

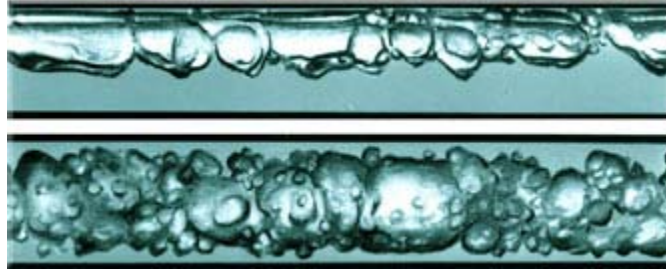
Milestones Achieved for the Fluids and Combustion Facility

In 2004, President Bush outlined a new space exploration vision for NASA. The exploration programs will seek profound answers to questions of our origins, whether life exists beyond Earth, and how we could live in other worlds. In response, research projects from NASA's Fluid Physics Research Program were moved into the Exploration Systems Mission Directorate and realigned to support the major milestones of this directorate. A new goal of this research is to obtain an understanding of the physical phenomena that are important in the design of the many space-based and ground-based fluids systems that utilize multiphase flow, such as life support, propulsion, and power systems.



Fluids and Combustion Facility—Combustion Integrated Rack and Fluids Integrated Rack.

The Fluids and Combustion Facility (FCF) is a payload planned for the International Space Station (ISS) that will support the study of fluid physics and combustion science in a long-duration, microgravity environment. The FCF is a system of on-orbit and ground hardware, software, experiment operations, and planning designed to accommodate a wide variety of investigations. On orbit, it will comprise two powered racks called the Combustion Integrated Rack and the Fluids Integrated Rack (FIR, see the preceding photograph). The FCF is being designed for autonomous and/or remotely controlled operations primarily through the Telescience Support Center at the NASA Glenn Research Center. Experimentation in the FIR will focus on fluids physics phenomena affected by gravity, including the distribution of phases, pressure drops, and heat transfer coefficients (see the following photograph). Knowledge gained of these physical phenomena will enhance the design of space-based and ground-based systems.



Air-water multiphase flow.

The FIR contains the hardware and software necessary for conducting a wide range of experiments, including experiments supporting NASA's Exploration Systems mission, while meeting ISS requirements and limitations related to safety and valuable resources, such as up/down mass and crew time. It provides many resources and capabilities that can be easily reconfigured for a wide variety of experimentation. The FIR utilizes the Active Rack Isolation System, which improves the microgravity environment for experiments by attenuating on-orbit vibrations transmitted from the Destiny Module to the International Standard Payload Rack. The FIR environmental subsystem will utilize air and water to remove up to 6 kW of heat generated by the FIR and payload hardware. The electrical power control unit will provide 120 and 28 Vdc power, power management and control functions, as well as fault protection. The FIR will provide payloads with access to the ISS gaseous nitrogen and vacuum systems through the gas interface subsystem. The FIR command and data management subsystem will provide command and data handling for both facility and payload hardware. The FIR cameras will provide various cameras and light sources to support imaging needs.

The FCF is being developed at Glenn under a prime contract with Northrop Grumman. Researchers have concluded the project's design phase and are currently assembling and testing flight hardware. In the past year, the FIR team successfully completed several major milestones, including the integration of the core systems (structural, power, and environmental control) into the FIR; a functional checkout of the core systems; the Active Rack Isolation System functional checkout and interface test; and several key ISS command and data-handling interface verifications. The flight hardware availability date is June 2005, which supports a shuttle launch no earlier than December 2005. There remain several variables that will affect the ultimate FIR launch date such as the shuttle return-to-flight date, the revised ISS assembly sequence, ISS resources available to payloads, and the payload's manifesting priority given its relevance to exploration research.

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