GROUND TESTING OF A 10 K SORPTION CRYOCOOLER FLIGHT Experiment (BETSCE)

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The Brilliant Eyes Ten-Kelvin Sorption Cryocooler Experiment (BETSCE) is a Space Shuttle side-wall-mounted experiment designed to mitigate the risk of utilizing 10 K sorption cryocooler technology for spacecraft cryogenic sensor cooling applications. The objectives of the BETSCE are to: (1) demonstrate 10 K sorption cooler technology in a microgravity space environment, (2) characterize spaceflight performance to develop the flight database needed to support the future cooler development effort, and (3) advance the enabling technologies and develop integration techniques by developing an automated, space flight-worthy instrument. Key technologies and elements to be characterized include hydride sorbent beds that reversibly chemisorb hydrogen at extreme low pressure (< 2 x 10-4 MPa) and desorb hydrogen at high pressure (> 10 MPa), phase change material, a cryogenic thermal storage device and its high thermal conductance interface to a mechanical cooler upper stage, heat exchangers and other refrigeration loop components, a cold head assembly containing a wicked solid/liquid cryogen reservoir, cycle process controls, and cycle repeatability.

This paper summarizes ground test results, which demonstrate that the BETSCE instrument meets the functional and Shuttle environmental requirements. The planned spaceflight experiment will provide further support for the use of sorption cryocooler technology for future long-life, low-vibration, spacecraft sensor cooling applications.

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Prefer Oral Session