

SPACE OPERATIONS SYMPOSIUM (B6)
Human Spaceflight Operations (1)

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ISS FLUID SCIENCE LABORATORY: HIGHLIGHTS ON ONE YEAR OF ON-ORBIT OPERATIONS

Abstract

The Fluid Science Laboratory (FSL) is an ISS-Columbus class-1 facility specifically designed to perform Fluid Physics experiments in weightlessness conditions. The FSL experiment concept is based upon a modular concept that foresees a dedicated Experiment Container (EC) for each experiment, to be autonomously operated in the facility. FSL is equipped with very sophisticated optical diagnostics, which can be automatically arranged in as much as 88 different optical modes, each characterized by a particular interferometry, holography or visualization set up.

On March 19th 2011 the GeoFlow-2 experiment, launched to the ISS with ATV-2 "Johannes Kepler", was installed inside FSL facility by ESA astronaut Paolo Nespoli, and on March 21st completed the first run. Up to now eleven months of continuous operations have been achieved, with short interruptions due to anomalies that have been promptly recovered. Runs are still on going and foreseen to be completed by March 16th 2012.

The core of GeoFlow-2 experiment can be seen as a representation of the Earth in miniature, in which gravity and temperature gradients are simulated. Scientific outcome is of interest in understanding flow in the atmosphere, the oceans and the movement of Earth's mantle on a global scale, besides engineering application.

The GeoFlow-2 experiment was run in fully automatic way, limiting the crew intervention to the EC installation at the beginning of the mission and to the de-installation at the end. The flow of data from the FSL to ground showed very good live images and high quality experiment data were stored on the hard disk of the FSL Video Management Unit (VMU). The scientific data for all the experiment runs were down-linked to the Columbus Control Centre and forwarded to the responsible User Support and Operations Centers, in Italy and Spain, and to the science team.

This paper intends to describe the most significant engineering aspects of this mission, the main challenges faced during the one year long experiment run and aims at sharing the lessons learned derived by this experience, to be taken into account for new development projects and for the following phases of utilization.