Thermal and Fluids Analysis Workshop 2012

Jet Propulsion Laboratory

Proceedings of a workshop
hosted by the Jet Propulsion Laboratory
at the Westin Pasadena Hotel
Pasadena, California
August 13 – 17, 2012

Passive Thermal Paper Sessions

Chairs: John Sharp, NASA – Marshall Space Flight Center
Callie McKelvey, NASA – Marshall Space Flight Center

Session #1

TFAWS2012-PT-01 **Thermal Optimization and Assessment of a Long Duration Cryogenic Propellant Depot**
Ryan Honour, Robert Kwas, Gary O'Neil, NASA - Kennedy Space Center
Bernard Kutter, United Launch Alliance

TFAWS2012-PT-02 **Development of the GPM Observatory Thermal Vacuum Test Model**
Kan Yang, Hume Peabody, NASA - Goddard Space Flight Center

TFAWS2012-PT-03 **Return to Mercury: An Overview of the MESSENGER Spacecraft Thermal Control System Design and Up-to-Date On-Orbit Flight Performance**
Carl J. Ercol, The Johns Hopkins University Applied Physics Laboratory

TFAWS2012-PT-04 **Method for Importing Multiple Nastran Composite Layups into Thermal Desktop Accounting for Through-Panel Radiation**
Matt Garrett, Victoria Harris, Alanna Koser, ATA Engineering, Inc.

TFAWS2012-PT-05 **Thermal and Fluid Modeling of the Cryogenic Orbital Testbed (CRYOTE) Ground Test Article (GTA)**
David Piryk, Paul Schallhorn, Laurie Walls, NASA - Kennedy Space Center
Bernard Kutter, United Launch Alliance
Noah Rhys, Yetispace Inc. (NASA - Marshall Space Flight Center)
Mark Wollen, Innovative Engineering Solutions

TFAWS2012-PT-06 **Modeling of Heat Transfer and Ablation of Refractory Material due to Rocket Plume Impingement**
Michael F. Harris, QinetiQ
Dr. Bruce T. Vu, NASA - Kennedy Space Center

TFAWS2012-PT-07 **Cube Flux Method to Generate Spacecraft Thermal Environments**
Siraj A. Jalali, Oceaneering Space Systems

Session #2

TFAWS2012-PT-08 **A Design Overview of the Thermal Control System for the Earth Orbiting SMAP Mission**
Nickolas Emis, Eug Kwack, Rebecca Mikhaylov, Danford Lau, Jennifer Miller, Gordy Cucullu, NASA - Jet Propulsion Laboratory

TFAWS2012-PT-09 **Thermal Analysis Using Assembly FEMs in Teamcenter, NX and Space Systems Thermal**
Robert Krylo, NASA - Jet Propulsion Laboratory

TFAWS2012-PT-10 **Review and Assessment of JPL's Thermal Margins (AIAA San Diego, CA, 42nd ICES Conference)**
George Siebes, Arturo Avila, Michael Blakely, Christine Farguson, A. Hoffman, Cynthia Kingery, K. Man, Jeffrey Nunes, Mark White, NASA - Jet Propulsion Laboratory

TFAWS2012-PT-11 **Conductive White Thermal Control Polyimide Films with Atomic Oxygen Durability**
Garrett D. Poe, NeXolve Corp.

Active Thermal Paper Sessions

Chairs: Ryan Stephan, NASA Johnson Space Center
Rubik Sheth, NASA Johnson Space Center

Session #1

TFAWS2012-AT-01 **Variable Conductance Heat Pipes for Variable Thermal Links**
William G. Anderson, Michael C. Ellis, John R. Hartenstine, Christopher J. Peters, Calin Tarau, Kara L. Walker, Advanced Cooling Technologies, Inc.

TFAWS2012-AT-02 **Loop Heat Pipe with Thermal Control Valve for Variable Thermal Conductance**
Kara L. Walker, John R. Hartenstine, Andrew Slippey, Calin Tarau, William G. Anderson Advanced Cooling Technologies, Inc.

TFAWS2012-AT-03 **High Accuracy Liquid Propellant Slosh Predictions Using an Integrated CFD and Controls Analysis Interface**
Brandon Marsell, David Griffin, QinetiQ North America
Dr. Paul Schallhorn, Jacob Roth, NASA - Kennedy Space Center

TFAWS2012-AT-04 **Numerical Investigation of Aerodynamical Performance of Damaged Low-Reynolds Airfoils for UAV Application**
Ali Doosttalab, Mohammad Mohammadi, Ali Ashrafizadeh, K.N.Toosi University of Technology, Iran
Mehdi Doosttalab, Nordex Energy GmbH, Germany

TFAWS2012-AT-05 **Active Solar Array Thermal Control System for the Solar Probe Plus Spacecraft**
Carl J. Ercol, The Johns Hopkins University Applied Physics Laboratory
Greg Guyette, Wei-Lin Cho, Hamilton Sundstrand Space Systems

TFAWS2012-AT-06 **Mechanically Pumped Fluid Loops: Components and Systems for Space Application**
Michael Brown, Pacific Design Technologies, Inc.

TFAWS2012-AT-07 **Environmental Control and Life Support System on Spacecraft**
Divya Krishnamoorthy, Mailam Engineering College

Session #2

TFAWS2012-AT-08 **Performance of Nanofluids in Microchannel Heat Exchangers**
Debendra Das, Ravikanth S. Vajjha, University of Alaska Fairbanks

TFAWS2012-AT-09 **Efficient Thermally Conductive Strap Design for Cryogenic Propellant Tank Supports and Plumbing**
J.P. Elchert, R. Christie, NASA - Glenn Research Center
P. Gebby, Vantage Systems, Inc.
A. Kashani, Atlas Scientific
C. Opalach, Lewis Educational and Research Collaborative Internship Program

TFAWS2012-AT-10 **The Transport of Mass, Energy, and Entropy in Cryogenic Support Struts for Engineering Design**
J.P. Elchert, NASA - Glenn Research Center

TFAWS2012-AT-11 **A Re-Entry Vehicle Reaction Control System Thermo-Fluidic Analysis Approach**
Lorenzo Andrioli, Savino De Palo, Thales Alenia Space

TFAWS2012-AT-12 **IV & V of Orion Active Thermal Control System (ATCS) Dynamic Models**
Xiao-Yen Wang, NASA - Glenn Research Center

TFAWS2012-AT-13 **A Scaling Tool For Modeling Single Stage Reverse Turbo-Brayton Cycle Cryocoolers with a Broad Area Cooling System for Cryogenic Propellant Tanks**
Monica C. Guzik, Thomas M. Tomsik, NASA - Glenn Research Center

TFAWS2012-AT-14 **Overview of OCT's Game Changing Solicitation for Variable Heat Rejection Technologies**
Rubik Sheth, NASA - Johnson Space Center

Aerothermal Paper Session

Chairs: *Karen Berger, NASA – Langley Research Center*
Eric Grob, NASA - Goddard Space Flight Center

Session #1

TFAWS2012-AE-01 **Sizing and Margins Assessment of the Mars Science Laboratory Aeroshell Thermal Protection System (AIAA San Antonio, TX, 41st Thermophysics Conference)**
Mike Wright, Robin A.S. Beck, David Driver, Helen H. Hwang, NASA - Ames Research Center
Karl T. Edquist, NASA - Langley Research Center
Steven A. Sepka, Anthony DeCaro, Eloret Corporation
Eric M. Slimko, NASA - Jet Propulsion Laboratory
William H. Willcockson, Lockheed Martin Space Systems

TFAWS2012-AE-02 **A Simplified Plume and Aerothermal Heating Analysis for LDSD**
Mike Pauken, NASA - Jet Propulsion Laboratory

TFAWS2012-AE-03 **Numerical Modeling of Solid Rocket Motor Plumes**
Manish Mehta, NASA - Marshall Space Flight Center
Brandon Williams, Computational Fluid Dynamics Research Corporation
Gabriel C. Putnam, All-Points-Logistics
Sheldon D. Smith, Jacobs ESTS Group - Plumetech

TFAWS2012-AE-04 **A Plume Impingement Test for Code Validation**
Jason Mishtawy, NASA - Marshall Space Flight Center

TFAWS2012-AE-05 **Space Launch System Base Convective Heating Test: Preliminary Design Analyses and Test Improvements**
Manish Mehta, C. Mark Seaford, NASA - Marshall Space Flight Center
Brandon L. Mobley, Robert D. Kirchner, Brian C. Kovarik, Carl D. Engel, Jacobs - Qualis

TFAWS2012-AE-06 **Interfacial Design of Composite Ablative Materials**
Dr. Tapan Desai, Advanced Cooling Technologies, Inc.
Dr. John Lawson, NASA - Ames Research Center
Prof. Pawel Keblinski, Rensselaer Polytechnic Institute

TFAWS2012-AE-07 **Space Shuttle Boundary Layer Transition Flight Experiment Overview**
Karen Berger, NASA - Langley Research Center
Brian P. Anderson, Charles H. Campbell, Michael T. Garske, NASA - Johnson Space Center
Gerald R. Kinder, The Boeing Company
Ann Micklos, United Space Alliance

Interdisciplinary Paper Session

Chairs: Hume Peabody, TMD, LLC
Kevin Anderson, NASA - Jet Propulsion Laboratory

Session #1

TFAWS2012-IN-01 **Computational Fluid Dynamics (CFD) Analysis of Optical Payload for Lasercomm Science (OPALS) Sealed Enclosure Module**
Dr. Kevin R. Anderson P.E., NASA - Jet Propulsion Laboratory, California State Polytechnic University at Pomona
Daniel Zayas, Daniel Turner, NASA - Jet Propulsion Laboratory

TFAWS2012-IN-02 **Regeneratively Cooled Rocket Nozzle CFD Cooling System Analysis**
Matt Devost, California State Polytechnic University at Pomona

TFAWS2012-IN-03 **Thermal Vacuum Testing: Methods of Thermal Conditioning in a Vacuum Environment**
Michael McCullar,NASA - Johnson Space Center

TFAWS2012-IN-04 **Dawn Thermal Challenges While Operating at Vesta**
Eric Sunada for Dr. Juan Cepeda-Rizo, NASA - Jet Propulsion Laboratory

TFAWS2012-IN-05 **Opals Mission Thermal Design Study**
Daniel Zayas, NASA - Jet Propulsion Laboratory

TFAWS2012-IN-06 **Thermal and Alignment Analysis of the Instrument-Level ATLAS Thermal Vacuum Test**
Heather Bradshaw, NASA - Goddard Space Flight Center

TFAWS2012-IN-07 **A System Analysis Demonstration Using Cielo**
Mike Chainyk, Greg Moore, NASA - Jet Propulsion Laboratory

Short Courses

Thermal Test Requirements, Design and Examples Course
John W. Welch, The Aerospace Corp.
Charles Phillips, NASA - Jet Propulsion Laboratory
Romain Peyrou-Lauga, ESTEC, European Space Agency

Active Thermal Control: Mechanically Pumped Fluid Loops Course
Pradeep Bhandari, NASA - Jet Propulsion Laboratory
David Bame, NASA - Jet Propulsion Laboratory
Tony Paris, NASA - Jet Propulsion Laboratory

Aerothermodynamic and Thermal Protection System Aspects of Entry System Design Course
Michael Wright, NASA - Ames Research Center
John Dec, NASA - Langley Research Center

Form Factors, Grey Bodies and Radiation Conductances
Steven L. Rickman, NASA - Engineering and Safety Center