

1994014712

N94-19185

Superfluid Helium On-Orbit Transfer (SHOOT) Flight Demonstration

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Abstract

The Superfluid Helium On-Orbit Transfer (SHOOT) Flight Demonstration was an attached Shuttle payload mounted on a Hitchhiker cross-bay carrier which flew on STS-57 in June of 1993. SHOOT successfully demonstrated the handling and transfer of superfluid helium between two containers, called dewars, in low gravity. SHOOT was a class C payload and for the STS-57 mission was termed a complex secondary payload. The primaries were the retrieval of the EURECA carrier and a collection of modular experiments contained in SPACEHAB. Because the liquid helium was continuously boiling off, SHOOT's activities were scheduled for the first three days of the mission, concurrent with some SPACEHAB experiments, but well before the EURECA retrieval. Control of the SHOOT experiment was highly interactive and originated primarily from the Goddard Payload Operations and Control Center (POCC). Transfer and calibration activities required continuous command windows of up to 50 minutes duration and up to 80 minutes out of each orbit. Occasionally the crew controlled the experiment using the Payload General Support Computer (PGSC) when near-real time control and monitoring was required. SHOOT also placed considerable demands on the orbiter, including a pitch rotation of 3°/sec for 15 minutes, and translational burns using both the aft and forward RCS jets to generate accelerations up to 7 milli-g. The basis for these and other requirements will be discussed. Interaction with the crew and timing of crew activity during the mission will be detailed. The processing flow of SHOOT at Kennedy Space Center (KSC) will be described with emphasis on the tradeoffs for vertical, as opposed to horizontal, installation in the orbiter. Finally, some lessons learned will be presented relevant to future cryogenic and Hitchhiker payloads.

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