

LESSONS LEARNED **DURING** THE INTEGRATION PHASE  
OF THE NASA IN-STEP CRYO SYSTEM EXPERIMENT

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The Cryo System Experiment, a NASA In-Space Technology Experiments Program (IN-STEP) Class D Flight Experiment, was developed by Hughes Aircraft Company to validate in zero-g space a 65 K cryogenic system for focal planes, optics, instruments, or other cryogenically cooled equipment. The system consists of a Hughes long-life, low-vibration 65K Improved Standard Spacecraft (Stirling-cycle) Cryocooler, and a diode oxygen heat pipe thermal switch that enables physical separation between the cooling source and the element to be cooled.

A key value of this flight experiment has been the opportunity for Hughes and JPL to identify and resolve cooler integration and instrumentation issues, that will be encountered during the integration of these emerging thermal management technologies in other space cryogenic cooling systems.

Presented are lessons learned from the system integration of cryocoolers for a flight experiment such as: the need for an expander cold tip restraint to preclude launch vibration damage; the design and installation of a high-compliance thermal strap that minimizes side loads on the expander; implementation of compressor and expander hysteresis test capability; the inclusion of both the cooler as well as its heat rejection materials in the mass calculation; electrical grounding issues; safety implications associated with classifying the cooler and heat pipe as pressurized components or pressure vessels; and contamination and parasitic.

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Prefer Oral Session