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MICROGRAVITY SCIENCES AND PROCESSES (A2)
Microgravity Experiments from Sub-orbital to Orbital Platforms (3)

Author: Mr. Michael Vergalla
Florida Institute of Technology, United States, mvergalla@gmail.com

Mr. Ran Zhou
Florida Institute of Technology, United States, Rzhou2007@fit.edu

INVESTIGATION OF SLOSH EVENTS USING EXISTING SPHERES HARDWARE ON ISS PLATFORM

Abstract

Currently a multi-platform experimental campaign is being conducted at Florida Institute of Technology. A foundation of ground, parabolic flight and sounding rocket tests have been conducted. In collaboration with MIT's SPHERES project FIT worked as guest scientists to determine if the present hardware on board the International Space Station is capable of producing a slosh event capable of adversely effecting the flight trajectory. If a slosh event can be obtained with the present hardware, then the next test sessions would be designed to investigate multiple motions that could be comparable to those conducted during a LEO to GEO transfer. Two test sessions have been completed. After the first sessions an event was observed that was possibly attributed to a reorientation of the liquid CO2 propellant. The second session was designed to investigate the motion with the same SPHERE and determine if the motion was due to thruster balance/orientation, or to a slosh event. A total of eight tests were conducted. The tests that FIT planned for Test Session 18 completed four linear translations along the +Z axis. The acceleration and deceleration were two equal and opposite pulses pointed along the +Z and the -Z axis (two thrusters each axis). Drift times were four seconds and five seconds for both full and empty tanks. Test Session 20 also completed four linear translations. This time the first two translations were with full tanks and along the -Z axis, for both the four second and five second delay. The final two tests were part of a new test plan to incorporate stabilization rotations. Prior to the +Z and -Z translations the SPHERE was spun to 1 rad/s. Only one delay time of four seconds. It was discovered that the angular velocities induced by the thrusters was repeatable in both directions for all delay times. It can be concluded that the thrusters was the cause of our flagged slosh event during these experimental sessions. Additionally the tests must be run with full tanks in order to maximize the fuel to structure mass ratio. More tests are being designed using simulation tools in an attempt to identify slosh events capable of being induced with existing hardware.