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C1Or1A-03: Characterization Testing of Lockheed Martin Micro1-2 Cryocoolers for the Mapping Imaging Spectrometer for Europa

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The Mapping Imaging Spectrometer for Europa (MISE) instrument on the Europa Clipper mission will use a Lockheed Martin “high power” Micro1-2 pulse tube cryocooler with a heat rejection temperature below 250 K. This paper describes the performance testing and results of Lockheed Martin Micro1-2 coolers optimized for these conditions. The thermal performance of two microcoolers was measured in vacuum for heat reject temperatures between 220 and 260 K for different helium fill pressures. The coolers were driven with input powers ranging from 5 to 40 W and drive frequency between 125 and 150 Hz. The optimal drive frequency was dependent on both input power and heat reject temperature. For all conditions measured, the heat flow from the compressor was between 54% and 58% of the total heat and the compressor temperature was between 4 K and 6 K warmer than the expander temperature. In addition, another Micro1-2 cooler optimized for 300 K environment was subjected to a life-test at cold reject temperatures spanning three times the expected life on the Europa mission. The cooler performance and helium leak rate did not change over this duration. Moreover, a burst test was performed on a unit of this model of cooler that did not have the internal components. Finally, the conversion efficiency of Iris Technologies Low Cost Control Electronics (LCCE-2) was measured while operating a Micro1-2 cooler over input powers of 5 W to 50 W. The conversion efficiency was independent of drive frequency.

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