

MICROGRAVITY SCIENCES AND PROCESSES SYMPOSIUM (A2)
Microgravity Sciences Onboard the International Space Station and Beyond (6)

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RESULTS OF MICROGRAVITY FLUID DYNAMICS CAPTURED WITH THE SPHERES-SLOSH
EXPERIMENT

Abstract

This paper provides an overview of the SPHERES-Slosh Experiment (SSE) aboard the International Space Station (ISS) and presents on-orbit results with data analysis. In order to predict the location of the liquid propellant during all times of a spacecraft mission, engineers and mission analysts utilize Computational Fluid Dynamics (CFD). These state-of-the-art computer programs numerically solve the fluid flow equations to predict the location of the fluid at any point in time during different spacecraft maneuvers. The models and equations used by these programs have been extensively validated on the ground, but long duration data has never been acquired in a microgravity environment. The SSE aboard the ISS is designed to acquire this type of data, used by engineers on earth to validate and improve the CFD prediction models, improving the design of the next generation of space vehicles as well as the safety of current missions. The experiment makes use of two Synchronized Position Hold, Engage, Reorient Experimental Satellites (SPHERES) connected by a frame. In the center of the frame there is a plastic, pill shaped tank that is partially filled with green-colored water. A pair of high resolution cameras records the movement of the liquid inside the tank as the experiment maneuvers within the Japanese Experimental Module test volume. Inertial measurement units record the accelerations and rotations of the tank, making the combination of stereo imaging and inertial data the inputs for CFD model validation.