National Aeronautics and Space Administration

Space Technology Mission Directorate

Flight Opportunities

2013 Annual Report

www.nasa.gov

July 20, 2011: Sathya Gangadharan and his fellow researchers board G-Force One at Ellington Field (TX) for the first parabolic flight of the Flight Opportunities program. (Photo: NASA/Robert Markowitz)


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Developing In Space Satellite Servicing and Refueling Capabilities

Written by Brian Roberts (PI) and Dr. Edward Cheung (PI), Satellite Servicing Capabilities Office, NASA/GSFC

The Satellite Servicing Capabilities Office (SSCO) at NASA's Goddard Space Flight Center, in partnership with West Virginia, conducted evaluations of robotic contact dynamics during parabolic flights in 2011. Knowledge gained during these flights is being used to mature autonomous capture algorithms and enhance the accuracy of a simulation platform at NASA's Goddard Space Flight Center. This platform is used to support the development and validation of technologies required for future missions that can include autonomous capture and servicing of satellites in geosynchronous and low Earth orbit.

Our primary goal was to collect data that can be used to verify simulated free-floating behavior of a robot on the ground. Prior to the flights, the autonomous capture technology was at a technology readiness level (TRL) of 3. Testing autonomous capture in a relevant environment (i.e., near-zero gravity) raised the TRL to 4. The flights also advanced the TRL of the ground-based contact dynamics simulation platform by providing "truth" data about the behavior of a free-floating object being touched by a robotic manipulator.

More information: flightopportunities.nasa.gov/technologies/9

DESIGNATION	**T0009-P**
SELECTION	**MAY 2011 (AFO1)**
PLATFORM	**PARABOLIC**
FLIGHTS TO DATE	**2**
PRIMARY TA	**TA04**

In May 2013, we performed additional parabolic flight tests to study the behavior of a flexible fuel hose in zero gravity. Before these flights took place, we could not verify the accuracy of our behavioral models with high precision. Prior attempts by our team to determine the behavior characteristics were limited by the presence of gravity or the damping of water used as a microgravity simulation. Parabolic flight tests represented the most direct way to obtain data that could predict flexible hose performance in space.

Data gathered during these flights has significantly matured our technological understanding. We discovered how the fuel nozzle tool can be rotated and positioned to ensure safe handling of the fuel hose. This is an important step to our completion of a low-risk system design.

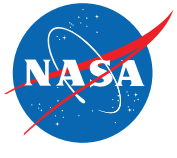
The Satellite Servicing Capabilities Office at NASA's Goddard Space Flight Center thanks the Flight Opportunities program for the opportunity to perform these mission-critical tests in a relevant environment.

More information: flightopportunities.nasa.gov/technologies/60

DESIGNATION	**T0060-P**
SELECTION	**JANUARY 2013 (AFO5)**
PLATFORM	**PARABOLIC**
FLIGHTS TO DATE	**1**
PRIMARY TA	**TA04**

(Not pictured)

◁ *July 20, 2011: flight testing of robotic contact dynamics by the NASA/GSFC Satellite Servicing Capabilities Office (SSCO) during the first parabolic flight week of the program (RGO-01). (Photo: NASA/Robert Markowitz)*



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NASA/SP-2014-218351