomy, bacteriorhodopsin based

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.

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E09. Large Scale Processes and Technologies for Colonization

Chair: Roger Lenard, Sandia Laboratories Albuquerque, NM, (505) 845-3143, rxlenar@sandia.gov
Co-Chair: John Brandenburg, Florida Space Institute, Kennedy Space Center, Florida, 32899, (321) 452-9834 ext 214, jbranden@mail.ucf.edu

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.

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E10. Terraforming, Domed Ecosystems and Planetary

Chair: Eric E. Rice, Orbital Technologies Corporation, Madison, WI, 608-827-5000 ex. 2730, ricee@orbitec.com
Co-Chair: Penelope Boston, New Mexico Institute of Technology, Socorro, NM, 505-835-5657, pboston@nmt.edu

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.

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F. 4TH SYMPOSIUM ON NEW FRONTIERS AND FUTURE CONCEPTS

PAUL MURAD, Program Chair
United States Department of Defense
Washington DC
571-432-1340,
ufoguypaul@yahoo.com

TONY ROBERTSON, Program Co-Chair
Propulsion Research Center/XD21
Marshall Space Flight Center, AL 35812
256-544-7102/4560, Fax: 256-544-2216,
Glen.A.Robertson@nasa.gov

Our objective is to present papers that deal with experiments, theories, and approaches that will help man achieve both a short-term and long-term destiny of space exploration. The short-term objective supports the near-term Presidential space initiative for man to return to the Moon and Mars, which implies using tried and proven methods or Heritage Technology, and the long-term objective is to lay down the scientific foundation necessary for future generations to extend mankind's reach beyond our solar system. Despite this contemporary focus, we would like to maintain a forum that stretches our intellectual capabilities and imagination, to study advanced technical disciplines ranging from communications, power generation/storage, and propulsion to investigating current (Relativity & Quantum Mechanics) and advanced theories (String & etc.) that will broaden our understanding of the relativistic space environment. Moreover, the global prospective toward space propulsion will aggressively continue moving forward regardless of current U.S. positions. The knowledge base gathered from the global prospective will allow for a more competitive international environment forcing a quicker return to research in space propulsion and power once the U.S. has dealt with its near-term priorities. A session is added that concerns itself with improving our understanding of Einstein's field equations and how they are applicable to future propulsion schemes. Thus, we hope this forum will maintain a flow of ideas. Furthermore, this forum will keep the doors open for advances in more non-conventional propulsive and power approaches that yield tremendous technology and economic dividends in both investment dollars and potential applications for future generations.

We desire clearly written papers for the current generation of scientists and engineers to nurture future generations. Papers should provide a balance between observations, ideas, theory, and experiments. Ideas need to be stated in a meaningful scientific format; theoretical papers need to address experiment(s) as a theory is useless without experimental verification; credible experiments need not support theory while experiments may support some theoretical approach that is either known or yet to be discovered. Abstracts and papers will be reviewed for conciseness, clarity, and originality according to the supporting information, theoretical analysis, and references provided, and should be 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 less) that would be used with the paper per standard STAIF procedure. Foreign authors are required to pre-register by 01 August 2006 and submit final drafts by 01 September 2006.

F01. Potential Frontiers

Chair: Charles Suchomel, USAF/ Air Force Research Laboratory Wright-Patterson AFB, OH, 937-904-8653, Charles.Suchomel@afrl.af.mil
Co-Chair: Franklin Mead, USAF/ Air Force Research Laboratory, Edwards AFB, CA, 661-275-5929, franklin.mead@edwards.af.mil

Overview papers are invited that summarize potential advancements, requirements, and maturation needed in various technologies including propulsion, power generation/storage, communications and other areas that will 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. Papers are encouraged that give overviews of research programs and technology development over the past year(s) and papers that describe new discoveries and/or report new scientific findings that encourage the public and governmental agencies to pursue additional scientific investigations are encouraged. Specific interest is in ideas from College and University level students. These papers should contain information that supports the major themes of the following sessions. This may involve an overview perspective that describes analytical or experimental results already obtained or experiments that are in progress are especially welcome.

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F02. Advanced Technologies for Terrestrial (Earth, Lunar, & Mars) and Relativistic Environments Based Propulsion and Power Concepts

Chair: John Cole, NASA Marshall Space Flight Center, Huntsville, AL, 256 544-4290, john.w.cole@nasa.gov
Co-Chair: David Goodwin, US Department of Energy, Washington DC, 301-903-6474, dave.goodwin@science.doe.gov

Papers are solicited that examine diverse, innovative, emerging, novel technologies, and the innovative use of existing technologies as well as their extensions, and generalizations to the propulsion and power generation/storage problem. Papers, if possible, should also 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. The collaborative research community needs to understand the impact of how novel technologies can contribute to a wide range of space system. Papers are invited that examine but are not limited to: 1) Understanding the Environment considering cosmic rays and charged particles that impact propulsion, 2) Advances in Magnet Technology for Space Propulsion and Power, 2) Earth, Moon & Mars-Based Launchers and other emerging technologies in the context of enhancing the feasibility of future propulsion/power generation.

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F03. Propulsion and Power Concepts for Taming the Solar System

Chair: Eric Davis, Institute for Advanced Studies at Austin, TX, 512-342-2187, ewdavis@earthtech.org
Co-Chair: R.M.L. Baker, GRAVWAVE, LLC, Playa del Rey, CA, 310 823-4143, robert.baker.jr@comcast.net

There is 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. The desire is to examine these concepts to ensure that the conventional wisdom has given these disciplines adequate consideration and that they possess a stable scientific foundation if extensive and continued research is to be justified. Moreover, papers should stress other topics that will have an impact on future propulsion systems. Papers are invited but are not limited to: 1) Innovative Space Propulsion and Power Approaches, 2) Alternative Concepts, and 3) Shielding Concepts.

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F04. Experimental Results and New Concepts within Current Physical Models

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

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F05. Innovative Theories and Concepts for Communications

Chair: Gary Stephenson, Seculine Consulting, Bellevue, WA, 425 443-8651, seculine@comcast.net
Co-Chair: Gregory V. Meholic, Aerospace Corporation, El Segundo, CA, 310 336-2919, Greg.V.Meholic@aero.org

This session will deal with theoretical and experimental analyses associated with the potential of quantum theory to provide advanced communication channels for use to space systems. Topics of interest will include, but not be limited to: advances in quantum theory, interpretation, and practice with regards to wave function collapse, quantum entanglement, cloning, teleportation, and communication. Capabilities of particular interest would include communication schemes that avoid the $1/r^2$ law, support higher bandwidths than possible with classical communications, afford better security, or are 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 arguments that lead to significant conclusions.

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F06. Theoretical Considerations – Warp Drives, FTL Speed Travel & Others

Chair: J.E. Brandenburg, Florida Space Institute-UCF, Orlando, FL, 407-882-3575, jbranden@mail.ucf.edu
Co-Chair: David Goodwin, US Department of Energy, Washington DC, 301-903-6474, dave.goodwin@science.doe.gov

There is considerable interest in understanding faster than light speed travel and the zero-point field in terms of new physics and other

consideration of such issues as they influence gravity, sensors, fields and suitable propulsion modes that may impact or be impacted by Einstein's Theory of Relativity. We need to address the limitations and assumptions in the Theory of Relativity to improve our understanding of this 4-space geometric representation. Other more novel future technologies or propulsion concepts not previously covered under the previous sessions also warrants discussion here. These may have applications to improve our understanding of how to use space travel at exceptionally long distances and relativistic speeds for space exploration. A subject of interest would also include shielding against meteorite impacts at relativistic conditions. Moreover, what is the impact of nanotechnology upon communications using quantum entanglement? What are the 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, that may have been largely ignored until now, may exist that warrant further investigations. Papers are also requested that answer questions such as: What would be the requirements for a Warp Drive Propulsor? How can one create a propulsion system, if suitable, that duplicates natural phenomena such as a transportable black hole? Finally, how to extract energy from the physical vacuum? Again, these papers must be balanced and follow sound scientific guidelines for acceptance.

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F07. An International Outlook on Far Term Propulsion and Power

Chair: Martin Tajmar, ARC Seibersdorf Research, Seibersdorf, Austria, +43-50550-3142, martin.tajmar@arcs.ac.at
Co-Chair: Charles Suchomel, USAF/ Air Force Research Laboratory Wright-Patterson AFB, OH, 937-904-8653, Charles.Suchomel@afrl.af.mil

The efforts of looking at unusual concepts and propulsion capabilities have made significant progress in the U.S. We are inviting papers from European scientists as well as other 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 subjects as outlined in the other sections.

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