

Development and Testing of a High-Capacity 20 K Cryocooler

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Creare is developing a high-capacity 20 K cryocooler to support NASA's initiatives for zero-boil-off storage and liquefaction of hydrogen in space. The cryocooler is a single-stage turbo-Brayton cryocooler that is designed to produce 20 W of refrigeration at 20 K and reject heat at 300 K. The turbomachines are derived from prior designs and have been optimized for operation in helium and at high volumetric flow rates. The recuperator is new technology developed through a collaboration with Mezzo Technologies and Edare LCC, Creare's sister company, and optimized for high mass flow rates, low pressure loss and high thermal effectiveness. The high effectiveness recuperator enables the cryocooler to operate between 300 K and 20 K in a single stage. Three centrifugal compressors in series provides the pressure ratio which is expanded through a single turbo-alternator at the cold end. The cryocooler components are packaged and integrated in a flight-like configuration suitable for launch vibration testing. This paper reviews the component testing, integration and initial testing of the cryocooler.