MICROGRAVITY SCIENCES AND PROCESSES SYMPOSIUM (A2)
Microgravity Sciences Onboard the International Space Station and Beyond - Part 1 (6)

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FLUIDICS : FLUID DYNAMIC IN SPACE EXPERIMENT

Abstract

The ESA Astronaut T. Pesquet was assigned to a long-duration mission on the International Space Station. He will be on-board during Expeditions 50 and 51 until June 2017. During his mission, Thomas Pesquet will perform Fluid experimentation using the new FLUIDICS (FLUId DynamICs in Space) hardware which has been defined by CNES and developed by Airbus Defense and Space. The purpose of this experiment is to validate the foreseen behavior of fluids under microgravity. The first part of the experiment addresses technological issues relative to the slosh of fluids during satellites manoeuvers. The second one will help to report the observation of capillary wave turbulence on the surface of a fluid layer in a low-gravity environment. The Fluidics experimental setup consists in a kind of centrifuge to study fluid dynamic in microgravity thanks to 2 cameras to record the fluid behavior and one force and torque sensor to record effort transmitted by the fluid to the tank. The first technology assessment is to validate numerical simulation tools. Here the considered sequences are not supposed to correspond to real spacecraft kinematics, but should consist in reference cases, that can be analyzed to check the DIVA CFD tool representativeness. Once this step will be completed the predictive models for future sloshing under different operational conditions will be updated. The second scientific objective is to observe the fluid covering all the internal surface of the spherical container that is submitted to random forcing. Such a large-scale observation without gravity waves has never been reached during ground experiments. When the forcing is periodic, two-dimensional spherical patterns are observed on the fluid surface such as subharmonic stripes or hexagons with wavelength satisfying the capillary wave dispersion relation. The duration of the experiment of some minutes allows observing wavelength never observed neither on ground nor during parabolic flights. The paper will give an extended view of the FLUIDICS hardware design test and training. FLUIDICS operations are foreseen during March and April 2017 and the full data will be available in June 2017. First results will be addressed in this paper after data processing during summer 2017.