

MICROGRAVITY SCIENCES AND PROCESSES SYMPOSIUM (A2)
Facilities and Operations of Microgravity Experiments (5)

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THE FLUID SCIENCE LABORATORY ON THE ISS COLUMBUS MODULE: PERFORMANCES AND
OPERATIONS

Abstract

The Fluid Science Laboratory (FSL) is an element of the “ESA Microgravity Facilities for Columbus” program and has been designed to operate on-orbit within the Columbus module of the International Space Station (ISS). The FSL has been designed to be integrated in the Columbus for 10 years on-orbit operation. The FSL consists of different modules and equipment functionally and operationally integrated into one International Standard Payload Rack (ISPR) integrated and operated in the Columbus module. The FSL supports scientific microgravity experiments in the field of fluid physics; it distributes ISPR utilities and specific locally generated services to the fluid experiments and retransmits images, science data and housekeeping data for on board and ground monitoring. Each experiment is hosted into a dedicated cartridge, called Experiment Container (EC), designed and implemented under the Principal Investigators’ (PI) responsibility in order to be accommodated on orbit into the FSL Central Experiment Module (CEM) and to be operated in pressurized environment via the FSL provided facilities. Adequate conditioning and routing of the Columbus resources is needed in order to support the following main FSL system functions: power conversion and distribution; communication and data processing, including data recording and playback; facility commanding and monitoring from ground and flight operator; telepresence via ground centers; facility thermal control and fire detection; experiment stimuli diagnostics, resources and interfaces. In order to allow the execution of a wide range of experiments, proper stimuli and optical diagnostics are provided by means of a set of interfaces and resources in a well-defined area inside the FSL volume for the accommodation of individual EC. Integration and exchange of the Experiment Containers is performed on board by the crew. On May 2007 the Fluid Science Laboratory, after 9 years of development carried out at Thales Alenia Space Italia, was finally integrated into the Columbus module and successfully launched in early February 2008. FSL Commissioning has been started and now is ready to support microgravity sciences. The FSL is one of the most complex microgravity laboratory for Space ever built. Based on multi-user capabilities, integrating very sensitive optical diagnostics, hosting the exchangeable largest experiment containers ever designed, the FSL represents the leading edge of the European technology. The possibility to control it totally from ground increases dramatically its operability in Space ensuring, during the nominal operations, the complete independence of the experiment conduction from the on-board crew. In the last year, the FSL Operations Team, formed by experts coming from the Payload Developers and experts of the User Support and Operation Center, worked jointly to prepare the ground displays, the procedures, to test the subsystems, to evaluate the scientific performances, to tune the control systems in a large effort aimed at the exploitation of the performances offered by this facility. This paper intends to illustrate the peculiarity of the FSL and the operations activities that are making the laboratory ready to provide significant science results.