

# Space Flight Systems Directorate Activities Report May 11-22, 2009

## **ADVANCED FLIGHT PROJECTS OFFICE**

### **ISS and Human Research Project Office**

#### **ISS Research Program**

**Twenty-Two Test Points Performed on SPICE on ISS.** The Smoke Point In Co-flow Experiment (SPICE) was operated in the Microgravity Science Glovebox (MSG) facility on board the International Space Station during Voluntary Science on May 16, 2009. Mike Barratt operated the SPICE experiment and performed six test points, and Koichi Wakata performed 16 test points, using the 75 percent propylene fuel.



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### **Mike Barratt Operating SPICE Experiment in the Microgravity Science Glovebox Facility On Board the ISS, May 16, 2009**

The Smoke Point in Co-Flow Experiment (SPICE) is a Microgravity Science Glovebox (MSG) combustion experiment that was launched on Shuttle Flight STS-126/ULF-2. The objective of SPICE is to measure the smoke point of jet diffusion flames in a co-flow environment as a function of nozzle diameter, co-flow velocity, and fuel velocity and fuel composition. Contact: MAH/Robert Hawersaat, (216) 433-8157

**Students Ranked Twelfth in State at Ohio Academy of Science (OAS) Annual Meeting Poster Session.** Students Arielle Stambler and Karen Inoshita from Hathaway Brown School participated in the 118th Annual Meeting of the Ohio Academy of Science (OAS) held at Wittenberg University, in Springfield, Ohio, on April 18, 2009. The student's research entitled "MISSE 2 PEACE Polymers Ground-to-Space Atomic Oxygen Erosion Correlation," was one of 60 projects selected from the State of Ohio to be presented at the OAS Poster Session. The student's poster summarized the research they conducted to improve the accuracy of ground-based plasma atomic oxygen durability testing through the use of ground-

laboratory to in-space atomic oxygen correlation experiments. The students determined the atomic oxygen erosion yields of 39 different Polymer Erosion and Contamination Experiment (PEACE) polymers in a radio-frequency (RF) plasma relative to Kapton H. Then plasma erosion yields were compared to in-space erosion yields obtained from the Materials International Space Station Experiment 2 (MISSE 2) PEACE Polymers experiment to determine the correlation between erosion rates in the two environments. Arielle and Karen were ranked twelfth in the state after being judged at the poster session, and were included in a select group (total of 14) to be invited to present their research at the American Association for the Advancement of Science (AAAS) Annual Meeting to be held San Diego in February 2010. The students abstract was also published in The Ohio Journal of Science, Volume 109, Number 1 (March 2009). This research is a collaborative effort with Kim de Groh (Code RES) and Bruce Banks (Alphaport/Code RES). This work is supported by the ISS Research Project. Contact: RES/Kim K. deGroh, (216) 433-2297

### **Human Research Program**

**Abstract Accepted for Presentation at the 2009 American Society of Biomechanics Conference.** The abstract titled “Kinematic and EMG Comparison of Gait in Normal G and Microgravity,” was accepted for presentation at this year's American Society of Biomechanics conference in University Park, Pennsylvania, on August 26-29, 2009. This paper details results of a study conducted in the NASA Glenn Research Center Exercise Countermeasures Lab and on the DC-9 microgravity laboratory. Authors are: John K. DeWitt, Brent Edwards, Gail P. Perusek, Sergey Samorezov, and Beth E. Lewandowski. Contact: MAH/Gail Perusek, (216) 433-8729

**ExPC Project Manager Hosts Filming Crew from Ivanhoe Broadcast News.** The Exercise and Physiological Countermeasures (ExPC) Project Manager hosted a filming crew from Ivanhoe Broadcast News on May 19, 2009, at the Exercise Countermeasures Laboratory with a test subject demonstrating the enhanced Zero-gravity Locomotion Simulator. The news brief will be distributed to 200 local news channels and Science Daily. The event was organized through the Glenn Research Center Public Affairs Officer, Katherine Martin. Contact: MAH/Gail Perusek, (216) 433-8729

### **Science Project Office**

#### **In-Space Propulsion Technology Project Office**

**HIVHAC (High Voltage Hall Accelerator) Preliminary Design Review (PDR) Close-out Review.** The HIVHAC (High Voltage Hall Accelerator) thruster development project held a review in early May to dispose of residual actions from a Preliminary Design Review. Material covered in the review included alternate thermal design options as well as mission, structural, and thermal analysis for the baseline Engineering Model (EM) design. Technical reviewers included participants from GRC's Codes D and R. The work is funded by the In-Space Propulsion Technology Program. Contacts: MAS/Eric Pencil, (216) 977-7463, RPP/Hani Kamhawi, (216) 977-7435

#### **NEXT Briefing to In-Space Propulsion Technology (ISPT) Program Executive**

A briefing was presented to Dr. David Lavery, In-Space Propulsion Technology (ISPT) Program Executive on the Non-reimbursable Space Act Agreement (SAA) between NASA Glenn and The Aerospace Corporation on NEXT (NASA's Evolutionary Xenon Thruster)

particle-field characterization tests. The work included detailed characterization tests of beam ion, charge-exchange ions, optical emissions, erosion/deposition measurements, and electromagnetic interference tests on the Engineering Model (EM) thruster. Options for future tests on the Prototype Model (PM) thruster were presented and the resulting decision will be dependent on pending budget guidelines. Also presented was an important outcome of the Space Act Agreement (SAA) collaboration work, which is the opening of dual use flight opportunities on non-NASA missions for ISPT electric propulsion products. The work is funded by the In-Space Propulsion Technology Program. Contacts: MAS/Eric Pencil (216) 977-7463, R/Mike Patterson (216) 977-7481

#### **Members of Mars Ascent Vehicle (MAV) Development Team and ATK Visit GRC.**

ATK Elkton visited the Glenn Research Center on May 19, 2009, along with members of the Mars Ascent Vehicle (MAV) development team from the Jet Propulsion Laboratory (JPL) and Marshall Space Flight Center (MSFC). The group discussed technology development options using solid rocket motors based on ATK's Star motor heritage. The In-Space Propulsion Technology project is preparing a solicitation for MAV propulsion technologies and a two-stage solid motor system is one of the leading technology candidates. Contact: Gray Research/John Dankanich, (216) 433-5356

#### **Advanced Capabilities Project Office**

**Exploration Technology Development Program (ETDP): Propulsion and Cryogenics Advanced Development (PCAD) and Cryogenic Fluid Management (CFM) Project Representatives Participated in the Altair Propulsion Risk Identification Workshop on May 12-13, 2009, in Huntsville, Alabama.** The Altair propulsion team presented the current state of the descent and ascent propulsion system designs. The goal of the meeting was for Altair propulsion to conduct a bottoms-up identification of propulsion risks (including propellant tank CFM elements). The team started the process to identify risk mitigation approaches and the associated degree of difficulty for the development and qualification of component, assembly, and subsystems. Final product from the meeting will be incorporated into the Altair development planning for risk identification, cost estimating, and future development/test needs. Results will also be used to map existing ETDP activities to capability gap mitigation, identify gaps and future task formulation. Contacts: MAC/Mark Klem (PCAD), (216) 977-7473; MAC/Michael Doherty (CFM), (216) 433-6641; and RPP/Michael L. Meyer (CFM), (216) 977-7492

#### **SPACE OPERATIONS PROJECT OFFICE**

**International Space Station** (Project Manager - Gregory V. Schmitz, Acting): Successfully completed P4/P6/S4/S6 Photovoltaic Thermal Control Subsystem (PVTCS) Pump & Flow Control Subassembly (PFCS) ORU Pump Switchover Operations. P4, P6, S4, and S6 PVTCS PFCS Orbital Replacement Unit (ORU) pumps were successfully switched over from Pump B to Pump A. GRC personnel on the System Problem Resolution Team (SPRT) worked with Active Thermal Control System Management and Prime Contractor to define and document a generic plan for swapping from one PFCS pump to the other (i.e. A-B or B-A) for all PV Modules. The rationale for pump switchover is to prevent possible early ORU replacement, delay zero fault tolerance by verifying integrity of both ORUs, and delay

the onset of zero fault tolerance (which occurs if a pump fails). Successful PVTCS PFCS pump operations were verified by nominal data readings of delta pressure and loop flow rate. Contact: DSV/Leon Collins

**Space Communications and Navigation (SCaN)** (Project Manager - Kul B. Bhasin): Served as a member of the Review Board for the Space Network (SN) User Service Access (USA) Preliminary Design Review (PDR) on May 13-14, 2009, at Honeywell Goddard Corporate Park near the NASA Goddard Space Flight Center. The USA will provide SN customers (primarily Constellation missions) with an expanded set of capabilities using the SN Tracking and Data Relay Satellite (TDRS) constellation and the White Sands Complex in New Mexico. Contact: MS/Kul B. Bhasin