

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

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GLENN RESEARCH CENTER'S SPACE-BASED RESEARCH IN COMBUSTION, FLUID PHYSICS  
AND ACCELERATION MEASUREMENT ON THE ISS

**Abstract**

NASA Glenn Research Center (GRC) in Cleveland, Ohio, is at the forefront of space-based research. Whether the goal was to solve terrestrial problems or advance space exploration, GRC has looked at both fundamental studies in microgravity as well as experiments targeted at reducing the risks to long duration human missions to the moon, Mars, and beyond.

In the International Space Station (ISS) era, we now have an orbiting laboratory that provides the highly desired condition of long-duration microgravity. This allows continuous and interactive research similar to Earth-based laboratories. Because of these capabilities, the ISS is an indispensable laboratory for low-gravity research. NASA GRC has actively developed and operated facilities and experiments on the ISS since the beginning of a permanent human presence on November 2, 2000. As the lead Center for Combustion Science and Spacecraft Fire Safety, Fluid Physics and Complex Fluids, and Acceleration Environment Characterization, GRC has led the successful implementation of an Acceleration Measurement system, the Combustion Integrated Rack (CIR), and the Fluids Integrated Rack (FIR) as well as the continued use of other ISS facilities. In combustion, these facilities have supported experiments in fundamental droplet combustion, gaseous diffusion flames, solid fuels, premixed flame studies, fire detection, fire extinguishment, soot phenomena, material flammability, and flame liftoff and stability. The fluids experiments have studied capillary flow, magneto-rheological fluids, colloidal systems, extensional rheology, heat pipes, and pool and nucleate boiling phenomena.

In this paper, we provide an overview of NASA GRC's ISS experiments conducted over the past 13 years, the facilities available in these key physical sciences, and a look to future developments. In addition, this paper will provide a brief discussion on plans to develop a new theme area to conduct fluids experiments to address the effects of microgravity on biological systems.