B. 14th CONFERENCE ON THERMOPHYSICS APPLICATIONS IN MICROGRAVITY

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This Conference pertains to thermophysical research and technology considered to be important for emerging aerospace applications. Sessions focus on scientific and technology research efforts originating from government, university and commercial research programs. The Conference starts with a session on emerging, and perhaps controversial, thermal control issues, which is followed by discussions on recent progress in fundamental research topics, and then the discussions move on to specific new technologies and applications. Technology discussions focus on; single and two-phase flow technologies, advanced thermal control coatings, convection interfacial mass transfer, and innovative thermal control devices for spacecraft applications.

B01. Current Topics in Thermal Control

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

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

Invitation Only - No Open Submissions

B02. Progress in Microgravity Thermophysics

Chair: Fred Best, Texas A&M University, fbest@ne.tamu.edu
Co-Chair: TBD

This session addresses recent advances in understanding the fundamentals of thermophysics in a microgravity, or partial gravity environment.

B03. Two-Phase Thermal Control Systems

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

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

B04. High Capacity Heat Rejection Systems – Lasers, Processors, and Nuclear Heat Sources

Chair: Pete Cologer, ATK, Beltsville, MD, 301 902 4394, pete.cologer@atk.com
Co-Chair: Gary Adamson, Hamilton Sundstrand, Windsor Locks, CT, 860-654-2646, gary.adamson@hs.utc.com

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

B05. Advanced Thermal Control Technologies via Conduction, Convection, and/or Radiation

Chair: Jeffrey Didion, NASA Goddard Space Flight Center, Greenbelt, MD, 301 286-4363, Jeffrey.R.Didion@nasa.gov
Co-Chair: Eric Sunada, Jet Propulsion Laboratory / California Institute of Technology, Pasadena, CA, 818-354-1543; eric.t.sunada@jpl.nasa.gov

Two-phase technologies have become the standard tools for spacecraft thermal control. Papers are invited that discuss either recent advancements in these established technologies or address emerging techniques: Examples are: phase-change and sensible heat thermal storage, heat pumps, high conductivity structures and substrates, thermal switches, novel radiator concepts, and single-phase mechanically pumped technologies. Papers on issues/scalability of high power thermal systems in microgravity are also invited.

B06. Thermal Control for Lunar and Deep Space Missions

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

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

This session will also consider technical papers which cover thermal concepts and technologies applied to any aspect of human space exploration; including crew transfer and landing vehicles, lunar and planetary bases and crew space life support.

B07. Advances in Spray Cooling

Chair: Kirk L. Yerkes, USAF/ Air Force Research Laboratory, Wright-Patterson AFB, OH, kirk.yerkes@wpafb.af.mil
Co-Chair: Eric Golliher, NASA Glenn Research Center, Cleveland, Ohio 44135, 216-433-6575; eric.l.golliher@nasa.gov

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

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

B08. Advanced Heat Pipe Technologies

Chair: Bob Reid, Los Alamos National Laboratory, Los Alamos, NM, 505-667-2626, rsr@lanl.gov
Co-Chair: D. Angirasa, EADS Astrium, Stevenage, Hertfordshire, SG1 2AS, UK, +44-1438-774072; a_devarakonda@yahoo.com

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

B09. Smart Materials

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

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

B10. ISRU Thermal Control Technologies

Chair: Daniel Nguyen, NASA Goddard Space Flight Center, Greenbelt, MD, 301-286-6600, Daniel.H.Nguyen@nasa.gov
Co-Chair: TBD

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