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SPACE TECHNOLOGY & APPLICATIONS INTERNATIONAL FORUM (STAIF-2006) February 12 - 16, 2006

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The University of New Mexico

EDUCATION OUTREACH

18th Secondary School Special Session

Irene L. El-Genk , Chair	Susan Ostlie , Co-Chair
Cibola High School	Madison Middle School
Albuquerque Public Schools	Albuquerque Public Schools

18th Space Design Competition

Steven A. Hatton , Chair	Jack Parker , Co-Chair
Space Design Competition	Space Design Competition
UNM-ISNPS	UNM-ISNPS

10TH CONFERENCE ON THERMOPHYSICS APPLICATIONS IN MICROGRAVITY

PROGRAM CHAIR: Ted Swanson, NASA Goddard Space Flight Center, Greenbelt, MD
PROGRAM CO-CHAIR: Tung T. Lam, The Aerospace Corporation, El Segundo, CA

23RD SYMPOSIUM ON SPACE NUCLEAR POWER AND PROPULSION

PROGRAM CHAIR: R. Joseph Cassady, Aerojet, Washington, DC
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4TH SYMPOSIUM ON SPACE COLONIZATION

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Michael G. Houts
NASA Marshall Space Flight Center

Final Program

Russell Joyner
Pratt and Whitney

Insoo Jun
Jet Propulsion Laboratory

Alex Kristalinski
Aerojet

Tung T. Lam
The Aerospace Corporation

Michael L. LaPointe
NASA Marshall Space Flight Ctr.

Todd Leonhardt
Rhenium Alloys, Inc.

Fuk Li
Jet Propulsion Laboratory

James J. Martin
NASA Marshall Space Flight Ctr.

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NASA Glenn Research Center

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Jet Propulsion Laboratory

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Los Alamos National Laboratory

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Bruce G. Schnitzler
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Ashburn, VA

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NASA Langley Research
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NASA Headquarters
Washington, DC

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NASA Langley Research
Center

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4th Symposium on Space Colonization

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3rd Conference on New Frontiers and Future Concepts

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Franklin Mead, Jr.
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Martin Tajmar
ARC Seibersdorf Research

Eric W. Davis
Institute for Advance Studies

Greg Meholic
The Aerospace Corporation

R. Clive Woods
Iowa State University

Alan Goff
Novatia Labs

James F. Woodward
California State Univ., Fullerton

Education Outreach

Steven A. Hatton, Chair
Institute for Space and Nuclear Power Studies
University of New Mexico
Albuquerque, NM

Claudia O'Keefe, Co-Chair
Institute for Space and Nuclear Power Studies
University of New Mexico
Albuquerque, NM

Irene El-Genk
Cibola High School

Susan Ostlie
Madison Middle School

Jack Parker
ISNPS – UNM

CONTRIBUTING ORGANIZATIONS

IDAHO NATIONAL LABORATORY
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EXHIBITS

Hilton Albuquerque, Southwest Ballroom

Exhibit Hours:	Monday, February 13	9:00am – 12:30pm	1:30pm – 5:00pm	
	Tuesday, February 14	9:00am – 12:30pm	1:30pm – 5:00pm	6:30pm – 7:30pm
	Wednesday, February 15	9:00am – 12:30pm	1:30pm – 4:30pm	

Boeing

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University of New Mexico-ISNPS

AWARDS AND OUTREACH

SCHREIBER-SPENCE ACHIEVEMENT AWARD

2006 AWARD COMMITTEE:

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The Schreiber-Spence Space Achievement Award was established by The University of New Mexico's Institute for Space and Nuclear Power Studies to recognize contributions that have advanced capabilities in space technologies and applications through excellence in pioneering applications, technical contributions, public service, or leadership. The award consists of a memento and a monetary award of \$2,500 (shared equally if there are multiple awardees who have contributed jointly). The award is given by the Institute when a worthy person (or persons contributing jointly) is identified by the Awards Committee. The award is not given more frequently than, nor necessarily, annually. The Award(s) will be presented at the STAIF-2006 Banquet. The awardee(s) is expected to attend the STAIF Conference, at which the award is given, and to address the attendees on a relevant topic. The award honors Raemer E. Schreiber and Roderick W. Spence for their

pioneering and technical contributions to concepts and designs for nuclear propulsion in space during their tenure at Los Alamos National Laboratory.

NOMINATION: Nominations for the award can be submitted at any time to The University of New Mexico's Institute for Space and Nuclear Power Studies, c/o Schreiber-Spence Space Achievement Award, on the special nomination form. The final selection for the award will be made based on the criteria described in the award bylaws. A copy of the award bylaws and the nomination form can be obtained by writing to the Institute or by calling (505) 277-0446. Nominations will be retained for consideration for a three-year period.

SELECTION CRITERIA: Strict selection criteria have not been adopted, nor judged to be appropriate, except as they are implicit in the purposes for which the Award has been established and as noted in the first paragraph of these "Guidelines." Additionally, contributions are, or have been, substantial and specific, and contributions acknowledged to be worthy of unusual recognition for excellence by those actively engaged in the field of space technologies and applications.

NOMINATION FORM: To be considered by the Award Committee, all sections of the Nomination Form must be completed in compliance with the requirements. The Award

Final Program

Committee will place particular emphasis in its review of the nominations on evidence substantiating the excellence of the contributions noted in the citation and as contained in the basis

for the nomination. Nominations can be submitted at any time on the Nomination Form to ISNPS.

Recipients of the Schreiber-Spence Space Achievement Award:

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1988 Roderick W. Spence
1990 Jerome Mullein
1990 William E. Wright
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1992 Harold B. Finger
1993 Robert T. Carpenter
1993 James J. Lombardo
1994 George Gryaznov, Russia
1994 Victor Ya. Poupko, Russia
1995 Martin Marietta Astro Space RTG Team
1996 SNAP-10A Team

1996 Gary L. Bennett
1997 Wesley T. Huntress
1998 The Cassini Mission Power Source Team
1999 NSTAR Team and SCARLET Team
2002 Robert L. Wiley
2003 Robert L. Forward
2003 Teledyne Transit/ Nimbus/ Pioneer/Viking/
RTG Team
2004 Robert W. Bussard
2005 Ronald J. Sovie
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2006 Milton Klein

MANUEL LUJAN, JR. STUDENT PAPER AWARD

2006 AWARD COMMITTEE:

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The Manuel Lujan Jr. Student Paper Award was established in 1987 by The University of New Mexico's Institute for Space and Nuclear Power Studies to recognize outstanding contributions

by students in the field addressed at all conferences and symposia of the Space Technology & Applications International Forum. Up to two awards could be granted at the forum, with each consisting of a certificate and \$500.00, shared equally if more than one awardee. The award is given by the Institute when worthy contributions are identified by the award committee.

NOMINATION CRITERIA: Nominations for the award will be based on the quality of the paper published in the STAIF proceedings, as well as on the technical quality and originality of the oral presentation at the annual meeting. For a paper to be considered for the award, it must have the student as the lead author and he, she must have done the majority of the research.

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OUTSTANDING PAPER AWARD

2006 AWARD COMMITTEES:

Robert Abelson, Jet Propulsion Laboratory; **Samit Bhattacharyya**, RenMar Enterprises, Inc.; **Karl Baker**, The Aerospace Corporation; **Garry Burdick**, Jet Propulsion Laboratory; **Alex Ignatiev**, University of Houston; **Tung T. Lam**, Aerospace; **Mike LaPointe**, NASA Marshall Space Flight Center; **Raymond A. Lewis**, Pennsylvania State University; **Edward McCullough**, Boeing; **Wendell Mendell**, NASA Johnson Space Center; **Michael Nikitkin**, Swales Aerospace; **James Powell**, StarTram, Inc.; **Narayanan Ramachandran**, NASA Marshall Space Flight Center; **Eric Rice**, Orbital Technologies Corporation (ORBITEC); **Glen A. Robertson**, NASA Marshall Space Flight Center; **Robert Wegeng**, NASA Headquarters; **Abe Weitzberg**, Consultant; **Scott Wold**, WCTS; **Clive Woods**, Iowa State University; **Kirk Yerkes**, U.S. Air Force Research Laboratory; and **Steve Zinkle**, Oak Ridge National Laboratory.

The Space Nuclear Power and Propulsion Outstanding Paper Award was established in 1992 by The University of New Mexico's Institute for Space and Nuclear Power Studies (ISNPS) to recognize outstanding technical contributions to the fields of all hosted conferences and symposia of the Space Technology and Applications International Forum (STAIF). The recognition of an outstanding contribution is based upon the written paper published in the STAIF Proceedings and the content of the presentation at the meeting. The award is presented by ISNPS upon the recommendation of the STAIF Award Committees.

NOMINATION AND EVALUATION

PROCEDURE: Contributions from STAIF conferences could be nominated by the session chair and co-chair, or any member of that conference or symposia Outstanding Paper Award Subcommittee. Nomination forms will be given to the session chairs and co-chairs at the speakers' breakfast. Individuals who wish to have their contribution or a colleague's contribution considered may request that a member of the Outstanding Paper Award Committee attend the session in which the presentation will be made. The request must be made in writing to the ISNPS office or to the

STAIF Outstanding Paper Award Committee Chair. For consideration, nominations must be received by the ISNPS office or Outstanding Paper Award Committee Chair by the 2nd Friday in February following the STAIF Conference.

NOMINATION AND EVALUATION

CRITERIA: The paper and the content of the presentation represents a technical contribution that (1) has an influential impact on the field of the topic of the conference or symposia in which it was presented, (2) has lasting technical value, and (3) is likely to be built upon and referenced by their peers. The primary emphasis in the selection of the award will be based on the written paper. In the case of a close decision, input from subcommittee members who heard the oral presentation and the session chair and co-chair may be used to render a final decision. The paper must be well written, well organized, and have appropriate references and acknowledgments. The paper must also present a complete and scientifically sound analysis. The STAIF Outstanding Paper Award is presented for technical contributions. While overview and historical papers are important for the historical archives, they will not be considered for the award. The author(s) must be a major technical contributor to the work. The paper should also acknowledge all major technical contributors to the work who are not co-authors.

RECIPIENTS OF 2005 AWARD

(a) 9th Conference on Thermophysics in Microgravity: **R. Panneer Selvam**, University of Arkansas, Fayetteville, AR; **Lanachao Lin**, Universal Energy Systems, Dayton, OH; and **Rengasamy Ponnappan**, Air Force Research Laboratory, Wright-Patterson AFB, OH, for their paper titled, "Computational Modeling of Spray Cooling: Current Status and Future Challenges."

(b) 22nd Symposium on Space Nuclear Power and Propulsion: (i) **Emanuel A. Skrabek**, Orbital Science Corporation, Sterling, VA, for his paper titled, "Consideration of Lower Allowable Impact Temperature for DOP-26 Iridium Alloy Fueled Clads," and (ii) **Jack Mondt**, **Ken Johnson** and **Jean-Pierre Fleurial**, Jet Propulsion Laboratory, Pasadena, CA; **Mohamed El-Genk**, University of New Mexico; and **Patrick Frye** and **Bill Determan**, Pratt & Whitney Rocketdyne, Canoga Park, CA,

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for their paper titled “Segmented Thermoelectric Multicouple Converter Technology Development.”

(c) 3rd Symposium on Space Colonization: **Takashi Nakamura** and **Constance L. Senior**, Physical Sciences Inc., San Ramon, CA, for their paper titled “Solar Thermal Power System for Lunar ISRU Processes.”

(d) 2nd Symposium on New Frontiers and Future Concepts: (i) **Glen A. Robertson**, Gravi Atomi Research, Madison, AL, for his paper,

“Manipulating the Vacuum Scalar Field with Superconductors: A Search for Exotic Material,” and (ii) **Martin Tajmar**, **Klaus Hense**, and **Klaus Marhold**, ARC Seibersdorf Research, Seibersdorf, Austria, and **Clovis de Matos**, European Space Agency, Paris, France, for their paper, “Weight Measurements of High-Temperature Superconductors during Phase Transition in Stationary, Non-Stationary Condition and under ELF Radiation.”

GENERAL ERNEST C. HARDIN SCHOLARSHIP AWARD

This scholarship fund was established in 1986 by The University of New Mexico’s Institute for Space and Nuclear Power Studies to recognize outstanding undergraduate and graduate students in engineering and science disciplines with emphasis on space science and technology and related fields. Several awards are offered annually to deserving freshmen and undergraduate students. In addition, awards consist of a certificate of recognition and a monetary sum of \$500 per year, for up to four years. The graduate student award has a monetary value of \$14,000-\$16,000 per year, plus tuition waivers and health insurance for up to three years.

SECONDARY SCHOOL SPECIAL SESSION

Secondary School Special Session

This session is co-sponsored by the University of New Mexico’s Institute for Space and Nuclear Power Studies, the New Mexico Space Grant Consortium and NASA National Space Grant Colleges and Fellowship Program. Activities are coordinated by **Irene El-Genk**, Cibola High School, and **Susan Ostlie**, Madison Middle School. New Mexico secondary school students and teachers participating in the Space Design Competition are invited to attend this session. Space related topics will be presented to the attendees by members of the science and engineering committees.

18th Annual Space Design Competition

This event is co-sponsored by the University of New Mexico’s Institute for Space and Nuclear Power Studies, the New Mexico Space Grant Consortium and NASA National Space Grant Colleges and Fellowship Program. Activities are coordinated by **Steven A. Hatton** and **Jack Parker**, UNM-ISNPS. This year’s design objective is entitled, “Lunar Resort.” Judging of the event will take place during the Secondary School Special Session, and the results of the competition will be presented during Plenary Session – II, Monday, February 13, 2006.

PUBLICATIONS

Available from the American Institute of Physics, c/o Springer-Verlag New York, Customer Service, 1-800-777-4643, or e-mail orders@springer-ny.com, or mail to Springer-Verlag, P. O. Box 2485, Secaucus, NJ 07096-2485, USA (For North America, add \$4.00 for shipping and handling for the first volume, plus \$1.00 for each additional volume. For orders outside of North America, add \$10.00 for first volume and \$5.00 for each additional volume.)

Proc. Space Technology and Applications International Forum (**STAIF-2006**):
AIP Conf. Proceedings 813, (1-vol. hardcover book), ISBN 0-7354-0305-8.....\$320.00
CD-ROM Version, ISBN 0-7354-0306-6.....\$145.00

Proc. Space Technology and Applications International Forum (**STAIF-2005**):
AIP Conf. Proceedings 746, (1-vol. hardcover book), ISBN 0-7354-0231-0.....\$320.00

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CD-ROM Version, ISBN 0-7354-0230-0.....	\$145.00	
Proc. Space Technology and Applications International Forum (STAIF-2004):		
AIP Conf. Proceedings 699, (1-vol. hardcover book), ISBN 0-7354-0171-3.....	\$290.00	
CD-ROM Version, ISBN 0-7354-0172-0.....	\$145.00	
Proc. Space Technology and Applications International Forum (STAIF-2003):		
AIP Conf. Proceedings 654, (1-vol. hardcover book), ISBN 0-7354-0114-4.....	\$280.00	
CD-ROM Version, ISBN 0-7354-0115-2.....	\$140.00	
Proc. Space Technology and Applications International Forum (STAIF-2002):		
AIP Conf. Proceedings 608, (1-vol. hardcover book), ISBN 0-7354-0052-0.....	\$295.00	
CD-ROM Version, ISBN 0-7354-0053-9.....	\$150.00	
Proc. Space Technology and Applications International Forum (STAIF-2001):		
AIP Conf. Proceedings 552, (1-vol. hardcover book), ISBN 1-56396-980-7.....	\$280.00	
CD-ROM Version, ISBN 1-56396-981-5.....	\$150.00	
Proc. Space Technology and Applications International Forum (STAIF-2000):		
AIP Conf. Proceedings 504, (2-vol. hardcover set), ISBN 1-56396-919-X.....	\$300.00	
CD-ROM Version, ISBN 1-56396-920-3.....	\$200.00	
Proc. Space Technology and Applications International Forum (STAIF-99):		
AIP Conf. Proceedings 458, (2-vol. hardcover set), ISBN 1-56396-846-0.....	\$300.00	
CD-ROM Version, ISBN 1-56396-879-7.....	\$200.00	
Proc. Space Technology and Applications International Forum (STAIF-98):		
AIP Conf. Proceedings 420 (3-vol. hardcover set), ISBN 1-56396-747-2.....	\$320.00	
Proc. 12th Symposium on Space Nuclear Power & Propulsion, Conf. on Alternative Power from Space, and Conf. on Accelerator-Driven Transmutation Technologies and Applications (1995)		
AIP Conf. Proceedings 324 (2-vol. hardcover set), ISBN 1-56396-427-9.....	\$225.00	
Proc. 1st Conf. on NASA Centers for Commercial Development of Space (1-vol. hardcover book), ISBN 1-56396-431-7, AIP Conf. Proceedings 325.....		\$125.00
A Critical Review of Space Nuclear Power & Propulsion (1984-1993) (Anniversary Issue), AIP Press, ISBN 1-56396-317-5.....		\$ 75.00
Proceedings of the 10th Symposium (1993) (3-vol. hardcover set), ISBN 1-56396-137-7, AIP Conf. Proceedings 271.....		\$275.00
Proceedings of the 9th Symposium (1992) (3-vol. hardcover set), ISBN 1-56396-027-3, AIP Conf. Proceedings 246.....		\$225.00
Proceedings of the 8th Symposium (1991) (3-vol. hardcover set), ISBN 0-88318-838-4, AIP Conf. Proceedings 217.....		\$175.00
AIP Conf. Proceedings Volume 301 (Space Nuclear Power and Propulsion-1994), Volume 361 (STAIF-1996), and Volume 387 (STAIF-1997) . . .out of print.		

HOTEL ACCOMMODATIONS

Hilton Albuquerque, 1901 University Blvd. NE, Albuquerque, NM 87102-1713
(505) 884-2500, Fax (505) 880-1196, Toll Free Reservations: 1-800-774-1500

Guest rooms have been reserved at the Hilton Albuquerque, located in the University District, for those who identify themselves as participants of STAIF-2006. The rates are:

ROOM RATES

Single Occupancy \$66.00	Triple Occupancy \$66.00
Double Occupancy \$66.00	Quadruple Occupancy \$66.00

ALL ATTENDEES ARE RESPONSIBLE FOR MAKING THEIR OWN RESERVATIONS DIRECTLY WITH THE HOTEL.

All group-rate reservation requests must be received by the hotel no later than FEBRUARY 1, 2006. Attendees must identify themselves as participants of STAIF-2006, and provide our Group ID code, **STAIF-6**; otherwise, the hotel will not be able to ensure the quoted group rate or guest room availability. Rates will not be changed at check-in or check-out for attendees who fail to identify their affiliation with this meeting. Guests arriving after 4:00 p.m. must guarantee their reservation with a credit card or one night's deposit; otherwise, the room will automatically be released after 4:00 p.m. Check-in time is 3:00 p.m. and Check-out is 12:00 noon. Cancellations must be made seventy-two (72) hours prior to arrival to avoid billing or forfeiting the deposit received.

REGISTRATION AND FEES

Hilton Albuquerque, Garden Room

Sunday, February 12,	4:30 pm - 7:30 pm
Monday, February 13,	7:00 am - 5:30 pm
Tuesday, February 14,	7:00 am - 7:00 pm
Wednesday, February 15	7:00 am - 4:30 pm
Thursday, February 16	7:30 am - 10:30 am

ALL ATTENDEES AND EXHIBITORS MUST REGISTER & PAY A REGISTRATION FEE

- (a) Open Technical Meeting Full Registration Fee: Includes Sessions, Tuesday banquet, daily coffee breaks, and a set of Proceedings on CD-ROM.
- (b) One-Day Registration: Includes Technical Sessions, coffee breaks and a set of Proceedings on CD ROM. (Banquet tickets are not included, but are available for purchase).
- (c) Student Registration: **TO QUALIFY, INDIVIDUALS MUST SHOW PROOF OF FULL TIME ENROLLMENT** for the 2006 Spring Semester. Pre-registrants should enclose a copy of their 2006 spring schedules. Registration fee includes a set of Proceedings on CD ROM and coffee breaks.
- (d) Additional luncheon tickets can be purchased on-site if available, although pre-purchasing luncheon tickets is encouraged to help provide accurate numbers to the caterer.

Cash, corporate or personal checks, Visa and MasterCard will be accepted. Payment by a personal or corporate check should be made payable to: INSTITUTE FOR SPACE & NUCLEAR POWER STUDIES, STAIF-2006 Conferences, MSC01-1120, FEC Room 239, 1 University of New Mexico, Albuquerque, NM 87131-0001, (505) 277-2813 or (505) 277-0446.

	<u>Early</u>	<u>Late</u> (after 12/19/2005)
OPEN TECHNICAL MEETING(a)	\$495.00	\$550.00
ONE DAY REGISTRATION (b)	\$350.00	\$380.00
STUDENT (C)	\$175.00	\$190.00
ADDITIONAL LUNCHEON TICKET(D)	\$35.00	\$35.00

CANCELLATIONS AND REFUNDS

Those unable to attend the conferences may receive a refund of their registration fee (less a 20% processing charge) by calling the Institute office at (505) 277-0446 or by email at: isnps@unm.edu no later than January 16, 2006. All refunds will be made promptly by mail. NO REFUNDS WILL BE ISSUED after JANUARY 16, 2006.

AWARDS BANQUET

Tuesday, February 14, 7:30 pm - 9:30 pm, New Mexico Ballroom, Hilton Albuquerque.

One banquet ticket will be included with each full registration. Additional tickets must be purchased in advance. Please be certain that you and each of your guests have registered. *All guests must check in at registration to receive their name badge and banquet tickets.* Guest banquet tickets will *not* be included in the host's registration packet.

Master of Ceremonies: James H. Crocker, Lockheed Martin Aeronautics, Denver, CO

Guest Speaker: Brigadier General S. Pete Worden (retired), Placitas, NM

CHAIRS' AND SPEAKERS' BREAKFAST

All STAIF-2006 speakers and session chairs are requested to attend the hosted Speakers' Breakfast on the day of their session or presentation to discuss the session arrangements and guidelines. A Speakers' Preparation Room will be available Monday through Wednesday.

AUDIO / VISUAL EQUIPMENT

One (1) LCD Data Projector, and one (1) screen will be provided at all sessions. A slide or overhead projector will also be provided on request without charge. Additional A/V equipment must be ordered through Institute personnel, in advance, and paid for by the author. Please call (505) 277-0446 with special requests. Attendees must provide their own laptop computers.

COMMITTEE MEETINGS

Steering and Executive Committee

Monday, February 13, 6:30 pm – 8:30 pm, Parlor C/D

Technical Program Committees

Tuesday, February 14, 12:30 pm – 1:45 pm

(All Session Chairs and Co-Chairs are committee members. Lunch is available for purchase)

10th Conf. on Thermophysics Applications in Microgravity, Parlor E/F

23rd Symp. on Space Nuclear Power and Propulsion, New Mexico Ballroom South

4th Conf. on Human/Robotic Tech. and the National Vision for Space Exploration, Parlor G/H

4th Symp. on Space Colonization, Parlor A/B

3rd Symp. on New Frontiers and Future Concepts, Rio Grande Room

Executive Program Committee

Wednesday, February 15, 6:30 pm – 8:30 pm

PROGRAM ACTIVITIES

SUNDAY, February 12, 2006

4:30 pm - 7:30 pm **Registration**, Garden Room

MONDAY, February 13, 2006

7:00 am - 7:45 a.m. **Speakers' Breakfast**, Rio Grande Room

7:00 am - 5:30 pm **Registration**, Garden Room

7:30 am - 12:30 pm **Space Design Competition**, Cantina and Promenade West

8:00 am - 8:45 am **Opening Remarks**, New Mexico Ballroom

8:45 am - 10:15 am **Plenary Session I**, New Mexico Ballroom

8:35 am - 10:05 am **Secondary School Teacher's Workshop**, Parlor A/B

10:15 am - 10:45 am **Coffee Break**, Southwest Ballroom

10:45 am - 12:30 pm **Plenary Session II**, New Mexico Ballroom

10:05 am - 12:30 pm **Secondary School Special Session**, Rio Grande Room

12:30 pm - 1:45 pm **Brown Bag Lunch**, Nuclear Power and Exploration: The New Needs, Rio Grande Room

1:45 pm - 3:45 pm **Technical Sessions** (see table of contents or centerfold for time and room)

3:45 pm - 4:00 pm **Coffee Break**, Southwest Ballroom

4:00 pm - 6:00 pm **Technical Sessions** (see table of contents or centerfold for time and room)

6:30 pm - 8:30 pm **Joint Steering and Executive Committee Meeting**, Parlor C/D

TUESDAY, February 14, 2006

7:00 am - 7:45 am **Speakers' Breakfast**, Rio Grande Room

7:00 am - 7:00 pm **Registration**, Garden Room

8:00 am - 10:00 am **Technical Sessions** (see table of contents or centerfold for time and room)

10:00 am - 10:30 am **Coffee Break**, Southwest Ballroom

10:30 am - 12:30 pm **Technical Sessions** (see table of contents or centerfold for time and room)

12:30 pm - 1:30 pm **Lunch Break**

12:30 pm - 1:45 pm **STAIF Technical Program Committee Meetings**

10th Conf. on Thermophysics Applications in Microgravity, Parlor E/F

23rd Symp. on Space Nuclear Power and Propulsion, NM Ballroom South

4th Conf. on Human/Robotic Technology and the National Vision for Space Exploration, Parlor G/H

4th Symp. on Space Colonization, Parlor A/B

3rd Symp. on New Frontiers and Future Concepts, Rio Grande Room

1:45 pm - 3:45 pm **Technical Sessions** (see table of contents or centerfold for time and room)

3:45 pm - 4:00 pm **Coffee Break**, Southwest Ballroom

4:00 pm - 6:00 pm **Technical Sessions** (see table of contents or centerfold for time and room)

7:00 pm - 7:30 pm **No-Host Cocktail Reception**, Promenade and Southwest Ballroom

7:30 pm - 9:30 pm **STAIF-2006 Awards Banquet**, New Mexico Ballroom

WEDNESDAY, February 15, 2006

7:00 am - 7:45 am **Speakers' Breakfast**, Rio Grande Room

7:00 am - 4:30 pm **Registration**, Garden Room

8:00 am - 10:00 am **Technical Sessions** (see table of contents or centerfold for time and room)

10:00 am - 10:30 am **Coffee Break**, Southwest Ballroom

10:30 am - 12:30 pm **Technical Sessions** (see table of contents or centerfold for time and room)

12:30 pm - 1:45 pm **Lunch Break**

1:45 pm - 3:45 pm **Technical Sessions** (see table of contents or centerfold for time and room)

3:45 pm - 4:00 pm **Coffee Break**, Southwest Ballroom

4:00 pm - 6:00 pm **Technical Sessions** (see table of contents or centerfold for time and room)

6:30 pm - 8:30 pm **Executive Program Committee Meeting**, Parlor C/D

THURSDAY, February 16, 2006

7:00 am - 7:45 am **Speakers' Breakfast**, Rio Grande Room

7:00 am - 10:30 am **Registration**, Garden Room

8:00 am - 10:00 am **Technical Sessions** (see table of contents or centerfold for time and room)

10:00 am - 10:30 am **Coffee Break**, Promenade West

10:30 am - 12:30 pm **Technical Sessions** (see table of contents or centerfold for time and room)

OPENING REMARKS

Monday, February 13, 8:00 am – 8:45 am, New Mexico Ballroom

James H. Crocker, STAIF-2006 General Chair, Lockheed Martin Space Systems Company

Donald D. Cobb, STAIF-2006 General Co-Chair, Los Alamos National Laboratory

Reed Dasenbrock, Interim Provost, University of New Mexico

Charles Fleddermann, Associate Dean, School of Engineering, University of New Mexico

PLENARY SESSION I: EMBARKING ON A NEW AGE OF EXPLORATION TOGETHER

Monday, February 13, 8:45 am – 10:15 am, New Mexico Ballroom

James Crocker Chair
Vice President, Civil Space
Lockheed Martin Space Systems Co.
Denver, CO

Donald D. Cobb, Co-Chair
Acting Deputy Director
Los Alamos National Laboratory
Los Alamos, NM

Introduction

Honorable Heather Wilson, US House of Representatives (R) New Mexico

Scott J. Horowitz, Associate Administrator, Explorations Systems Mission Directorate

John Grossenbacher, Director, Idaho National Laboratory

PLENARY SESSION II: FROM ROMANCE TO PRAGMATISM FOR EXPLORATION

Monday, February 13, 10:45 am - 12:30 pm, New Mexico Ballroom

Bonnie Dunbar, Chair
President & CEO
Seattle Museum of Flight
Seattle, WA

Robert Sackheim, Co-Chair
Assistant Director and Chief Engineer for Propulsion
NASA Marshall Flight Center
Huntsville, AL

Introduction

Ron Sega, Undersecretary of the Air Force, Washington, D.C.

G. Thomas Marsh, Executive Vice President, Lockheed Martin Space Systems Company

Scott Pace, Associate Administrator for Program Analysis and Evaluation, NASA

12:15 pm – Presentation of Space Design Competition Student Awards, Steven A. Hatton and Jack Parker

SECONDARY SCHOOL SPECIAL SESSION

Monday, February 13, 10:05 am - 12:30 pm

Rio Grande Room

Irene L. El-Genk, Chair
Cibola High School, Albuquerque, NM

Susan Ostlie, Co-Chair
Madison Middle School, Albuquerque, NM

Jeff C. King, Institute for Space and Nuclear Power Systems, University of New Mexico, Albuquerque, NM

John E. Brandenburg, Florida Space Institute, University of Central Florida, Orlando, FL

SECONDARY SCHOOL TEACHER'S WORKSHOP

*Monday, February 13, 8:35 am – 10:05 am
Boardroom*

Steven A. Hatton, Chair, ISNPS, The University of New Mexico, Albuquerque, NM
Susan Brown, NASA Education Specialist, Director, Southern New Mexico Science,
Engineering, Mathematics, and Aerospace Academy, Las Cruces, NM

NUCLEAR POWER AND EXPLORATION: THE NEW NEEDS

MONDAY, FEBRUARY 13, 2006

Monday, February 13, 12:30 pm – 1:45 pm, Rio Grande Room

Brown Bag Lunch

Robert Sackheim, Chair, Assistant Director and Chief Engineer for Propulsion, NASA
Marshall Space Flight Center

TECHNICAL SESSIONS

MONDAY, FEBRUARY 13, 2006

[A01] Flight Experiences with Two-Phase Loops on Operational Spacecraft

Monday, February 13, 2006, 1:45 - 3:45 p.m. - Parlor E/F

Chairs: Ted Swanson, NASA Goddard Space Flight Center, Greenbelt, MD
Tung T. Lam, The Aerospace Corporation, Los Angeles, CA

1:45 pm - *Flight Experiences with Two-Phase Loops on Operational Spacecraft*
Ted Swanson, NASA Goddard Space Flight Center, Greenbelt, MD

2:30 pm - *Heat Rejection Concepts for Radioisotope Power Systems on the Lunar Surface*
E.W. Tobery, N. Deane, F. Dottore, D. Pantano, R. D. Cockfield, Jaime Reyes and
J. Braun, Lockheed Martin Space Systems Company, King of Prussia, PA; Ronald
A. Creel, Science Applications International Corp., Torrance, CA

3:15 pm - *Panel Discussion*

[D01] Human & Robotic Technology Opening Session

Monday, February 13, 2006, 1:45 - 3:45 p.m. - Parlor G/H

Chairs: John Mankins, Artemis Innovation, Ashburn, VA
Robert Wegeng, NASA Headquarters, Washington, DC

1:45 pm - *Welcome and Introduction*
John Mankins, Artemis Innovation, Ashburn, VA

2:15 pm - *An Overview of the NASA Exploration Technology Development Program*
Frank Peri, Christopher L. Moore, NASA Headquarters, Washington, D.C.

2:45 pm - *NASA Exploration Technology Program -- ESAS Study*
Jay Falker, Doug Craig, Jason Derleth, James J. Reuther, NASA Headquarters,
Washington, DC; Steve Cavanagh, Pat Troutman, NASA Langley Research
Center, Langley, VA; Brenda Ward, NASA Johnson Space Center, Houston, TX

Final Program

- 3:15 pm - *An Overview of the NASA Robotic Lunar Exploration Program***
Mark S. Borkowski, NASA Headquarters, Washington, D.C.

[C01] Prometheus Space Reactor Design Overview

Monday, February 13, 2006, 1:45 - 3:45 p.m. - New Mexico Ballroom South

- Chairs:** R. Joseph Cassady, Aerojet, Washington, DC
Garry Burdick, Jet Propulsion Laboratory, Pasadena, CA
- 1:45 pm - *Summary of NR Program Prometheus Efforts***
John Ashcroft, Lockheed Martin, KAPL, Inc., Schenectady, NY; Curtis Eshleman, Bechtel Bettis, Inc., West Mifflin, PA
- 2:15 pm - *Fast Gas Reactor Nuclear Design***
Jonathan Witter, Lockheed Martin, KAPL, Inc., Schenectady, NY
- 2:45 pm - *Fast Gas Reactor Mechanical Design***
Dennis Kedzierski, Bechtel Bettis, West Mifflin, PA; Christopher Maercklein, Lockheed Martin, KAPL, Inc., Schenectady, NY
- 3:15 pm - *Panel Discussion***

[E01] Space Colonization - Opening Session I

Monday, February 13, 2006, 1:45 - 3:45 p.m. - New Mexico Ballroom North

- Chairs:** Edward McCullough, Boeing, Riverside, CA
Alex Ignatiev, University of Houston, Houston, TX
- 1:45 pm - *NASA's Exploration Launch Plans***
Stephen Cook and John Sumrall, NASA Marshall Space Flight Center, Huntsville, AL
- 2:15 pm - *RLEP - Mission Summary Status***
Anthony Lavoie, NASA Marshall Space Flight Center, Huntsville, AL
- 2:45 pm - *Bases***
Klauss Heiss, High Frontier, Alexandria, VA
- 3:15 pm - *Settlements***
Anita Gale, Space Settlement Design Competitions, Nassau Bay, TX

[F01] Potential Frontiers - I

Monday, February 13, 2006, 1:45 - 3:45 p.m. - Rio Grande Room

- Chairs:** Charles Suchomel, Air Force Research Laboratory, Wright-Patterson AFB, OH
Franklin B. Mead, Air Force Research Laboratory, Edwards AFB, CA
- 1:45 pm - *Panel Discussion***
Paul A. Murad, Vienna, VA
- 2:15 pm - *An Evolutionary Model for Space Solar Power***
Nicholar Boechler, Sameer Hamerr, Sam S. Wanis, Narayanan Komerath, Georgia Institute of Technology, Atlanta, GA
- 2:45 pm - *Parallel Path Magnetic Technology for High Efficiency Power Generators and Motor Drives***
Charles J. Flynn, Flynn Research, Greenwood MO; Norman B. Talsoe, NBT Consulting, Minnetonka, MN; Jamie J. Childress, Boeing, Seattle, WA
- 3:15 pm - *The GEM (Gravity-Electro-Magnetism) Theory of Field Unification: Experimental Progress***
J.E. Brandenburg, Florida Space Institute, University of Central Florida, Kennedy Space Center, FL

[C02] Thermionic Technology and Application

Monday, February 13, 2006, 4:00 - 6:00 p.m. - Parlor A/B

Final Program

- Chairs:** Steven F. Adams, Air Force Research Laboratory, Wright-Patterson AFB, OH
Hal Streckert, General Atomics, San Diego, CA
- 4:00 pm - *Solar Thermionic Test in a Thermal Receiver***
Paul N. Clark, Jean-Louis Desplat, and Holger Streckert, General Atomics, San Diego, CA; Steven F. Adams, Air Force Research Laboratory, Wright Patterson AFB, Dayton, OH; James Smith, NASA Marshall Space Flight Center, Huntsville, AL
- 4:30 pm - *Solar Thermionic Space Power Technology Testing: A Historical Perspective***
Steven F. Adams, Propulsion Directorate, Air Force Research Laboratory, Wright Patterson AFB, OH
- 5:00 pm - *Thermionic Converters Based on Nanostructured Carbon Materials***
Franz A.M. Koeck, Yunyu Wang, and Robert J. Nemanich, North Carolina State University, Raleigh, NC
- 5:30 pm - *Thermionic Energy Conversion with Nanoscale Materials and Devices***
Yang Liu and Timothy S. Fisher, Purdue University, West Lafayette, IN

[A02] High Capacity Heat Rejection Systems

Monday, February 13, 2006, 4:00 - 6:00 p.m. - Parlor E/F

- Chairs:** Michael N. Nikitkin, Swales Aerospace, Beltsville, MD
Eric A. Silk, NASA Goddard Space Flight Center, Greenbelt, MD
- 4:00 pm - *A Thermal Management Solution for Pulsed High Heat Load Satellites Using a Novel Heat Storage Solution***
Charlotte Gerhart, AFRL/VSSL, Kirtland AFB, NM; Kaveh Khalili, Rocky Research, Boulder City, NV
- 4:30 pm - *Thermal Analysis and Shape Optimization of an In-Space Radiator Using Genetic Algorithms***
Patrick V. Hull, Mike Tinker, and Michael SanSoucie, Ken Kittredge, NASA Marshall Space Flight Center, Huntsville, AL
- 5:00 pm - *Material Options for Fabricating Radiator Facesheets in Support of Dynamic Power Conversion***
Cheryl L. Bowman, Mrityunjay Singh, QSS Inc., Cleveland, OH., David L. Ellis, NASA Glenn Research Center, Cleveland, OH
- 5:30 pm - *General Purpose Heat Source Stacking Configurations for High Power Radioisotope Power Systems***
E.W. Tobery, N. Deane, F. Dottore, D. Pantano, R. D. Cockfield, Jaime Reyes and J. Braun, Lockheed Martin, King of Prussia, PA; D. Wagner and J. Turpin, NASA Marshall Space Flight Center, Huntsville, AL

[D02] Human & Robotic Technology Advanced Protection and Propulsion

Monday, February 13, 2006, 4:00 - 6:00 p.m. - Parlor G/H

- Chairs:** Nantel Suzuki, NASA Headquarters, Washington, DC
David Beals, NASA Langley Research Center, Hampton, VA
- 4:00 pm - *Development of a Lunar Direct Return Capable Heatshield for CEV***
James J. Reuther, Paul Wercinski, Ethiraj Venkatapathy, Don Ellerby, George Raiche, NASA Ames Research Center, Moffett Field, CA; Lynn Bowman, Craig Jones, NASA Langley Research Center, Langley, VA; John Kowal, NASA Johnson Space Center, Houston, TX
- 4:30 pm - *In-Space Cryogenic Fluid Management, Transfer and Storage Technologies for Exploration Systems***
Joe T. Howell, NASA Marshall Space Flight Center, Huntsville, AL; David J.

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Chato, NASA Glenn Research Center, Cleveland, OH

5:00 pm - *Ultralightweight Ballutes for Return from the Moon*

Jim Masciarelli, Ball Aerospace, Boulder, CO

5:30 pm - *Panel Discussion*

[C03] Reactor Systems Concepts for Surface Power – I

Monday, February 13, 2006, 4:00 - 6:00 p.m. - New Mexico Ballroom South

Chairs: Robert L. Cataldo, NASA Glenn Research Center, Cleveland, OH
Michael G. Houts, NASA Marshall Space Flight Center, MSFC, AL

4:00 pm - *Design of a Low Power, Fast-Spectrum, Liquid-Metal Cooled Surface Reactor System*

T. F. Marcille, D.D. Dixon, G.A. Fisher, S.P. Doherty, D. I. Poston, and R. J. Kapernick, Los Alamos National Laboratory, Los Alamos, NM

4:30 pm - *Solid Core, Gas-Cooled Reactor for Space and Surface Power*

Jeffrey C. King and Mohamed S. El-Genk, Institute for Space and Nuclear Power Studies, University of New Mexico, Albuquerque, NM

5:00 pm - *A Stainless-Steel, Uranium-Dioxide, Potassium-Heat-Pipe-Cooled Surface Reactor System*

Benjamin Amiri, University of Florida, Gainesville, FL; Bryan T. Sims, Purdue University, West Lafayette, IN; David I. Poston, and Richard J. Kapernick, Los Alamos National Laboratory, Los Alamos, NM

5:30 pm - *SUSEE: A Compact Lightweight Space Nuclear Power System Using Present Water Reactor Technology*

George Maise, James Powell and John Paniagua, Plus Ultra Technologies, Inc., Shoreham, NY

[E02] Space Colonization - Opening Session II

Monday, February 13, 2006, 4:00 - 6:00 p.m. - New Mexico Ballroom North

Chairs: Edward McCullough, Boeing, Riverside, CA
Alex Ignatiev, University of Houston, Houston, TX

4:00 pm - *Status on Development of the Regolith & Environment Science and Oxygen and Lunar Volatile Extraction (RESOLVE) Experiment for Lunar ISRU*

Gerald B. Sanders, NASA Johnson Space Center, Houston, TX

4:30 pm - *Current Knowledge on the Existence and Distribution of H₂O on Mars*

Greg Mungas, Jet Propulsion Laboratory, Pasadena, CA

5:00 pm - *Grand Visions for Colonization of Space*

Robert Cassanova, USRA-NASA Institute for Advanced Concepts, Atlanta, GA

5:30 pm - *Space Resource Utilization on The Moon and Mars*

Ed McCullough, Boeing, Huntington Beach, CA; Larry D. Clark, Lockheed Martin Space Systems Company, Denver, CO

[F02] Experimental Results and New Concepts within Current Physical Models - I

Monday, February 13, 2006, 4:00 - 6:00 p.m. - Rio Grande Room

Chairs: Gary Stephenson, Seculine Consulting, Bellevue, WA
Paul A. Murad, Vienna, VA

4:00 pm - *Review of Experimental Concepts for Studying the Quantum Vacuum Field*

E. W. Davis and H. E. Puthoff, Inst. for Advanced Studies at Austin, Austin, TX;
V. L. Teofilov, Lockheed-Martin Space Systems, Sunnyvale, CA; B. Haisch,
ManyOne Networks, Scotts Valley, CA; L. J. Nickisch, NorthWest Research
Associates, Bellevue, WA; A. Rueda, California State University-Long Beach,

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Long Beach, CA; D. C. Cole, Boston University, Boston, MA

4:30 pm - *Is Faster-Than-Light Communication Possible?*

Raymond W. Jensen, University of Notre Dame, Notre Dame, IN

5:00 pm - *Gravitomagnetic Fields in Rotating Superconductors to Solve Tate's Cooper Pair Mass Anomaly*

Martin Tajmar, ARC Seibersdorf Research, Seibersdorf, Austria; Clovis de Matos, European Space Agency - HQ, Paris, France

5:30 pm - *Traveling in the Computational Universe*

Giorgio Fontana, University of Trento, Italy

TUESDAY, FEBRUARY 14, 2006

[C04] Thermophotovoltaic Power Conversion Technology

Tuesday, February 14, 2006, 8:00 - 10:00 a.m. - Parlor A/B

Chairs: Christopher S. Murray, Sandia National Laboratories, Albuquerque, NM
Edward J. Brown, Lockheed Martin Space Systems Company, Schenectady, NY

8:00 am - *Summary of Thermophotovoltaic Testing Results*

Edward J. Brown, KAPL, Inc, Lockheed Martin, Schenectady, NY

8:30 am - *Thermophotovoltaic Energy Conversion for Space Applications*

V.L. Teofilo, P. Choong, J. Chang, and Y-L. Tseng, Lockheed Martin Space Systems Company, Palo Alto, CA.; W. Chen, University of California, San Diego, CA

9:00 am - *Performance of a Space Based Thermophotovoltaic System Operating at a High Heat Rejection Temperature*

David DePoy, E. J. Brown, H. Ehsani, P. M. Fourspring, J. J. Azarkevich, S. R. Burger, M. W. Dashiell, T. A. Lavery, K. D. Rahner, Lockheed Martin Space Systems Company, Schenectady, NY; T. D. Rahmlow, E. J. Gratrix, J. E. Lazo-Wasem, Rugate Technologies, Inc., Oxford, CT; B. R. Wernsman, Bechtel Bettis, Inc., West Mifflin, PA

9:30 am - *Radioisotope Micropower System Using Thermophotovoltaic Energy Conversion*

Robert D. Koudelka, Christopher S. Murray, James G. Flemming, and Michael J. Shaw, Sandia National Laboratories, Albuquerque, NM; Vince Teofilo, Lockheed Martin Space Systems, Sunnyvale, CA; Charles Alexander, Oak Ridge National Laboratory, Oak Ridge, TN

[A03] Thermal Control Technologies for Future Spacecraft

Tuesday, February 14, 2006, 8:00 - 10:00 a.m. - Parlor E/F

Chairs: Jeffrey R. Didion, NASA Goddard Space Flight Center, Greenbelt, MD
Kirk L. Yerkes, USAF / Air Force Research Laboratory, Wright-Patterson AFB, OH

8:00 am - *Issues and Advancements for Space Durable Multi-Functional Thermal Control Coatings*

Joyce Dever and Donald A. Jaworske, NASA Glenn Research Center, Cleveland, OH; Mukhund S. Deshpande, Applied Material Systems Engineering, Inc., Schaumburg, IL; Clifford A. Cerbus, University of Dayton Research Institute, Dayton, OH

8:30 am - *Material Opportunity to Electronic Composite Enclosures for Aerospace and Spacecraft Thermal Management*

Roland Watts, Mark Kistner and Amanda Colleary, AFRL/MLBC and AFRL/MLSC, Wright Patterson AFB OH

9:00 am - *Demonstration of a Low-Lift Heat Pump for High-Power Spacecraft Thermal Control*

Lawrence R. Grzyll, Mainstream Engineering Corporation, Rockledge, FL

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- 9:30 am - *Atlas Centaur Extensibility to Long-Duration In-Space Applications***
Bernard F. Kutter, Frank Zegler, Sam Lucas, Larry Hines, Mohamed Ragab, and Josh Hopkins, Lockheed Martin Space Systems Company, Denver, CO; Iran Spradley, Lockheed Martin Space Systems Company, Palo Alto, CA

[D03] Human & Robotic Technology Advanced Power and Thermal

Tuesday, February 14, 2006, 8:00 - 10:00 a.m. - Parlor G/H

- Chairs:** Frank Peri, NASA Langley Research Center, Hampton, VA
Carlos Campos, NASA Headquarters, Washington, DC
- 8:00 am - *NASA's Plans for Advanced Development of Fuel Cells and Batteries in Support of the Exploration Vision***
Mark A. Hoberecht, Thomas B. Miller, Monica I. Hoffmann, Michelle A. Manzo, NASA Glenn Research Center, Cleveland, OH
- 8:30 am - *Advanced Thermal Control Systems for the Exploration Vision***
Molly S. Anderson, David T. Westheimer, NASA Johnson Space Center, Houston, TX
- 9:00 am - *Advanced Batteries for Space***
Suresh Mani, Biying Huang, Charlie Xu, Kevin Yin, Traci Chin, Chris Silkowski, and Mike Wixom, T/J Technologies, Ann Arbor, MI
- 9:30 am - *High Energy Density Regen Power Systems***
Larry D. Clark and Kevin S. Payne, Lockheed Martin Space Systems Company, Denver, CO

[C05] Prometheus Space Reactor Plant Characteristics

Tuesday, February 14, 2006, 8:00 - 10:00 a.m. - New Mexico Ballroom South

- Chairs:** John Ashcroft, Knolls Atomic Power Laboratory, Schenectady, NY
Desari V. Rao, Los Alamos National Laboratory, Los Alamos, NM
- 8:00 am - *Factors Influencing Selection of Components for a Direct Gas Brayton Space Reactor System***
John Ashcroft, Sean Belanger, Wayne Burdge, Krista Jensen, N. Beth Proctor, Lockheed Martin, KAPL, Inc., Schenectady, NY; Eric Clementoni, Annie Zemo-Fulkerson, Bechtel Bettis, West Mifflin, PA
- 8:30 am - *Pressure Vessel and Reflector Temperature Sensitivity Studies of a Notional Gas-Cooled Space Reactor***
David Volk, Bechtel Bettis, West Mifflin, PA
- 9:00 am - *Prometheus Hot Leg Piping Concept***
Anastasia Gribik, Bechtel Bettis, West Mifflin, PA; Peter DiLorenzo, Lockheed Martin, KAPL, Inc., Schenectady, NY
- 9:30 am - *Sensors for Gas Brayton Reactor Concept***
Kent Loomis, John Boyle, Lockheed Martin, KAPL, Inc., Schenectady, NY; Darren Robare, Bechtel Bettis, West Mifflin, PA

[C06] Special Session on Mars Exploration

Tuesday, February 14, 2006, 8:00 - 10:00 a.m. - New Mexico Ballroom North

- Chairs:** Samad Hayati, Jet Propulsion Laboratory, Pasadena, CA
Noel W. Hinners, Lockheed Martin Space Systems Company (retired), Denver, CO
- 8:00 am - *Viking '76 Lander: Lessons Learned from the United States' First Mars Surface Mission Enabled by Nuclear Power***
Noel W. Hinners, Lockheed Martin Space Systems Company (retired), Denver, CO
- 8:30 pm - *Mars Pathfinder/Sojourner and the Exploration Rovers: Help Me Get Through***

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the Night (and Then Some)

Jacob R. Matijevec and Joy A. Crisp, Jet Propulsion Laboratory, Pasadena, CA

9:00 am - *The Potential Benefits of Nuclear Power on the Surface of Mars: The Robotic Exploration Perspective*

Samad Hayati and Tibor S. Balint, Jet Propulsion Laboratory, Pasadena, CA

9:30 am - *Pioneering the Path to Mars: Prometheus Power and Propulsion Near-Term Plans and Investments to Meet Long-Term Exploration Needs*

John W. Warren, NASA Headquarters, Washington, DC

[C07] Electric Propulsion Systems/Concepts

Tuesday, February 14, 2006, 10:30 a.m. - 12:30 p.m. - Parlor A/B

Chairs: Alex Kristalinski, Aerojet, Redmond, WA
Douglas I. Fiehler, QSS Group, Inc., Cleveland, OH

10:30 am - *Radioisotope Electric Propulsion: Enabling the Decadal Survey Science Goals for Primitive Bodies*

Ralph McNutt Jr., R.E. Gold, L. M. Prockter, P.H. Ostdiek, J.C. Leary, The Johns Hopkins University, Laurel, MD; D.I. Fiehler, QSS Group, Inc., Cleveland, OH; S.R. Oleson, K.E. Witzberger, NASA Glenn Research Center, Cleveland, OH

11:00 am - *Radioisotope Electric Propulsion: Technology Options and Mission Opportunities*

Steven R. Oleson, NASA Glenn Research Center, Cleveland, OH; Douglas I. Fiehler, QSS Group, Brookpark, OH; Paul H. Ostdiek, The Johns Hopkins University Applied Physics Laboratory, Laurel, MD

11:30 am - *Thruster Trades for Discovery and New Frontiers Class REP Missions*

Randy Aadland, Andy Hoskins, Aerojet, Redmond, WA; R. Joseph Cassidy, Aerojet, Washington, DC

12:00 pm - *Use of High-Power Brayton Nuclear Electric Propulsion (NEP) for a 2033 Mars Round-Trip Mission*

Melissa L. McGuire, Michael C. Martini, Thomas W. Packard, and John E. Weglian, NASA Glenn Research Center, Cleveland, OH; James H. Gilland, Ohio Aerospace Institute, Brook Park, OH

[C08] Advanced Nuclear Concepts and Technologies

Tuesday, February 14, 2006, 10:30 a.m. - 12:30 p.m. - Parlor E/F

Chairs: James J. Martin, NASA Marshall Space Flight Center, Huntsville, AL
George H. Miley, University of Illinois, Urbana-Champaign, Urbana, IL

10:30 am - *An Investigation of Bremsstrahlung Reflection in a Dense Plasma Focus Propulsion Device*

Robert E. Thomas and G.H. Miley, University of Illinois at Urbana - Champaign, Urbana, IL; Franklin B. Mead, AFRL/PRSP, Edwards AFB, CA

11:00 am - *Planetary Surface Power and Interstellar Propulsion Using Fission Fragment Magnetic Collimator Reactor*

Pavel V. Tsvetkov and Ron R. Hart, Texas A&M University, College Station, TX; Don B. King and Gary E. Rochau, Sandia National Laboratories, Albuquerque, NM

11:30 am - *FIREBALL: Fusion Ignition Rocket Engine with Ballistic Ablative Lithium Liner*

Adam K. Martin, Richard H. Eskridge, Michael H. Lee, NASA Marshall Space Flight Center, Huntsville, AL; Perter J. Fimognari, University of Alabama in Huntsville, Huntsville, AL

12:00 pm - *Design and Initial Testing of New Components and Diagnostics in the High Performance Antiproton Trap (HiPAT)*

J. Boise Pearson, NASA Marshall Space Flight Center, Huntsville, AL; and

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Raymond A. Lewis, RLewis Company, Boalsburg, PA

**[D04] Cross-Cutting Modular Design Technologies,
and Their Application to a Near-Term
Solar Electric Transport Spacecraft - I**

Tuesday, February 14, 2006, 10:30 a.m. - 12:30 p.m. - Parlor G/H

- Chairs:** John T. Dorsey, NASA Langley Research Center, Hampton, VA
Timothy J. Collins, NASA Langley Research Center, Hampton, VA
- 10:30 am - *Innovative Modular Design of Exploration Spacecraft, with Application to Solar-Electric Transport Vehicles: A Project Overview***
Timothy J. Collins, John Dorsey and William R. Doggett, NASA Langley Research Center, Hampton, VA
- 11:00 am - *System Definition and Mission Implementation of a Modular Cis-Lunar Solar Electric Tug***
Dennis Ray Wingo, SkyCorp Incorporated, Huntsville, AL; Gordon Woodcock, Huntsville, AL; John T. Dorsey and William R. Doggett, NASA Langley Research Center, Hampton, VA
- 11:30 am - *Framework For Defining And Assessing Benefits Of A Modular Assembly Design Approach For Exploration Space Systems***
John T. Dorsey, Timothy J. Collins, William R. Doggett, NASA Langley Research Center, Hampton, VA; Rud V. Moe, NASA Goddard Spaceflight Center, Greenbelt, MD
- 12:00 pm - *Flight Mechanics and Control Requirements for a Modular Solar Electric Tug Operating in Earth-Moon Space***
Gordon Woodcock, Technical Consultant, Huntsville, AL; Dennis Wingo, SkyCorp, Inc., Huntsville, AL

**[C09] Refractory Metal System Design, Manufacturing,
Fabrication, and Joining Techniques**

Tuesday, February 14, 2006, 10:30 a.m. - 12:30 p.m. - New Mexico Ballroom South

- Chairs:** Todd Leonhardt, Rhenium Alloys, Inc., Elyria, OH
Paul B. Willis, Jet Propulsion Laboratory, Pasadena, CA
- 10:30 am - *Fabricating The Solid Core Heat Pipe Reactor***
Peter J. Ring and Edwin D. Sayre, Advanced Methods and Materials, Inc., Sunnyvale, CA; Mike G. Houts, NASA Marshall Space Flight Center, Huntsville, AL
- 11:00 am - *Preliminary Investigations of Joining Technologies for Attaching Refractory Metals to Ni-Based Superalloys***
Jerry E. Gould, Edison Welding Institute, Columbus, OH; Frank J. Ritzert, NASA Glenn Research Center, Cleveland, OH; William S. Loewenthal, Ohio Aerospace Institute, Cleveland, OH
- 11:30 am - *Thermal-Mechanical Studies for Gas-Cooled Space Reactor Designs***
Richard J. Kapernick and William C. Creamer, Los Alamos National Laboratory, Los Alamos, NM
- 12:00 pm - *The Effect of the Presence of 2 wt% Hafnium in T-111***
Chadwick D. Barklay, University of Dayton, Dayton, OH; Daniel P. Kramer, University of Dayton Research Institute, Dayton, OH; Roger G. Miller, Argonne National Laboratory, Idaho Falls, ID

[C10] Space Nuclear Reactor Power Systems and Concepts

Tuesday, February 14, 2006, 10:30 a.m. - 12:30 p.m. - New Mexico Ballroom North

- Chairs:** David I. Poston, Los Alamos National Laboratory, Los Alamos, NM
Bill J. Nesmith, Jet Propulsion Laboratory, Pasadena, CA
- 10:30 am - *Radiation Shielding Design and Orientation Considerations for a 1 kW Heat Pipe Cooled Reactor Utilized to Bore Through the Ice Caps of Mars***
Michael Fensin, University of Florida, Gainesville, FL; John O. Elliott, Jet Propulsion Laboratory, Pasadena, CA; Ron Lipinski, Sandia National Laboratories, Albuquerque, NM, David I. Poston, Los Alamos National Laboratory, Los Alamos, NM
- 11:00 am - *S⁴ Reactor: Operating Lifetime and Estimates of Temperature and Burnup Reactivity Coefficients***
Jeffrey C. King and Mohamed S. El-Genk, Institute for Space and Nuclear Power Studies, The University of New Mexico, Albuquerque, NM
- 11:30 am - *A Solid Core Heatpipe Reactor With Cylindrical Thermoelectric Converter Modules***
Edwin D. Sayre, Engineering Consultant, Los Gatos, CA; Sam Vaidyanathan, Consulting Engineer, San Jose, CA
- 12:00 pm - *How Small Can Fast-Spectrum Space Reactors Get?***
Steven A. Hutton and Mohamed S. El-Genk, Institute for Space and Nuclear Power Studies, The University of New Mexico, Albuquerque, NM

[F03] Theoretical Considerations – Warp Drives, FTL Speed Travel & Others

Tuesday, February 14, 2006, 10:30 a.m. - 12:30 p.m. - Rio Grande Room

- Chairs:** John E. Brandenburg, Florida Space Institute, Orlando, FL
David Goodwin, U.S. Department of Energy, Washington, DC
- 10:30 am - *Ultra-High-Intensity Lasers for Gravitational Wave Generation and Detection***
R.M.L. Baker, Jr., GRAVWAVE LLC, Playa del Rey, CA; Fangyu Li, Chongqing University, Chongqing, P.R. China; Ruxin Li, Chinese Academy of Sciences, Shanghai, P.R. China
- 11:00 am - *Experimental Concepts for Generating Negative Energy in the Laboratory***
E. W. Davis and H. E. Puthoff, Institute for Advanced Studies at Austin, Austin, TX
- 11:30 am - *Exact Relativistic ‘Antigravity’ Propulsion***
Franklin S. Felber, Starmark Inc., San Diego, CA
- 12:00 pm - *The Alcubierre Warp Drive in Higher Dimensional Spacetime***
H.G. White, League City, TX; E.W. Davis, Institute for Advanced Studies at Austin, Austin, TX

[E03] Space Tourism/Adventures

Tuesday, February 14, 2006, 1:45 - 3:45 p.m. - Parlor A/B

- Chairs:** Christopher Lee Martens, Mutual Space, Ltd., Crestline, CA
Jane Reifert, Incredible Adventures Inc, Sarasota, FL
- 1:45 pm - *How to Build a Successful Adventure Business: A Primer for Space Tourism Companies***
Jane Reifert, Incredible Adventures, Inc., Sarasota, FL
- 2:15 pm - *Designing the Orbital Space Tourism Experience***
Derek Webber, Spaceport Associates, Rockville, MD
- 2:45 pm - *Lunar Colonization and NASA’s Exploration Changes***
Raymond B. Gavert, NASA Headquarters, Washington, DC

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- 3:15 pm - Evidence for a Large Natural Nuclear Reactor in Mars' Past**
John Brandenburg, Florida Space Institute, University of Central Florida, Orlando, FL

[A04] Variable Emittance Coatings and Applications

Tuesday, February 14, 2006, 1:45 - 3:45 p.m. - Parlor E/F

- Chairs:** Donya M. Douglas, NASA Goddard Space Flight Center, Greenbelt, MD
William J. Biter, Sensortex, Inc., Kennett Square, PA
- 1:45 pm - Surface Power Radiative Cooling Tests**
Jason Vaughn and Todd Schneider, NASA Marshall Space Flight Center, Huntsville, AL
- 2:15 pm - Electrochromic Devices For Satellite Thermal Control**
Hulya Demiryont and Kenneth Shannon III, Eclipse Energy Systems Inc., St. Petersburg, FL; Rengasamy Ponnappan, Propulsion Directorate, Air Force Research Laboratory, Wright Patterson AFB, OH
- 2:45 pm - Development Status of Electrostatic Switched Radiator**
William J. Biter, Stephen Hess, and Sung Oh, Sensortex, Inc., Kennett Square, PA
- 3:15 pm - Panel Discussion**

[D05] Human & Robotic Technology Novel Concepts

Tuesday, February 14, 2006, 1:45 - 3:45 p.m. - Parlor G/H

- Chairs:** Sharon M. Garrison, NASA Goddard Space Flight Center, Greenbelt, MD
Christopher L. Moore, NASA Headquarters, Washington, DC
- 1:45 pm - Precision Landing and Hazard Avoidance Technology Demonstration Program**
Robert V. Frampton, James M. Ball, Karl C. Oittinen, The Boeing Company, Huntington Beach, CA 92647; Mata Bishun, MacDonald Dettwiler Associates(MDA), Ontario, Canada; Robert D. Richards, Optech Inc., Toronto, Ontario, Canada
- 2:15 pm - Automated Assembly and Reconfiguration of Large-Scale Space Systems**
Larry D. Dewell, Salma I. Saeed, Nelson Pedreiro, Lockheed Martin Space Systems Company, Palo Alto, CA
- 2:45 pm - Modular, Multifunctional, and Self-Reconfigurable SuperBot for Space Technology**
Wei-Min Shen and P. M. Will, University of Southern California, Information Sciences Institute, Marina del Rey, CA; J. Bogdanowicz, Raytheon, El Segundo, CA; W. Chun, Lockheed Martin Space Systems Company, Boulder, CO; M. Yim, University of Pennsylvania, Philadelphia, PA; M. Sims and S.Colombano, NASA Ames Research Center, Moffett Field, CA; D. Kortenkamp, Metrica Corp, Houston, TX; S. Vanderzy, Alliance Spacesystems, Inc., Pasadena, CA; E. Baumgartner, Jet Propulsion Laboratory, Pasadena, CA J. Taylor, University of Hawaii, Honolulu, HI
- 3:15 pm - Micro-Inspector Spacecraft for Space Exploration Missions and Beyond**
Leon Alkalai, Hannah Goldberg and Juergen Mueller, Jet Propulsion Laboratory, Pasadena, CA

[C11] Nuclear Thermal Rockets: Past, Present, and Future - I

Tuesday, February 14, 2006, 1:45 - 3:45 p.m. - New Mexico Ballroom South

- Chairs:** Stanley K. Borowski, NASA Glenn Research Center, Cleveland, OH
Wayne Bordelon, NASA Marshall Space Flight Center, Huntsville, AL
- 1:45 pm - Crewed Orbiter / Moon Survey Mission to Mars Using "Bimodal" NTR Propulsion**

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Stanley K. Borowski, NASA Glenn Research Center, Cleveland, OH; Thomas W. Packard, Analex Corporation, Brook Park, OH; David R. McCurdy, QSS Group Inc., Cleveland, OH

2:15 pm - *Conceptual Engine System Design for NERVA Derived 66.7KN and 111.2KN Thrust Nuclear Thermal Rockets*

James E. Fittje, Analex Corp, Cleveland, OH; Robert J. Buehrle, NASA Glenn Research Center, Brookpark, OH

2:45 pm - *Zero Boil-Off System Design and Thermal Analysis of the Bimodal Thermal Nuclear Rocket*

Robert J. Christie, ZinTechnologies, Brook Park, OH.; David W. Plachta, NASA Glenn Research Center, Cleveland, OH

3:15 pm - *Power System Assessment to Support the Staging in Low-Earth-Orbit of a Mars Piloted Vehicle Using Nuclear Thermal Propulsion*

Robert L. Cataldo, NASA Glenn Research Center, Cleveland, OH

[C12] Dynamic Power I - 100 We Class

Tuesday, February 14, 2006, 1:45 - 3:45 p.m. - New Mexico Ballroom North

Chairs: Richard K. Shaltens, NASA Glenn Research Center, Cleveland, OH
Patrick E. Frye, Pratt & Whitney Rocketdyne, Canoga Park, CA

1:45 pm - *Low-Mass Stirling Convertor Assembly Progress Update*

Songgang Qiu, John E. Augenblick, and Darin Redinger, Infinia Corporation, Kennewick, WA

2:15 pm - *Advanced Stirling Convertor Update*

J. Gary Wood, Sunpower, Inc., Athens, OH; Cliff Carroll, Dan Matejczyk and E. Soendker, Pratt and WhitneyRocketdyne, Canoga Park, CA; L. B. Penswick, Stevenson, WA

2:45 pm - *Accelerated Life Structural Benchmark Testing for a Stirling Convertor Heater Head*

David L. Krause, NASA Glenn Research Center, Cleveland, OH; Pete T. Kantzos, Ohio Aerospace Institute, Cleveland, OH

3:15 pm - *Panel Discussion*

[F04] Advanced Technologies for Terrestrial (Earth, Lunar & Mars) Based Propulsion and Power Concepts - I

Tuesday, February 14, 2006, 1:45 - 3:45 p.m. - Rio Grande Room

Chairs: Eric W. Davis, Institute for Advanced Studies at Austin, Austin, TX
Charles Suchomel, Air Force Research Laboratory, Wright-Patterson AFB, OH

1:45 pm - *An Adjoint Random-Walk Solution to the Heliospheric Transport Equation*

Keran O'Brien, Northern Arizona University, Flagstaff, AZ

2:15 pm - *Generation of Gravitational Waves with Nuclear Reactions*

Giorgio Fontana, University of Trento, Italy; Robert M. L. Baker, Jr., GRAVWAVE® LLC, Playa del Rey, CA

2:45 pm - *Closed-Form Solutions to the Transient/Steady-State Navier-Stokes Fluid Dynamic Equations*

P.A. Murad, Vienna, VA

3:15 pm - *Experimental Data Demonstrating Augmentation of Ambient Gravitational and Geomagnetic Fields*

Danielle Graham, NW Frontier Research Institute, Yelm, WA

[C13] Thermoelectric Power Conversion Technology and Applications - I

Tuesday, February 14, 2006, 4:00 - 6:00 p.m. - Parlor A/B

- Chairs:** Jean-Pierre Fleurial, Jet Propulsion Laboratory, Pasadena, CA
Bahman Heshmatpour, Teledyne Energy Systems, Inc., Hunt Valley, MD
- 4:00 pm -** *Advanced High Efficiency Thermoelectric Materials*
Laffite Flanders, Keith R. Cummer, Joseph Feinsinger, and Ben Heshmatpour, Teledyne Energy Systems, In., Hunt Valley, MD
- 4:30 pm -** *Status of Skutterudite-Based Thermoelectric Technology Components Development and Testing at JPL*
Thierry Caillat, Jet Propulsion Laboratory, Pasadena, CA
- 5:00 pm -** *A Three-Dimensional Analysis of Skutterudite-Based Segmented Unicouple with Metallic Coating*
Hamed H. Saber and Mohamed El-Genk, Institute for Space and Nuclear Power Studies, The University of New Mexico, Albuquerque, NM
- 5:30 pm -** *Aerogel Sublimation Suppression Barriers for Thermoelectric Generators*
Jeff Sakamoto, Jay Paik, Steve Jones, Thierry Caillat, and Jean-Pierre Fleurial, Jet Propulsion Laboratory, Pasadena, CA; Winny Dong, California Polytechnic State University, Pomona, CA

[A05] Two-Phase Thermal Control Systems

Tuesday, February 14, 2006, 4:00 - 6:00 p.m. - Parlor E/F

- Chairs:** Michael Pauken, Jet Propulsion Laboratory, Pasadena, CA
Donald M. Ernst, Advanced Cooling Technologies, Inc., Lancaster, PA
- 4:00 pm -** *Two-Phase Pressure Drop in a Twisted Tape Boiler for a Microgravity Rankine Cycle Power System*
Ryoji Oinuma, David Bean, Charles Neill, Kevin Supack, and Frederick Best, Texas A&M University, College Station, TX
- 4:30 pm -** *Two-Phase Thermal Management Systems for Space*
R. Scott Downing, Mike Andres, Dam Nguyen, David G. Halsey and Tim Bauch, Hamilton Sundstrand, Rockford, IL
- 5:00 pm -** *High Conductance Loop Heat Pipes for Space Application*
Sergey Y. Semenov, and Wei-Lin Cho, Thermacore, Inc., Lancaster, PA; Scott Jensen, Utah State University Research Foundation, North Logan, UT
- 5:30 pm -** *Miniature Loop Heat Pipe with Multiple Evaporators for Small Spacecraft (an ST8 Experiment for the New Millennium Program*
Jentung Ku, Laura Ottenstein, and Donya Douglas, NASA Goddard Space Flight Center, Greenbelt, MD; Michael Pauken, Jet Propulsion Laboratory, Pasadena, CA

[D06] Human & Robotic Technology: The Human System

Tuesday, February 14, 2006, 4:00 - 6:00 p.m. - Parlor G/H

- Chairs:** Gale Allen, NASA Headquarters, Washington, DC
Steve Davison, NASA Headquarters, Washington, DC
- 4:00 pm -** *Developing Crew Healthcare and Habitability Systems for the Exploration Vision*
Kathy Laurini and Charles F. Sawin, NASA Johnson Space Center, Houston, TX
- 4:30 pm -** *NASA's Plans for Developing Life Support and Environmental Monitoring and Control Systems*
B. M. Lawson, NASA Johnson Space Center, Houston, TX; Darrell L. Jan, Jet Propulsion Laboratory, Pasadena, CA

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- 5:00 pm - *A Strategy to Safely Live and Work in the Space Radiation Environment***
Barbara J. Corbin, Frank M. Sulzman, Sam Krenek, NASA Johnson Space Center, Houston, TX
- 5:30 pm - *Grand Visions for Exploration of Space with Humans and Robots***
Robert Cassanova and Diana Jennings, NASA Institute for Advanced Concepts, Atlanta, GA; Ron Turner, ANSER, Arlington, VA

[C14] Nuclear Thermal Rockets: Past, Present, and Future II

Tuesday, February 14, 2006, 4:00 - 6:00 p.m. - New Mexico Ballroom South

- Chairs:** Stanley K. Borowski, NASA Glenn Research Center, Cleveland, OH
Wayne Bordelon, NASA Marshall Space Flight Center, Huntsville, AL
- 4:00 pm - *Parametric Weight Study of Cryogenic Metallic Tanks for the "Bimodal" NTR Mars Vehicle Concept***
Daniel N. Kosareo, Zin Technologies, Inc., Brook Park, OH; Joseph M. Roche, NASA Glenn Research Center, Cleveland, OH
- 4:30 pm - *Parametric Sizing of Composite Metal Lined Tanks for Bimodal Nuclear Thermal Propulsion Applications***
Galib H. Abumeri, QSS Group, Cleveland, OH; Joseph M. Roche, NASA Glenn Research Center, Cleveland, OH
- 5:00 pm - *Structural Analyses of the Support Trusses for the Nuclear Thermal Rocket Engines and Drop Tanks***
David E. Myers, NASA Glenn Research Center, Cleveland, OH; Daniel N. Kosareo, Zin Technologies Incorporated, Brook Park, OH
- 5:30 pm - *Bimodal Nuclear Thermal Rocket Sizing and Trade Matrix for Lunar, Near Earth asteroid and Mars Missions***
David R. McCurdy and Reza Zinolabedini, QSS Group Inc., Cleveland, OH; Thomas M. Krivanek and Joseph M. Roche, NASA Glenn Research Center, Cleveland, OH

[C15] Reactor Systems Concepts for Surface Power - II

Tuesday, February 14, 2006, 4:00 - 6:00 p.m. - New Mexico Ballroom North

- Chairs:** Michael G. Houts, NASA Marshall Space Flight Center, MSFC, AL
Robert L. Cataldo, NASA Glenn Research Center, Cleveland, OH
- 4:00 pm - *Design Considerations and Conceptual Designs for Surface Nuclear Power Systems for the Moon and Mars***
David L. Blessing, Lockheed Martin Systems Management, Marlton, NJ; Joel Kirkland, Lockheed Martin Space Systems Company, Denver, CO
- 4:30 pm - *Lunar Fission Surface Power System Design and Implementation Concept***
John O. Elliott, Kim Reh, Duncan MacPherson, Jet Propulsion Laboratory, Pasadena, CA
- 5:00 pm - *Design of a 25-kWe Surface Reactor System Based on SNAP Reactor Technologies***
David D. Dixon, Matthew T. Hiatt, David I. Poston, and Richard J. Kapernick, Los Alamos National Laboratory, Los Alamos, NM
- 5:30 pm - *Water and Regolith Shielding for Surface Reactor Missions***
David I. Poston, Pratap Sadasivan, and David D. Dixon, Los Alamos National Laboratory, Los Alamos, NM; Katrina J. Leichter, University of Idaho, Moscow, ID; and Brian J. Ade, Purdue University, West Lafayette, IN

[F05] Experimental Results and New Concepts within Current Physical Models - II

Tuesday, February 14, 2006, 4:00 - 6:00 p.m. - Rio Grande Room

- Chairs:** James F. Woodward, California State University, Fullerton, Fullerton, CA
Greg V. Meholic, The Aerospace Corporation, El Segundo, CA
- 4:00 pm - *High Frequency Gravitational Wave Optics***
R. Clive Woods, Iowa State University, Ames, IA
- 4:30 pm - *Piezoelectric-Crystal-Resonator High-Frequency Gravitational Wave Generation and Synchro-Resonance Detection***
Robert M.L. Baker, Jr., GRAVWAVE LLC, Playa del Rey, CA; R. Clive Woods, Iowa State University, Ames, IA; Fangyu Li, Chongqing University, Chongqing, P.R. China
- 5:00 pm - *A Novel Variable-Focus Lens for HFGW***
R. Clive Woods, Iowa State University, Ames, IA
- 5:30 pm - *Minimum Experimental Standards in the Laboratory Search for Gravity Effects***
H. Reiss, University of Wuerzburg, Wuerzburg, Germany; G. Hathaway, Hathaway Consulting Services, Toronto, Canada

WEDNESDAY, FEBRUARY 15, 2006

[E04] Space Exploration

Wednesday, February 15, 2006, 8:00 - 10:00 a.m. - Parlor A/B

- Chairs:** Robert Cassanova, NASA Institute for Advanced Concepts, Atlanta, GA
Edward McCullough, Boeing, Riverside, CA
- 8:00 am - *StarTram: An Ultra Low-Cost Launch System to Enable Large Scale Exploration of the Solar System***
James Powell, George Maise, John Paniagua, StarTram, Inc., Shoreham, NY
- 8:30 am - *Mars Transfer and Lander Vehicle Concepts for Human Exploration Missions in the 2033-2038 Time Frame***
Benjamin B. Donahue, Boeing, Huntsville, AL
- 9:00 am - *Atlas as a Human Rated Launch Vehicle***
Michael J. Holguin, Lockheed Martin Space Systems Company, Denver, CO
- 9:30 am - *Conceptual Design for Interplanetary Spaceship Discovery***
Mark G. Benton, Sr., Boeing Space and Intelligence Systems, Los Angeles, CA

[A06] Thermal Control for Deep Space Missions

Wednesday, February 15, 2006, 8:00 - 10:00 a.m. - Parlor E/F

- Chairs:** Charles Dan Butler, NASA Goddard Space Flight Center, Greenbelt, MD
Eric Sunada, Jet Propulsion Laboratory, Pasadena, CA
- 8:00 am - *Mars Science Laboratory Rover Thermal Control Using a Mechanically Pumped Fluid Loop***
Pradeep Bhandari, Mauro Prina, Brenda Ramirez, Gaj Birur, Keith Novak, David Bame, Paul Karlmann, Michael Pauken, Jet Propulsion Laboratory, Pasadena, CA
- 8:30 am - *Lightweight Cryogenic Radiator***
Christopher L. Seaman and Timothy R. Knowles, Energy Science Laboratories, Inc., San Diego, CA
- 9:00 am - *Electron Beam Exposure of Thermal Control Paints on Carbon-Carbon and Carbon-Polyimide Composites***
Donald A. Jaworske, NASA Glenn Research Center, Cleveland, OH

Final Program

- 9:30 am - Vaporizing Heat Sink**
Timothy Knowles, Michael Carpenter, G. J. Price, and T. M. Bier, Energy Science Laboratories, Inc., San Diego, CA

[C16] Standard/Advanced RPS Concepts and Applications

Wednesday, February 15, 2006, 8:00 - 10:00 a.m. - Parlor G/H

- Chairs:** Robert Abelson, Jet Propulsion Laboratory, Pasadena, CA
Harold McFarlane, Idaho National Laboratory, Idaho Falls, ID
- 8:00 am - A Conceptual Titan Orbiter with Probe Mission Using Advanced Radioisotope Power Systems**
Robert D. Abelson, Thomas R. Spilker and James H. Shirley, Jet Propulsion Laboratory, Pasadena, CA
- 8:30 am - A Conceptual Venus Rover Mission Using Advanced Radioisotope Power Systems**
Michael Evans, James H. Shirley and Robert Dean Abelson, Jet Propulsion Laboratory, Pasadena, CA
- 9:00 am - Advanced Radioisotope Power System Enabled Titan Rover Concept with Inflatable Wheels**
Tibor S. Balint and James H. Shirley, Jet Propulsion Laboratory, Pasadena, CA.;
Timothy M. Schriener, Oregon State University, Corvallis, OR
- 9:30 am - Exploring Europa with an RPS-Powered Orbiter Spacecraft**
Robert D. Abelson, Jackie Green, James Shirley, Bill Smythe, and Thomas R. Spilker, Jet Propulsion Laboratory, Pasadena, CA

[C17] Nuclear Thermal Rocket Technology and Integration

Wednesday, February 15, 2006, 8:00 - 10:00 a.m. - New Mexico Ballroom South

- Chairs:** Richard Ballard, NASA Marshall Space Flight Center, Huntsville, AL
Stanley V. Gunn, Rocketdyne (Retired), Chatsworth, CA
- 8:00 am - Multiphysics Thermal-Fluid Design Analysis of a Non-Nuclear Tester for Hot-Hydrogen Material Development**
Ten-See Wang, John Foote, Ron Litchford, NASA Marshall Space Flight Center, Huntsville, AL
- 8:30 am - Non Nuclear NTR Environmental Simulator**
William J. Emrich, Jr., NASA Marshall Space Flight Center, Huntsville, AL
- 9:00 am - Turbopump Design & Analysis Approach for Nuclear Thermal Rockets**
Shu-cheng S. Chen and Joseph P. Veres, NASA Glenn Research Center, Cleveland, OH; James E. Fittje, Analex Corporation, Brook Park, OH
- 9:30 am - REIMR - A Process for Utilizing Liquid Rocket Propulsion-Oriented 'Lessons Learned' to Mitigate Development Risk in Nuclear Thermal Propulsion**
Richard O. Ballard, NASA Marshall Space Flight Center, Huntsville, AL

[C18] Non-Nuclear Testing in Support of Space Reactor Development

Wednesday, February 15, 2006, 8:00 - 10:00 a.m. - New Mexico Ballroom North

- Chairs:** Melissa Van Dyke, NASA Marshall Space Flight Center, Huntsville, AL
James E. Werner, Idaho National Laboratory, Idaho Falls, ID
- 8:00 am - Feasibility of Ground Testing a Moon and Mars Surface Power Reactor in EBR-II**
Sheryl L. Morton, Carl E. Bailey, Thomas J. Hill, and James E. Werner, Idaho National Laboratory, Idaho Falls, ID

Final Program

- 8:30 am - Lithium Circuit Test Section Design & Fabrication**
Thomas Godfroy, Anne Garber, and James J. Martin, NASA Marshall Space Flight Center, Huntsville, AL
- 9:00 am - Non-Nuclear Fuel Fabrication For Nuclear Thermal Propulsion**
Binayak Panda, Robert R. Hickman, Sandeep R. Shah, and Wayne Bordelon, NASA Marshall Space Flight Center, Huntsville, AL
- 9:30 am - Dynamic Response Testing in an Electrically Heated Reactor Test Facility**
Shannon M. Bragg-Sitton, NASA Marshall Space Flight Center, Huntsville, AL; T.J. Morton, The University of New Mexico, Albuquerque, NM

[C19] High Power Electric Propulsion Systems

Wednesday, February 15, 2006, 10:30 a.m. - 12:30 p.m. - Parlor A/B

- Chairs:** Michael R. LaPointe, NASA Marshall Space Flight Center, Huntsville, AL
James Polk, Jet Propulsion Laboratory, Pasadena, CA
- 10:30 am - High Power Electric Propulsion System For NEP**
Christophe R. Koppel, Olivier Duchemin, and Dominique Valentian, Snecma, France
- 11:00 am - Status of Magnetic Nozzle and Plasma Detachment Experiment**
D. Gregory Chavers, Chris Dobson, Jonathan Jones, Michael H. Lee, Adam K. Martin, Judith Gregory and Jim Cecil, NASA Marshall Space Flight Center, Huntsville, AL; Roger D. Bengtson, Boris Breizman and Alexey Arefiev, University of Texas at Austin, TX; Franklin Chang-Diaz, Jared Squire, Tim Glover and Greg McCaskill, Ad Astra Rocket Company, Houston, TX; Jason Cassibry and Zhongmin Li, University of Alabama, Huntsville, AL
- 11:30 am - Design and Construction of the PT-1 Prototype Plasmoid Thruster**
Richard H. Eskridge, Adam K. Martin, Michael H. Lee, NASA Marshall Space Flight Center, Huntsville, AL; Peter J. Fimognari, University of Alabama at Huntsville, Huntsville, AL
- 12:00 pm - Analytical and Experimental Determination of Magnetic Field Strength in Various Current Carrying Coil Geometries**
Jeremy Corpening and Ivana Hrbud, Purdue University, West Lafayette, IN

[C20] Missions Using Nuclear Power/Propulsion

Wednesday, February 15, 2006, 10:30 a.m. - 12:30 p.m. - Parlor E/F

- Chairs:** Bernard R. Wernsman, Bechtel Bettis, Inc, West Mifflin, PA
Lawrence E. DeFillipo, Science Applications International Corp., Reston, VA
- 10:30 am - A Saturn Ring Observer Mission Using Multi-Mission Radioisotope Power Systems**
Robert D. Abelson, Thomas R. Spilker and James H. Shirley, Jet Propulsion Laboratory, Pasadena, CA
- 11:00 am - A Nuclear Powered ISRU Mission to Mars**
Elvina Finzi, Andrea Davighi and Amalia Finzi, Politecnico di Milano, Italy
- 11:30 am - Active Temperature Compensation Using a High-Temperature, Radiation-Hardened, Fiber Optic, Hybrid Pressure and Temperature Sensor**
Robert S. Fielder, Matthew E. Palmer, Matthew A. Davis, Gordon P. Engelbrecht, Luna Innovations, Inc., Blacksburg, VA
- 12:00 pm - Initial Performance Evaluation of Optical Fibers, Sensors, and Connectors Under High-Energy Electron Beam Irradiation Relevant to the Jupiter Environment**
Matthew E. Palmer, Robert S. Fielder, David Slusher, Luna Innovations, Inc., Blacksburg, VA

[D07] Human & Robotic Technology Advanced Operations and In Situ Resource Utilization

Wednesday, February 15, 2006, 10:30 a.m. - 12:30 p.m. - Parlor G/H

- Chairs:** Robert Wegeng, NASA Headquarters, Washington, DC
John Mankins, Artemis Innovation, Ashburn, VA
- 10:30 am - NASA's New Technologies For Assisting Human Exploration**
Myron A. Diftler, Christopher J. Culbert, Rob Ambrose, NASA Johnson Space Center, Houston, TX
- 11:00 am - NASA's Plans for Developing Lunar ISRU for Robotic and Human Exploration**
Gerald B. Sanders, NASA Johnson Space Center, Houston, TX
- 11:30 am - Rough and Steep Terrain Lunar Surface Mobility**
Brian Wilcox, Jet Propulsion Laboratory, Pasadena, CA
- 12:00 pm - AWIMR - An Autonomous Walking Inspection and Maintenance Robot**
Mark L. Hanson, Rick Wagner, Hobson Lane, Gordon Barbay, Nathan Sentz, Michael Lim, Northrop Grumman Space and Technology, Redondo Beach, CA; Brett Kennedy, Jet Propulsion Laboratory, Pasadena, CA; Christopher Sheehan, ZIN Technologies, Inc, Cleveland, OH; Dimi Apostolopoulos, Mike Murphy, Metin Setti, Carnegie Mellon University, Pittsburgh, PA; Myron A. Diftler, NASA Johnson Space Center, Houston, TX

[C21] Integration and Utilization of Surface Fission Energy Sources

Wednesday, February 15, 2006, 10:30 a.m. - 12:30 p.m. - New Mexico Ballroom South

- Chairs:** Michael G. Houts, NASA Marshall Space Flight Center, MSFC, AL
Robert L. Cataldo, NASA Glenn Research Center, Cleveland, OH
- 10:30 am - A Comparison of Fission Power System Options for Lunar and Mars Surface Applications**
Lee S. Mason, NASA Glenn Research Center, Cleveland, OH
- 11:00 am - Design Options to Reduce the Cost of a First Generation Surface Reactor**
David I. Poston and Thomas F. Marcille, Los Alamos National Laboratory, Los Alamos, NM
- 11:30 am - Comparison of Reactor Cooling Technologies for Near-Term Surface Reactor Systems**
David I. Poston, Los Alamos National Laboratory, Los Alamos, NM
- 12:00 pm - Integration and Utilization of Nuclear Systems on the Moon and Mars**
Michael G. Houts, George R. Schmidt, Shannon M. Bragg-Sitton, Robert R. Hickman, Andy Hissam, Vance Houston, James J. Martin, Omar Mireles, David I. Poston, Bob Reid, Todd Schneider, Eric Stewart, Jason Turpin, Melissa Van Dyke, Jason Vaughn, and David Wagner, NASA Marshall Space Flight Center, Huntsville, AL

[C22] Thermal Energy Transport and Heat Rejection Technology

Wednesday, February 15, 2006, 10:30 a.m. - 12:30 p.m. - New Mexico Ballroom North

- Chairs:** Tung T. Lam, The Aerospace Corporation, Los Angeles, CA
William R. Determan, Pratt & Whitney Rocketdyne, Inc., Canoga Park, CA
- 10:30 am - Bellows-Type Accumulators for Liquid Metal Loops of Space Reactor Power Systems**
Jean-Michel Tournier and Mohamed S. El-Genk, Institute for Space and Nuclear Power Studies, The University of New Mexico, Albuquerque, NM

Final Program

- 11:00 am - *Design of a Thermoelectric Electromagnetic Pump for Liquid Metal Heat Transport Loop Applications***
W. R. Determan, D. Ades, K. Metcalf, D. Wait, G. O'Connor, J. Tosh, and M. Bebejian, Pratt & Whitney Rocketdyne Inc., Canoga Park, CA
- 11:30 am - *MMRTG Heat Rejection Summary***
Alan V. von Arx, Boeing, Canoga Park, CA
- 12:00 pm - *High Temperature Water Heat Pipes Radiator for a Brayton Space Reactor Power System***
Mohamed S. El-Genk and Jean-Michel Tournier, Institute for Space and Nuclear Power Studies, The University of New Mexico, Albuquerque, NM

**[F06] Experimental Results and New Concepts
within Current Physical Models - III**

Wednesday, February 15, 2006, 10:30 a.m. - 12:30 p.m. - Rio Grande Room

- Chairs:** R. Clive Woods, Iowa State University, Ames, IA
Martin Tajmar, ARC Seibersdorf Research GmbH, Seibersdorf, Austria
- 10:30 am - *Mach's Principle, Flux Capacitors, and Propulsion***
James F. Woodward and Peter Vandeventer, California State University, Fullerton, CA
- 11:00 am - *The Woodward Effect: Math Modeling and Continued Experimental Verifications at 2-to-4 MHz***
Paul March, Friendswood, TX; Andrew Palfreyman, San Jose, CA
- 11:30 am - *Experimental Study of the Machian Mass Fluctuation Effect Using a μ N Thrust Balance***
Nembo Buldrini, Klaus Marhold, Bernhard Seifert, and Martin Tajmar, ARC Seibersdorf Research GmbH, Austria
- 12:00 pm - *Electromagnetic Nonlinearity in the Dielectric Medium of Experimental EM Impulse-Momentum Systems***
Glen A. Robertson, NASA Marshall Space Flight Center, Huntsville, AL

[E05] Space Bases on the Moon

Wednesday, February 15, 2006, 1:45 - 3:45 p.m. - Parlor A/B

- Chairs:** Klaus Heiss, High Frontier, Alexandria, VA
Paul van Susante, Colorado School of Mines, Golden, CO
- 1:45 pm - *Architecture for a Mobile Lunar Base Using Lunar Materials***
David V. Smitherman, Daniel J. Dunn, II, NASA Marshall Space Flight Center, Huntsville, AL; Vinay Dayal, Iowa State University, Ames, IA
- 2:15 pm - *Biomedical Research Priorities for the Lunar Base***
David Robertson, André M. Diedrich, Andrew C. Ertl, Lynda Lane, and Italo Biaggioni; Center for Space Physiology and Medicine, Vanderbilt University, Nashville TN
- 2:45 pm - *Power System Concepts for the Lunar Outpost: A Review of the Power Generation, Energy Storage, Power Management and Distribution (PMAD) System Requirements and Potential Technologies for Development of the Lunar Outpost***
Zahid Khan, Bechtel Power, Frederick, MD; A. Vranis and A. Zavoico, Bechtel National, Frederick, MD; S. Freid, Bechtel Nevada, Las Vegas, NV; B. Manners, NASA Glenn Research Center, Cleveland, OH
- 3:15 pm - *Panel Discussion***

[C23] Space Reactor Shield Design Methods and Technologies

Wednesday, February 15, 2006, 1:45 - 3:45 p.m. - Parlor E/F

- Chairs:** Insoo Jun, Jet Propulsion Laboratory, Pasadena, CA
Brian Campbell, Knolls Atomic Power Laboratory (KAPL), Schenectady, NY
- 1:45 pm - *Shield Design for Lunar Surface Applications***
Gregory A. Johnson, Pratt & Whitney - Rocketdyne, Inc., Canoga Park, CA
- 2:15 pm - *Lunar Surface Reactor Shielding Study***
Shawn Kang and William McAlpine, Jet Propulsion Laboratory, Pasadena, CA;
Ronald Lipinski, Sandia National Laboratories, Albuquerque, NM
- 2:45 pm - *Increase in Propellant Tank Pressure from Hydrazine Radiolysis: Implications for Space Nuclear Power Systems***
Laurie Hixson, Herbert O. Funsten, and Bernard R. Foy, Los Alamos National Laboratory, Los Alamos, NM
- 3:15 pm - *A Study Of Spacecraft Charging Due To Exposure To Interplanetary Protons***
Nelson W. Green and Robb Frederickson, Jet Propulsion Laboratory, Pasadena, CA

[D08] Human & Robotic Technology Advanced Materials, Structures and Mechanisms

Wednesday, February 15, 2006, 1:45 - 3:45 p.m. - Parlor G/H

- Chairs:** David Beals, NASA Langley Research Center, Hampton, VA
Carlos Campos, NASA Headquarters, Washington, DC
- 1:45 pm - *Advanced Materials, Structures and Mechanisms: NASA's Development Plans***
Judith J. Watson, W. Keith Belvin, NASA Langley Research Center, Hampton, VA;
Suresh N. Singhal, NASA Marshall Space Flight Center, Huntsville, AL
- 2:15 pm - *Intelligent Flexible Materials for Deployable Space Structures (InFlex)***
David P. Cadogan, ILC Dover, Frederica, DE
- 2:45 pm - *Flexible Fabrics with High Thermal Conductivity for Advanced Spacesuits***
Kent A. Watson, Donavon M. Delozier, National Institute of Aerospace,
Hampton, VA; John W. Connell, Joseph G. Smith, Jr., Robin Southward, Sayata Ghose, NASA Langley Research Center, Hampton, VA; Luis Trevino, Grant Bue, Evelyne Orndoff, NASA Johnson Space Center, Houston, TX Yi Lin and Ya-Ping Sun, Clemson University, Clemson, SC
- 3:15 pm - *Friction Stir Welding of Thin Sheet Aluminum to Create Affordable Robust Cryogenic Tanks***
David M. Potter, Michael J. Holguin, Lockheed Martin Space Systems, Denver, CO;
Jennifer A. Takeshita, Lockheed Martin Space Systems, New Orleans, LA

[C24] Prometheus Space Reactor Materials

Wednesday, February 15, 2006, 1:45 - 3:45 p.m. - New Mexico Ballroom South

- Chairs:** Michael Zika, Bechtel Bettis, West Mifflin, PA
Ron Lipinski, Sandia National Laboratories, Albuquerque, NM
- 1:45 pm - *Fast Gas Reactor Fuel Material Options***
Scott Simonson, Lynn Kolaya, Beth Lugert, Lockheed Martin, KAPL Inc., Schenectady, NY; John Hack, Bechtel Bettis, West Mifflin, PA
- 2:15 pm - *Summary of Structural Material Considerations for Prometheus Space Nuclear Power***
Tom Angeliu, Youssef Ballout, Matthew Frederick, Amitava Guha, Nikki Johnson, Tym Schumaker, Lockheed Martin, KAPL Inc., Schenectady, NY; Rita Baranwal, John Hack, Erik Mader, Craig McCann, Wayne Ohlinger, Bechtel

Final Program

Bettis, West Mifflin, PA

2:45 pm - *Mass Transport Modeling and Supporting Experimental Tasks for the Prometheus Space Reactor System*

Tymm Schumaker, Lockheed Martin, KAPL Inc., Schenectady, NY

3:15 pm - *Compatibility of Space Nuclear Power Plant Materials in an Inert He/Xe Working Gas Containing Reactive Impurities*

Meryl M. Hall, Bechtel Bettis, West Mifflin, PA

[C25] Space Nuclear Power Systems: Simulation and Modeling

Wednesday, February 15, 2006, 1:45 - 3:45 p.m. - New Mexico Ballroom North

Chairs: Steven A. Wright, Sandia National Laboratories, Albuquerque, NM
John Ashcroft, Knolls Atomic Power Laboratory, Schenectady, NY

1:45 pm - *Direct Gas Brayton Reactor Plant Transient Modeling*

Larry McCann, Bechtel Bettis, West Mifflin, PA

2:15 pm - *The Role of Computational Fluid Dynamics in Design of a Gas Reactor for Space*

Donald Lorentz, Bechtel Bettis, West Mifflin, PA

2:45 pm - *He/Xe Transport Property Review and Recommendation for Project Prometheus*

Melissa Haire, Bechtel Bettis, West Mifflin, PA

3:15 pm - *Modeling Compact Counter Flow Heat Exchangers with RELAP5-3D*

Jacob Crittenden, Bechtel Bettis, West Mifflin, PA

[C26] Dynamic Power II - 100 kWe Class

Wednesday, February 15, 2006, 1:45 - 3:45 p.m. - Rio Grande Room

Chairs: Lee S. Mason, NASA Glenn Research Center, Cleveland, OH
Tim Bauch, Hamilton Sundstrand, Rockford, IL

1:45 pm - *Closed Brayton Cycle (CBC) Power Generation from an Electric Systems Perspective*

David G. Halsey, David A. Fox, Hamilton Sundstrand, Rockford, IL

2:15 pm - *Rotor Support Technology Developments for Long Life Closed Brayton Cycle Turbines*

Christopher DellaCorte, Kevin C. Radil, Robert J. Bruckner, Steven W. Bauman, Bernadette J. Puleo, and Samuel A. Howard, NASA Glenn Research Center, Cleveland, OH

2:45 pm - *Experimental Validation of a Closed Brayton Cycle System Transient Simulation*

David S. Hervol, NASA Glenn Research Center, Cleveland, OH; Paul K. Johnson, Analex Corporation, Cleveland, OH

3:15 pm - *A Comparison of Coolant Options for Brayton Power Conversion Heat Rejection Systems*

John Siamidis, Analex Corporation, Cleveland, OH; Lee Mason, NASA Glenn Research Center, Cleveland, OH

[E06] Space Resource Utilization on Mars

Wednesday, February 15, 2006, 4:00 - 6:00 p.m. - Parlor A/B

Chairs: Adam P. Bruckner, University of Washington, Seattle, WA
Dale E. Lueck, NASA Kennedy Space Center, FL

4:00 pm - *Microchannel Reactors for ISRU Applications Using Nanofabricated Catalysts*

Susana Carranza and Darby B. Makel, Makel Engineering Inc., Chico, CA;
Randall L. Vander Wal, Gordon M. Berger, Vladimir V. Pushkarev, Universities

Final Program

Space Research Association, Columbia, MD

- 4:30 pm - *Development of a Microchannel In Situ Propellant Production System***
Kriston Brooks, Scot Rassat, John Hu, Susie Stenkamp, Steve Schlahta, Jagan Bontha, and Jamie Holladay, Battelle Pacific Northwest Division, Richland, WA; Tom Simon, Kris Romig, and Candice Howard, NASA Lyndon B Johnson Space Center, Houston, TX
- 5:00 pm - *In Situ Manufacturing of Plastics and Composites to Support H&R Exploration***
Susana Carranza, Darby B. Makel, Brandon Blizman, Makel Engineering Inc., Chico, CA
- 5:30 pm - *Recovering the Atmospheric Resources of Mars: Updating the MARRS Study***
Christopher England, Jet Propulsion Laboratory, Pasadena, CA; J. Dana Hrubes, Raytheon Polar Services Inc., Centennial, CO

[C27] Mission/Systems Safety and Reliability

Wednesday, February 15, 2006, 4:00 - 6:00 p.m. - Parlor E/F

- Chairs:** Lawrence E. DeFillipo, Science Applications International Corp., Reston, VA
Joseph A. Sholtis, Sholtis Engineering & Safety Consulting, Tijeras, NM
- 4:00 pm - *Evaluation of Launch Accident Safety Options for Low-Power Surface Reactors***
Cindy Fung Poon, University of Florida, Gainesville, FL; David I. Poston, Los Alamos National Laboratory, Los Alamos, NM
- 4:30 pm - *A Common Methodology for Safety and Reliability Analysis for Space Reactor Missions***
Michael V. Frank, Safety Factor Associates, Inc., Encinitas, CA
- 5:00 pm - *Negative Margin Criterion For GPHS Impact Response Prediction***
Denton Anderson, Teledyne Energy Systems, Inc., Hunt Valley, MD
- 5:30 pm - *Evaluation Of Potential Radiological Releases For The Pluto New Horizons Mission***
Vincent J. Dandini, Eric W. Klamerus, Gary F. Polansky, Gregory D. Wyss, Sandia National Laboratories, Albuquerque, NM; Firooz A. Allahdadi, Kirtland Air Force Base, Albuquerque, NM

[D09] Cross-Cutting Modular Design Technologies, and Their Application to a Near-Term Solar Electric Transport Spacecraft – II

Wednesday, February 15, 2006, 4:00 - 6:00 p.m. - Parlor G/H

- Chairs:** John T. Dorsey, NASA Langley Research Center, Hampton, VA
Timothy J. Collins, NASA Langley Research Center, Hampton, VA
- 4:00 pm - *Modular Solar Electric Tug Spacecraft Structural Definition, Including Dynamic Analysis, Sizing, Packaging, Deployment and Assembly***
Timothy J. Collins, John T. Dorsey, and William R. Doggett, NASA Langley Research Center; Martin Mikulas, National Institute of Aerospace, Smithfield, VA
- 4:30 pm - *Truss Performance and Packaging Metrics***
Martin M. Mikulas, National Institute of Aerospace, Hampton, VA; Timothy J. Collins, William Doggett, John Dorsey, and Judith J. Watson, NASA, Langley Research Center, Hampton, VA
- 5:00 pm - *Reconfiguration of EVA Modular Truss Assemblies Using an Anthropomorphic Robot***
Myron A. Diftler and J.S. Mehling, NASA Johnson Space Center, Houston, TX; William R. Doggett, NASA Langley Research Center, Hampton, VA; Bruce D. King, Lockheed Martin Space Systems Company, Hampton, VA
- 5:30 pm - *Methodology for Evaluating Modular Assembly of Large Space Platforms***
Jeffrey H. Smith, Julie Wertz, and Lawrence Caroff, Jet Propulsion Laboratory, Pasadena, CA

[C28] Nuclear Thermal Rockets: Past, Present, and Future – III

Wednesday, February 15, 2006, 4:00 - 6:00 p.m. - New Mexico Ballroom South

- Chairs:** Russell Joyner, Pratt and Whitney, Jupiter, FL
Joseph M. Roche, NASA Glenn Research Center, Cleveland, OH
- 4:00 pm - *Multi-Disciplinary Analysis of CERMET Nuclear Thermal, Bimodal Nuclear Thermal, and Thrust Augmented Nuclear Thermal Propulsion for Human Exploration Missions***
Russell Joyner, Robert Rowland and Andrea Lentati, Pratt & Whitney, Jupiter, FL
- 4:30 pm - *3D Reacting Flow Analysis of LANTR Nozzles***
Mark E. M. Stewart, QSS Group, Inc., Brook Park, OH; Thomas M. Krivanek and Joseph A. Hemminger, M. Bulman, NASA Glenn Research Center, Brook Park, OH; M.J. Bulman, Aerojet, Sacramento, CA
- 5:00 pm - *LANTR Engine Optimization For Lunar Missions***
M. J. Bulman and Greg Poth, Aerojet, Sacramento, CA; Stanley K. Borowski, NASA Glenn Research Center, Brook Park, OH
- 5:30 pm - *NERVA Liquid Hydrogen Turbopump Inducer Analysis Using Modern Methods***
Edward Bennett and Travis Jonas, Aerojet, Sacramento, CA

[C29] Thermoelectric Power Conversion Technology and Applications - II

Wednesday, February 15, 2006, 4:00 - 6:00 p.m. - New Mexico Ballroom North

- Chairs:** Bahman Heshmatpour, Teledyne Energy Systems, Inc., Hunt Valley, MD
Jean-Pierre Fleurial, Jet Propulsion Laboratory, Pasadena, CA
- 4:00 pm - *Radioisotope Thermoelectric Generators Based on Segmented BiTe/PbTe-BiTe/TAGS/PbSnTe***
Malachy McAlonan, Kalpesh Patel and Keith R. Cummer, Teledyne Energy Systems, Inc., Hunt Valley, MD
- 4:30 pm - *DEGRA - A Computer Model for Predicting Long Term Thermoelectric Generator Performance***
Richard Ewell, Virgil Shields, David Hanks and Eric Wood, Jet Propulsion Laboratory, Pasadena, Ca; Juan Lozano, California Institute of Technology, Pasadena, CA
- 5:00 pm - *Development of Segmented Thermoelectric Multicouple Converter Technology***
Jean-Pierre Fleurial, Jet Propulsion Laboratory, Pasadena, CA
- 5:30 pm - *Fractional Watt AMTEC Converter***
T.K. Hunt and J. R. Rasmussen, EnCel LLC, Ann Arbor, MI

[F07] Advanced Technologies for Terrestrial (Earth, Lunar & Mars) Based Propulsion and Power Concepts - II

Wednesday, February 15, 2006, 4:00 - 6:00 p.m. - Rio Grande Room

- Chairs:** John W. Cole, NASA Marshall Space Flight Center, Huntsville, AL
David Goodwin, U.S. Department of Energy, Washington, DC
- 4:00 pm - *Space Propulsion Based on Dipole Assisted IEC System***
George H. Miley, Robert E. Thomas and Yoshikazu Takeyama, University of Illinois at Urbana-Champaign, Urbana, IL; Hiromu Momota and Prajakti J. Shrestha, NPL Associates Inc., Champaign, IL
- 4:30 pm - *A Contamination-Free Ultrahigh Precision Formation Flying Method for Micro-, Nano-, and Pico-Satellites with Nanometer Accuracy***

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Young K. Bae, Bae Institute, Tustin, CA

5:00 pm - *Advanced Technology and Breakthrough Physics for 2025 and 2050 Military Aerospace Vehicles*

David Froning, Gumeracha, Australia; Paul Czysz, HyperTech Concepts, Saint Louis MO.

5:30 pm - *Propulsion and Power Generation Capabilities of a Dense Plasma Focus (DPF) Fusion System for Future Military Aerospace Vehicles*

Sean D. Knecht and Franklin B. Mead, AFRL/PRSP, Edwards AFB, CA; Robert E. Thomas and George H. Miley, University of Illinois, Urbana, IL; David Froning, Flight Unlimited, Gumeracha, Australia

THURSDAY, FEBRUARY 16, 2006

[E07] Space Resource Utilization on the Moon

Thursday, February 16, 2006, 8:00 - 10:00 a.m. - Parlor A/B

Chairs: Gerald B. Sanders, NASA Johnson Space Center, Houston, TX
Edward McCullough, Boeing, Riverside, CA

8:00 am - *A Vibrofluidized Reactor for Resource Extraction from Lunar Regolith*
Vedha Nayagam and Kurt Sacksteder, NASA Glenn Research Center, Cleveland, OH

8:30 am - *Effect Of Water Ice Content On Excavatability Of Lunar Regolith*
Leslie Gertsch, University of Missouri- Rolla, Rolla, MO; Robert Gustafson, Orbitec Inc., Madison, WI; Richard Gertsch, Michigan Technological University, Houghton, MI

9:00 am - *A Demonstration Experiment for the Fabrication of Thin Film Solar Cells on the Moon*
Alex Ignatiev, and Alex Freundlich, Texas Center for Advanced Materials, University of Houston, Houston, TX; Takashi Nakamura, Physical Sciences Inc., San Ramon, CA

9:30 am - *An End-to-End System Model Tool for ISRU Production Systems*
Diane L. Linne, Joshua E. Freeh, Christopher A. Gallo, Robert D. Green, Jeffrey S. Hojnicky, Christopher J. Steffen, Robert T. Tornabene, NASA Glenn Research Center; Dawn Sgro, QSS Group, Inc., Lanham, MD

[A07] Heat Pipe Technologies

Thursday, February 16, 2006, 8:00 - 10:00 a.m. - Parlor E/F

Chairs: Jean-Michel Tournier, University of New Mexico, Albuquerque, NM
Angirasa Devarakonda, NASA Glenn Research Center, Cleveland, OH

8:00 am - *High Temperature Titanium-Water Heat Pipe Radiator*
William G. Anderson, Richard Bonner, and John Hartenstine, Advanced Cooling Technologies Inc., Lancaster, PA.; Jim Barth, ATK Space Systems, San Diego, CA

8:30 am - *Design, Fabrication and Testing of High-Capacity, High Temperature Monel/Water Heat Pipes*
John H. Rosenfeld, Thermacore International Inc., Lancaster, PA; Bruce L. Drolen, Boeing Satellite Development Center, El Segundo, CA; Cheng-Yi Lu, Pratt & Whitney Rocketdyne Inc., Canoga Park, CA

9:00 am - *High Temperature Water Heat Pipe Life Tests*
William G. Anderson, Peter M. Dussinger, and David Sarraf, Advanced Cooling Technologies Inc., Lancaster, PA

9:30 am - *Life Testing Approach for Refractory Metal/Sodium Heat Pipes*
James J. Martin and Robert S. Reid, NASA Marshall Space Flight Center, Huntsville, AL

[D10] Human & Robotic Technology Advanced Avionics and Software

Thursday, February 16, 2006, 8:00 - 10:00 a.m. - Parlor G/H

- Chairs:** Christopher L. Moore, NASA Headquarters, Washington, DC
Frank Peri, NASA Langley Research Center, Hampton, VA
- 8:00 am - *Radiation Hardened Electronics for Space Environments (RHESE)***
Michael D. Watson, Don Frazier, Jim Adams, Todd Macleod, Clint Patrick, David Hyde, NASA Marshall Space Flight Center, Huntsville, AL; Elizabeth Kolawa, Jet Propulsion Laboratory Pasadena, CA; Michael Johnson, NASA Goddard Space Flight Center, Greenbelt, MD; Kalmanje Krishnakumar, NASA Ames Research Center, Mountain View, CA; Marvin Beatty, NASA Langley Research Center, Langley, VA
- 8:30 am - *Radiation Hardened Electronics for Low Temperature Environments***
Michael D. Watson, Don Frazier, Jim Adams, Todd Macleod, Clint Patrick, David Hyde, NASA Marshall Space Flight Center, Huntsville, AL; Elizabeth Kolawa, Jet Propulsion Laboratory Pasadena, CA; Michael Johnson, NASA Goddard Space Flight Center, Greenbelt, MD; Kalmanje Krishnakumar, NASA Ames Research Center, Mountain View, CA; Marvin Beatty, NASA Langley Research Center, Langley, VA
- 9:00 am - *Self-Reconfigurable Analog/Mixed Signal Electronics for Extreme Environments***
Adrian Stoica, Didier Keymeulen, Ricardo Zebulum, Ramesham Rajeshuni, Veronica Lacayo, Taher Daud, Gary Burke, Jet Propulsion Laboratory, Pasadena CA; Joseph Neff, Brian Meadows, SPAWAR, San Diego, CA
- 9:30 am - *SiGe Integrated Electronics for Extreme Environments***
John D. Cressler, Georgia Institute of Technology, Atlanta, GA

[C30] Human Lunar and Mars Mission Power and Propulsion Requirements

Thursday, February 16, 2006, 8:00 - 10:00 a.m. - New Mexico Ballroom South

- Chairs:** Leonard A. Dudzinski, NASA Headquarters, Washington, DC
John Wheeler, U.S. Department of Energy, Germantown, MD
- 8:00 am - *Qualification of the GPHS-RTG for the Pluto New Horizons Mission***
Robert D. Cockfield, Lockheed Martin Space Systems Company, King of Prussia, PA
- 8:30 am - *NaBH₄/H₂O₂ Fuel Cells for Lunar and Mars Exploration***
Nie Luo, George H. Miley, Joseph Mather, Rodney Burton, Glenn Hawkins, and Richard Gimlin, University of Illinois, Urbana, IL; John Rusek, Swift Enterprises, Ltd., West Lafayette, IN; Tom I. Valdez and Sekharipuram R. Narayanan, Jet Propulsion Laboratory, Pasadena, CA
- 9:00 am - *Mission Performance of High-Power Electromagnetic Thruster Systems***
James H. Gilland, Ohio Aerospace Institute, Brookpark, OH; Melissa L. McGuire, Tyacie Corale, Michelle Clem, NASA Glenn Research Center, Cleveland, OH
- 9:30 am - *AC/DC Power Systems with Applications in Future Human Habitat on Lunar and Mars Bases***
Badrul H. Chowdhury, Shushant Barave, University of Missouri-Rolla, Rolla, MO; Sabbir A. Hossain, James T. Lawrence, NASA Johnson Space Center, Houston, TX

[C31] Radioisotope Power Systems Technology and Development

Thursday, February 16, 2006, 8:00 - 10:00 a.m. - New Mexico Ballroom North

- Chairs:** Tibor S. Balint, Jet Propulsion Laboratory, Pasadena, CA
David J. Anderson, NASA Glenn Research Center, Cleveland, OH
- 8:00 am - *Status of NASA's Advanced Radioisotope Power Conversion Technology Research and Development***
Wayne A. Wong, David J. Anderson, Karen L. Tuttle, and Roy C. Tew, NASA Glenn Research Center, Cleveland, OH
- 8:30 am - *Validation Database Based Thermal Analysis of an Advanced RPS Concept***
Tibor S. Balint, Nickolas Emis, Jet Propulsion Laboratory, Pasadena, CA
- 9:00 am - *Radioisotope-Based Nuclear Power Strategy for Exploration Systems Development***
George R. Schmidt and Michael G. Houts, NASA Marshall Space Flight Center, Huntsville, AL
- 9:30 am - *Thermal Analysis and Testing of a Small Radioisotope Power System Concept***
Brian G. Woods and Lindsay Arnold, Oregon State University, Corvallis, OR;
Tibor S. Balint, Jet Propulsion Laboratory, Pasadena, CA

[C32] Space Reactors Testing Lessons Learned

Thursday, February 16, 2006, 8:00 - 10:00 a.m. - Texas/Nevada

- Chairs:** James E. Werner, Idaho National Laboratory, Idaho Falls, ID
Patrick McDaniel, Sandia National Laboratories, Albuquerque, NM
- 8:00 am - *SNAP 10 Testing***
Glen L. Schmidt, New Mexico Institute of Mining and Technology, Albuquerque, NM
- 8:30 am - *Experimental Tests (Completed and Planned) for the Space Nuclear Thermal Propulsion (SNTP) Program***
Steven B. Dron, Sandia National Laboratories, Albuquerque, NM
- 9:00 am - *Summary of Ground Test Lessons Learned***
Wayne Bordelon, NASA Marshall Space Flight Center, Huntsville, AL
- 9:30 am - *Ground Testing of Space Nuclear Reactor Systems - Lesson Learned***
Thomas J. Hill, Idaho National Laboratory, Idaho Falls, ID

[E08] Space Settlements/Colonies

Thursday, February 16, 2006, 10:30 a.m. - 12:30 p.m. - Parlor A/B

- Chairs:** Anita Gale, Space Settlement Design Competitions, Nassau Bay, TX
Richard Edwards, Space Settlement Design Competitions, Nassau Bay, TX
- 10:30 am - *The Astrosociology of Space Colonies: Or the Social Construction of Societies in Space***
Jim Pass, Long Beach City College, and astrosociology.com, Long Beach, CA
- 11:00 am - *Next X-Prize: LI Base with Linked Asteroid Mining as Prime Catalyst for Space Enterprise***
Ken R. Erickson, Good Samaritan Hospital, Corvallis, OR
- 11:30 am - *A New Method of Space Travel Optimized for Space Tourism and Colonization***
Philip A. Turek, Cerritos High School, Cerritos, CA
- 12:00 pm - *Validation of Tailored Force Fields Concept for Use in Space-Based Construction***
Sameh S. Wanis and Narayanan Komerath, Georgia Institute of Technology, Atlanta, GA

[A08] Advances in Spray Cooling Technology

Thursday, February 16, 2006, 10:30 a.m. - 12:30 p.m. - Parlor E/F

- Chairs:** Eric A. Silk, NASA Goddard Space Flight Center, Greenbelt, MD
Kirk L. Yerkes, USAF / Air Force Research Laboratory, Wright-Patterson AFB, OH
- 10:30 am - *Effect of Vapor Bubble Size on Heat Transfer in Spray Cooling***
R. Panneer Selvam, Mita Sarkar, and Suranjan Sarkar, University of Arkansas, Fayetteville, AR; Rengasamy Ponnappan, Air Force Research Laboratory, Wright Patterson AFB, OH
- 11:00 am - *Spray Cooling in Terrestrial and Simulated Reduced Gravity***
Charles Andy Hunnell, John M. Kuhlman, and Donald D. Gray, West Virginia University, Morgantown, WV
- 11:30 am - *Spray Cooling Development Effort for Microgravity Environments***
Brian L. Rowden and R. Panneer Selvam, Power Electronics Leveling Solutions and University of Arkansas, Fayetteville, AR; Eric A. Silk, NASA Goddard Space Flight Center, Greenbelt, MD
- 12:00 pm - *An Orientation Independent, Scalable Spray Cooling System for High Heat Flux Removal***
Timothy Shedd and Benjamin Regner, University of Wisconsin-Madison, Madison, WI

[C33] Materials and Concepts for Space Power Systems

Thursday, February 16, 2006, 10:30 - 12:30 p.m. - Parlor G/H

- Chairs:** Wayne Ohlinger, Bechtel Bettis, Inc., West Mifflin, PA
Scott Simonson, Lockheed Martin, KAPL, Inc., Schenectady, NY
- 10:30 am - *Lunar Base Thermoelectric Power Station Study***
W.R. Determan and Patrick E. Frye, Pratt & Whitney Rocketdyne, Canoga Park, CA; Jack Mondt, Jean-Pierre Fleurial, Ken Johnson, G. Stapfer, Jet Propulsion Laboratory, Pasadena, CA; Michael D. Brooks and Ben Heshmatpour, Teledyne Energy Systems, Inc., Hunt Valley, CA
- 11:00 am - *NRPCT Perspective on Lithium Hydride for Use in a Space Shield***
Brian Campbell, Barri Gurau, Rose Lewis, Jane Oppenlander, Dean Poeth, and James Vollmer, Lockheed Martin, KAPL, Inc., Schenectady, NY
- 11:30 am - *Reflector Material Selection for Space Nuclear Applications***
Brian Campbell, James Nash, Tristan Schaefer, Jonathan Witter, Lockheed Martin, KAPL Inc.; Bren Phillips, Bechtel Bettis, West Mifflin, PA
- 12:00 pm - *Assessing the Radiation Damage of Ni-base Superalloys for Prometheus Space Nuclear Power***
Tom Angeliu, John Ward, Jonathan Witter, Lockheed Martin, KAPL Inc., Schenectady, NY

[C34] Nuclear Thermal Rockets: Past, Present, and Future IV

Thursday, February 16, 2006, 10:30 a.m. - 12:30 p.m. - New Mexico Ballroom South

- Chairs:** Stanley K. Borowski, NASA Glenn Research Center, Cleveland, OH
Bruce G. Schnitzler, Idaho National Laboratory, Idaho Falls, ID
- 10:30 am - *Aerojet's NERVA Engine Program: The Real Facts and Lessons***
Mel Bulman, Aerojet, Sacramento, CA
- 11:00 am - *An Integrated Analysis of a NERVA Based NTP System***
Hans Ludewig, Lap-Yan Cheng, Lynne Ecker, and Michael Todosow, Brookhaven National Laboratory, Upton, NY
- 11:30 am - *Mini-MITEE: Ultra Small, Ultra Light NTP Engines for Robotic Science and***

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Manned Exploration Missions

James Powell, George Maise and John Paniagua, Plus Ultra Technologies, Inc., Shoreham, NY

12:00 pm - Ultra Low Flow / Ultra High Head Coefficient Inducer Design and Test Validation

Sen Y. Meng and Brian Shinguchi, United Technology/Pratt Whitney-Rocketdyne, Canoga Park, CA

[C35] Radioisotope Power System Technology and Missions

Thursday, February 16, 2006, 10:30 a.m. - 12:30 p.m. - New Mexico Ballroom North

Chairs: Patrick E. Frye, Pratt & Whitney Rocketdyne, Canoga Park, CA
Firooz A. Allahdadi, Kirtland Air Force Base, Albuquerque, NM

10:30 am - Concept for a Radioisotope Powered Dual Mode Lunar Rover

John O. Elliott and Keith Coste, Jet Propulsion Laboratory, Pasadena, CA;
Timothy M. Schriener, Oregon State University, Corvallis, OR

11:10 am - Radiation Environments and Exposure Considerations for the Multi-Mission Radioisotope Thermoelectric Generator

William M. Kelly, Nora M. Low, Andrew Zillmer, and Gregory A. Johnson, Pratt & Whitney Rocketdyne, Canoga Park, CA; Eugene Normand, Boeing Radiation Effects Laboratory, Seattle, WA

11:30 am - Small Power Technology Systems for Tetrahedral Rovers

P.E. Clark, L3 Communications GSI, Chantilly, VA; S.R. Floyd, C.D. Butler and Y. Flom, NASA Glenn Space Flight Center, Greenbelt, MD

12:00 pm - Open Discussion and Q&A

[F08] Potential Frontiers - II

Thursday, February 16, 2006, 10:30 a.m. - 12:30 p.m. - Texas/Nevada

Chairs: Glen A. (Tony) Robertson, NASA Marshall Space Flight Center, Huntsville, AL
James F. Woodward, California State University, Fullerton, Fullerton, CA

10:30 am - Mars-X A Low Cost Mars Mission Architecture Using Solar Electric Propulsion and Moon-Mars Synergism

J.E. Brandenburg, Florida Space Institute, University of Central Florida, Kennedy Space Center, FL

11:00 am - GEM (Gravity Electro-Magnetism) Unification: Theory of FTL (Faster Than Light) Travel

J.E. Brandenburg, Florida Space Institute, University of Central Florida, Kennedy Space Center, FL

11:30 am - Progress in Electrogravitics and Electrokinetics for Aviation and Space Travel

Thomas Valone, Integrity Research Institute, Washington, DC

12:00 pm - Proposed Experiment to Simulate Gravity Using Diamagnetism

Jeremiah Hansen, Fredericksburg, VA

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