Flight Opportunities Program
Office of the Chief Technologist

Parabolic Flight Campaign Aug 2012

Campaign Dates: August 16-24, 2012
Total payloads: 5
Parabolas: Zero G

#	Title	PI/Organization	Description/Objective
1	Indexing Media Filtration	Dr. Vijayakumar/ Aerfil LLC Juan Agui /NASA Glenn Research Center	To show the effect of gravity on Dust separation capability, Collection of large particulates, Dust collection efficiency, and In-place media indexing, The flight data will be used to assess the performance of the hardware in low-g environments. Deficiencies in performance or operation will be identified and corrected in the next revision of system prior to the next flight.
2	Physics of Regolith Impacts in Microgravity Experiment	Dr. Joshua Colwell University of Central Florida	Investigate the behavior of fine particles in dusty environments in response to human and robotic activities to provide a guide to mitigating against dust contamination in manned and unmanned exploration of the Moon, Mars, and asteroids. Flight data consists of high-speed video. Analysis of the data will indicate whether the technology performed as designed.
3	UAH CubeSat Parabolic Flight Testing	Dr. Francis Wessling UAH Aerospace Engineering	To verify our models and simulation data and to verify deployment mechanism, obtaining data from our inertial sensors and video analysis and use both to validate our models.
4	Effects of Reduced Gravity on Flow Boiling and Condensation	Issam Mudawar Boiling and Two-Phase Flow Laboratory (BTPFL)	Flow condensation facility enables study of spatial development of condensation flow and heat transfer regimes in micro-gravity. Flight data will be used to investigate the influence of microgravity on condensation flow regimes, pressure drop, heater transfer coefficient and interfacial wave structure in annular condensation.
5	Deployable Solar and Antenna Array Microgravity Testing	Ted Fritz Boston University Center for Space Physics	Validate the performance of the complete system design and Characterize dynamic deployment in a microgravity environment. Data will be taken in the form of quantitative accelerometer data and qualitative high speed video to verify design assumptions and optimize the final design for maximum reliability.

Indexing Media Filtration System for Long Duration Space Missions

Problem Statement

•*Accumulation of particulate matter over long duration space missions will challenge spacecraft filtration systems . Performance improvements are needed in service life, regenerability, and reduced to no crew-tended maintenance.*

•The low-g environment provided by the Flights Opportunity program will help test the performance in the relevant environment.

- Customer: AES ARREM

Technology Development Team

- R. Vijayakumar
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  vijay@aerfil.com
- NASA POC:
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Proposed Flight Experiment

Experiment Readiness:

- The flight rig will be available to fly in August 2012.

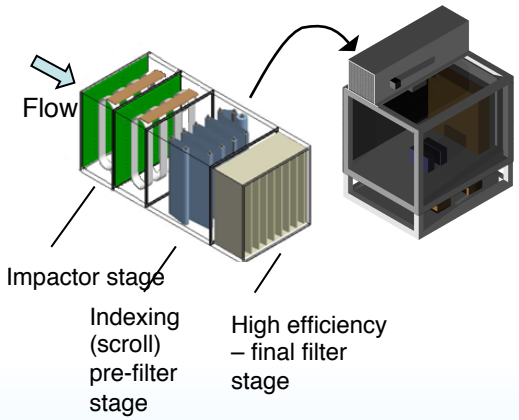
Test Vehicles:

- Parabolic aircraft providing low gravity environment.

Test Environment:

- A smaller scale prototype of this experimental hardware was flown in various low-g environments (zero, lunar, and Martian). The current requirements are mainly for zero-g (priority) parabolas and a smaller set of either or both lunar and Martian g's.

Test Apparatus Description:



Technology Maturation

- Demonstrated performance of full scale prototype in low-g and spacecraft cabin environments.
- Maturity steps: scaled prototype flight demo (2011), full scale flight demo (2012, 2013), ECLS flight demo (2015), DSH ground demonstration (2017),
- Schedule: Tentative integrated ECLS flight demo in 2015 (per 2012 OCT Roadmap)

Objective of Proposed Experiment

- To show the effect of gravity on:
  - Dust separation capability.
  - Collection of large particulates (that tend to settle out in 1-g).
  - Dust collection efficiency.
  - In-place media indexing.

• The flight data will be used to assess the performance of the hardware in low-g environments. Deficiencies in performance or operation will be identified and corrected in the next revision of system prior to the next flight opportunity.

Applicable Technology Areas : Life Support Systems and Habitations www.nasa.gov/offices/oct/home/roadmaps

Physics of Regolith Impacts in Microgravity Experiment

Problem Statement

- Understand how to safely and efficiently operate equipment and scientific instruments on the surface of a dust-covered object with low surface gravity.
- This flight campain provides data on the response of regolith to low-energy disturbances in very low gravity environments.
- NASA exploration division and planetary scientists are the prime beneficiaries of PRIME.

Technology Development Team

- Dr. Joshua Colwell, University of Central Florida, jec@ucf.edu.
- Experiment funding is provided by the Center for Microgravity Research and Education at the University of Central Florida. The P.I. (Colwell) is the point of contact.
- NASA is the most likely partner in this technology development.

Proposed Flight Experiment

Experiment Readiness:

- The experiment will be ready to fly August 15, 2012.

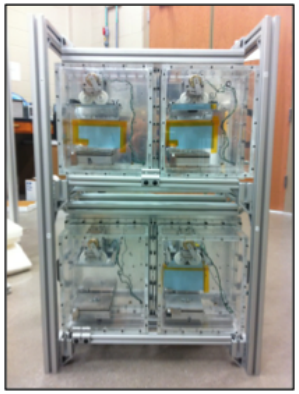
Test Vehicles:

- PRIME is designed for flight on parabolic airplane flights.

Test Environment:

- The experiment has flown in zero-g parabolic flights before. The requested test environment is zero-g parabolic flights.

Test Apparatus Description:



The experiment consists of a frame containing 8 removable impact chambers. A high-speed digital camera is attached to each impact chamber which is allowed to free float during the parabola. The opening of the target tray door and the firing of the projectile are operated by a single electronic control.

Technology Maturation

- Successful operation of the experiment in free-float mode will advance the TRL from TRL-6 to TRL-8. Successful operation means the projectile impacts the target at the correct speed during free-float conditions and usable high-speed video data is collected.
- We have implemented automated control of the launcher and target trays and need to test it in the zero-g environment.
- There is no deadline.

Objective of Proposed Experiment

- Investigate the behavior of fine particles in dusty environments in response to human and robotic activities to provide a guide to mitigating against dust contamination in manned and unmanned exploration of the Moon, Mars, and asteroids.
  •Flight data consists of high-speed video. Analysis of the data will indicate whether the technology performed as designed.

List the applicable Technology Areas addressed by your technology: TA06, TA07, TA08

UAH CubeSat

Problem Statement

- The technology problem being addressed is in the area of Modeling, Simulation, Information Technology and Processing. This experiment will provide modeling and simulation experience to the developing workforce.
- This flight opportunity will provide a way to validate our models and simulations.
- NASA, Department of Defense, commercial companies

Technology Development Team

- Francis Wessling, Ph. D., UAHuntsville Aerospace Engineering, wesslif@uah.edu
- Office of Vice President for Research, UAHuntsville, john.horack@uah.edu Alabama Space Grant Consortium, John Gregory, Ph. D., gregoryj@uah.edu
- ASGC, NASA

Proposed Flight Experiment

Experiment Readiness:

- The experiment will be ready for flight by July 15, 2012

Test Vehicles:

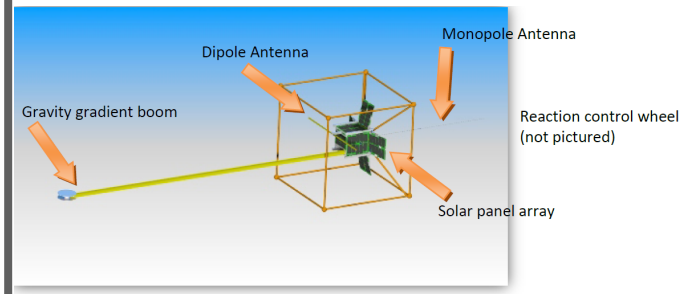
- Parabolic aircraft

Test Environment:

- This experiment has not been flown in a microgravity experiment before

Test Apparatus Description:

- System overview – Each deployable (labeled items) will be triggered and the inertial reactions measured and used to validate models and simulations



Technology Maturation

- To achieve the next TRL, level 6, for the deployment and stabilization subsystem, we will fly the system prototype on a parabolic flight
- We will finish the prototype and have it ready for testing by July 15, 2012
- We have an orbital launch some time in 2013-2014 for the fully operational CubeSat

Objective of Proposed Experiment

- To verify our models and simulation data and to verify deployment mechanisms
- We will obtain data from our inertial sensors and video analysis and use both to validate our models

List the applicable Technology Areas addressed by your technology: www.nasa.gov/offices/oct/home/roadmaps

41-P Flow Boiling & Condensation Experiment

Problem Statement

- Reduced gravity condensation heat transfer data and models virtually nonexistent.
- Parabolic flight data will be used to develop phenomenological understanding, empirical correlations and theoretical models.
- Proposed research aims to develop a facility for International Space Station (ISS) to serve as primary platform for obtaining two-phase flow and heat transfer data in microgravity.

Technology Development Team

- Prof. Issam Mudawar, Director Boiling and Two-Phase Flow Laboratory(BTPFL) *mudawar@ecn.purdue.edu*
- Dr. Mohammad Mojibul Hasan NASA Glenn Research Center *modammad.m.hasan@nasa.gov*

Proposed Flight Experiment

Experiment Readiness:

- Entire facility is ready and it has previously flown in May 2012

Test Vehicles:

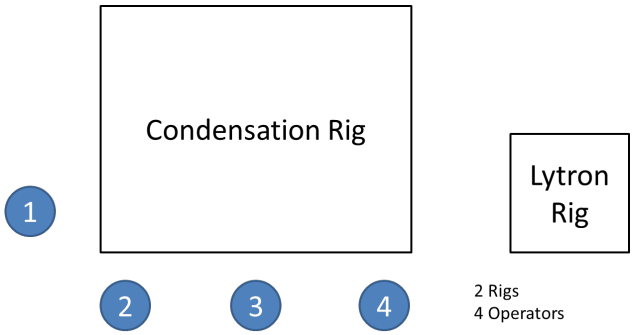
- Parabolic aircraft

Test Environment:

- Mostly microgravity, with few Lunar and Martian gravity conditions.

Test Apparatus Description:

- Condensation Facility has two rigs (Condensation rig and Lytron rig) and requires four operators.



Technology Maturation

- Current TRL for condensation heat transfer data and models for microgravity is 3.
- Parabolic flight data in short duration reduced gravity and model development will advance the TRL to 4-5 and long duration will advance the technology y to TRL 6 or higher.
- A microgravity experiment on the ISS for Flow Boiling and Condensation is planned for 2017 and there is no specific deadline to mature the technology to TRL 6 or higher.

Objective of Proposed Experiment

- Flow condensation facility enables study of spatial development of condensation flow and heat transfer regimes in microgravity.
- Flight data will be used to investigate the influence of microgravity on condensation flow regimes, pressure drop, heater transfer coefficient and interfacial wave structure in annular condensation.

TA14 Thermal Management Systems

Boston University Satellite (BUSAT) Deployables

Problem Statement

Deployable systems on CubeSat to nanosat class satellites are extremely rare because of the risk they bring to a flight. Developing a reliable, simple, and broadly applicable deployable system using COTS technology will greatly enhance small sat capability.

BUSAT will characterize and demonstrate the technology readiness of a CubeSat-standard deployment system in a microgravity environment

Potential users of BUSAT's technology include: NASA cubesat-standard missions, NSF cubesat missions, the University Nanosat Program, Air Force Operationally Responsive Space office, Air Force Research Laboratory

Technology Development Team

Principal Investigator:
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Proposed Flight Experiment

Experiment Readiness:

- Fabrication and Assembly Complete: June 1

Test Vehicles:

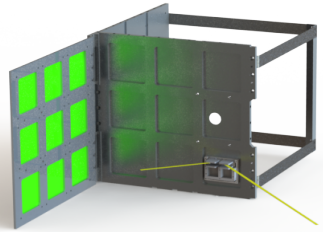
- Parabolic Aircraft

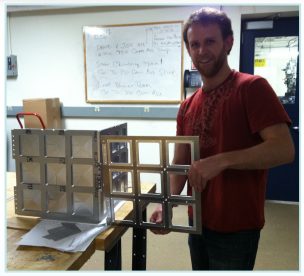
Test Environment:

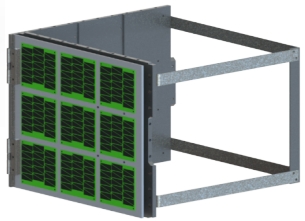
- 1G bench testing
- No previous microgravity testing

Test Apparatus Description:

- Engineering unit with fracturable bolt solar panel and spring hinge antenna deployment







Technology Maturation

Existing TRL's:

- Solar Panel Release System: 5
- Antenna Release System: 5
- Antennas: 4

Steps to Mature Technology: Microgravity testing of complete system, thermal testing of hinges, thermal testing of antennas

Deadline to TRL 6: January 2013

Objective of Proposed Experiment

Testing Objectives

1. Validate the performance of the complete system design
2. Characterize dynamic deployment in a microgravity environment
3. Demonstrated repeatable and reliable deployment

Data will be taken in the form of quantitative accelerometer data and qualitative high speed video to verify design assumptions and optimize the final design for maximum reliability

Deployment of Flex Materials (1.3.1c), Restraint/Release Devices (2.3.1b), Common Universal Interfaces (2.3.1a)