Space Flight Systems Directorate
Activities Report
Sept. 20-26, 2009

ADVANCED FLIGHT PROJECTS OFFICE

ISS and Human Research Project Office
ISS Research Program

On September 22, 2009, an additional set of fluid sample vials were filled and sealed for the Investigating the Structure of Paramagnetic Aggregates from Colloidal Ellipsoids-3 (InSPACE-3) flight experiment. A previous set was filled on July 20-22, 2009. Approximately 23 capillary glass vials (10 containing the ellipsoid particles sample fluid and 13 containing a dicolloid particles sample fluid) were filled with InSPACE-3 fluid and the vial ends sealed using a fusing method. The fusing method, utilizing a mini-torch, is a newly implemented sealing method for InSPACE-3 to solve leakage problems encountered with the InSPACE-2 vials (sealed using an epoxy). This second set of vials will be evaluated and tracked for any fluid evaporation losses over the next four months. Dr. Paula Vasquez (University of Delaware), a postdoctoral fellow working on InSPACE-3, visited Glenn Research Center (GRC) to review the vial filling procedures, and observe filling of this second set of sample vials.

The objective of the InSPACE-3 experiment is to continue InSPACE-1 and InSPACE-2 studies to determine the lowest energy configurations of the three-dimensional structures of a magnetorheological (MR) fluid in a pulsed magnetic field. InSPACE-3 also builds on the InSPACE-1 and InSPACE-2 by investigating two different non-spherical super-paramagnetic colloidal particles in these pulsed magnetic fields. Contact: MAH/Nancy Hall, (216) 433-5643

Successful Executive Systems Acceptance Review Held for CVB Experiment to Ship Remaining Pentane Modules for Launch on ULF-3. The Constrained Vapor Bubble (CVB) experiment held a successful Executive Systems Acceptance review on September 17, 2009. Permission was granted to ship the remaining pentane modules (20 and 40 mm) for launch on ULF-3. They were shipped to Johnson Space Center (JSC) on September 21, 2009, for a bench review that is presently scheduled for October 7, 2009.
Contact: MAH/Ronald Sicker, (216) 433-6498

Human Research Program

IVGEN Passes Phase III Payload Safety Review. On September 16, the IntraVenous fluid GENeration (IVGEN) flight project passed its Phase III payload safety review.
Contact: MAH/DeVon Griffin, (216) 433-8109

Advanced Capabilities Project Office

Exploration Life Support (ELS) - GRC Hosted Annual ELS Atmospheric Revitalization (AR) Technical Interchange and Strategic Planning Workshop - The annual Exploration Life Support (ELS) Atmosphere Revitalization (AR) Element workshop was hosted by the Glenn Research Center and held on September 15-17, 2009. The primary purpose of the multi-center meeting was for AR technology developers to present overviews of their FY09 accomplishments

to other technology developers and requirement owners. This was the third major AR meeting that GRC has hosted in the past 18 months. Dan Barta/JSC, Program Manager for ELS and Jay Perry/MSFC, Element Lead for the AR task, both complimented the GRC hosts on our Center, the facility tours, and the meeting accommodations (e.g., dinner arrangements).
Contact: MAH/Nancy R. Hall, (216) 433-5643

Fire Prevention, Detection, and Suppression (FPDS) - Completion of Lunar Gravity Materials Flammability Tests in the Zero Gravity Facility – Drop tests in the Zero Gravity facility were completed on September 22, 2009, that investigated material flammability in lunar gravity. The objective of these tests was to compare the maximum oxygen concentration (MOC) at which time a material will self-extinguish in normal gravity and zero-gravity with the MOC obtained in lunar-gravity. Surprisingly, we found that in natural convection at lunar gravity, all three materials (Nomex, Mylar, and Ultem 1000) continued to burn at oxygen concentrations *lower* than they did with natural convection in normal-gravity and with forced convection in 0-g. In fact, Mylar burned at a $\%O_2$ 5.8% lower in lunar-g than in normal-g. Therefore, these materials were *more flammable* in lunar gravity than in either normal- or 0-g. Additional tests on different materials will be needed to further quantify this behavior. This was a joint project between NASA GRC and NASA White Sands Tests Facility and funded by the Lunar Surface Habitation Functional Integration Group with additional support from the FPDS technology development project. Contacts: MAC/Dr. Gary A. Ruff, (216) 433-5697, and REC/Dr. Sandra Olson, (216) 433-2859

Advanced Thermal Control Systems (ATCS) - Design and Development of Air-Liquid Composite Heat Exchanger Completed - Researchers in the Polymers Branch have completed the design and fabrication of a Composite Air-Liquid Heat Exchanger Engineering Demonstration Unit as part of the Advanced Thermal Controls Project in the Exploration Technology Development Program. The composite heat exchanger is 37 percent lighter than the corresponding metallic unit. Performance testing is scheduled for late September. A review was held with JSC Program Manager, Ryan Stephan, on September 8, 2009, to discuss the fabrication of this unit, the performance test plan, and the preliminary work performed to evaluate concepts for a composite liquid-liquid heat exchanger. Contacts: MAC/Mark Hyatt, (216) 433-3248, RXP/OAI/Dr. Eugene Shin, (216) 433-2544, and Dr. Michael A. Meador, (216) 433-9518

Human Robotic Systems (HRS) - Lunar Gravity Rover Simulator Completed - A one-sixth scale model of the Lunar Gravity Simulator (JSC's revised Chariot Lunar Electric Rover), debuted fully-assembled for the first time on Thursday, September 10, 2009, by summer intern DER/Kyle Johnson. The simulator has eight individually steerable and driven wheel pods; each pod on sprung and damped suspensions; paired on to four modules and joined together. This scale vehicle will be used to simulate the dynamic motion responses of the full-scale vehicle to travel on the moon. The vehicle will be video recorded while operating on a simulated lunar surface at the full speed. During playback, the motion will be slowed to one-sixth speed to simulate the motion imagery of what should be expected during full-scale operation on the Moon. Summer interns Kyle Johnson, Mark Plant, and Mike Adams contributed to the engineering of this model. Contacts: RXN/Phil Abel, (216) 433-6063, and RXN/Steve Bauman, (216) 433-3826

SPACE OPERATIONS PROJECT OFFICE

Space Communications & Navigation Technology Project (SCaN)
(Project Manager - Konstantinos S. Martzaklis, Acting):
GRC technical staff visited Harris Corp. (Melbourne, FL) and held a technology interchange on uplink antenna arraying at X-Band and GRC arraying simulations. SCaN is sponsoring GRC to investigate antenna arraying techniques for its future architecture for improved network performance and reduced costs. Contact: RHA/Dr. Roberto Acosta, (216) 433-6640

- A number of 5 page proposals have been drafted in response to SCaN's internal Call for Proposals for Gamechanging Technologies. The proposals are undergoing internal review. Proposal submittal to HQ is due 10/5. Contact: DPC/Gus Martzaklis, (216) 433-8966
- SBIR Technology: The Space Operations Mission Directorate (SOMD) Small Business Innovative Research (SBIR) 2008 Phase II review, ranking and recommendation process was completed. Technology advisory committees comprised of representatives from Exploration Systems Mission Directorate (ESMD), Science Mission Directorate (SMD) and SOMD were convened to provide input on the appropriateness of each proposal for helping NASA achieve objectives. The proposal reviews were coordinated across the following centers: ARC, GRC, GSFC, JPL, JSC, KSC, LaRC and SSC. A total of 27 proposals were ranked for final consideration on behalf of SOMD. Final awards are expected to be announced at the end of September at which time they will be briefed to senior management within the Agency and SOMD. Contact: RHN/James D. Stegeman, (216) 433-3389
- Bill Marinelli (HQ SCaN Technology Deputy Manager) and Jason Crusan (SOMD) visited GRC on September 23. They met with Gus Martzaklis and Kathy Needham on technology infusion strategies and with Gus Martzaklis (DPC) and Dr. Rainee Simons (RHE) on travelling wave tube amplifier (TWTA) and microwave power module (MPM) performance for high data rate applications of the two technologies for lunar communications (as high as 3 Gbps). Contact: DPC/Gus Martzaklis, (216) 433-8966
- Dr. Bob Romanofski (RHA), PI for the Reflectarray experiment on MISSE-8 (Material International Space Station Experiment), and his team provided mechanical, thermal and electrical updates to NRL (the experiment integrator) in preparation for the MISSE-8 System Critical Design Review scheduled for September 29, 2009. Contact: RHA/Dr. Bob Romanofsky, (216) 433-3507

Compatibility Test Sets (Project Manager - Michael A. Jarrell):

- Participated in the Space Communications and Navigation Systems (SCaN) Network Integration and Engineering (NI&E) planning session at JPL September 22-23. FY09 accomplishments and FY10 plans were presented.
- Preparing for SRR by concentrating on deliverables. Draft agenda prepared.

Communication, Navigation & Networking re-Configurable Testbed (CoNNeCT)
(Project Manager – Ann P. Over):

- CoNNeCT is a HQ Space Operations Mission Directorate (SOMD) sponsored, Space Station externally mounted communication, networking and navigation national testbed planned to be flown in 2011. A successful Preliminary Design Review (PDR) was held Sept. 8-11 at GRC. The PDR Board was chaired by Ms. Carolyn Dent from GSFC and was composed of members from GSFC, GRC, and JSC. The review was also attended by Industry partners and

ISS Integration leads. The CoNNeCT Team provided a detailed project overview including overall objectives, systems engineering, design and compliance to requirements, system assembly, integration and verification, and project cost, schedule, and risks. Following the prepared materials, a series of six tabletop sessions were held to answer board questions and review additional details. The PDR Board concluded the review with a verbal out brief indicating that CoNNeCT had successfully met the PDR criteria, and further review of the documentation was pending.

Upcoming Significant Events:

- SCaN Systems Planning PSR, 10/8 at GSFC
- CTS SRR October 20-21, 2009
- GRC SCaN Technology Review, 11/4 at GRC