

20 Watt 20 Kelvin Reverse Turbo-Brayton Cycle Cryocooler Testing and Applications

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Long-term storage of cryogenics is an essential capability required to enable NASA's anticipated missions to both the Lunar and Martian surfaces. A key component to furthering these capabilities is the development of a high capacity, low temperature cryocooler to allow for zero-boil-off storage of liquid hydrogen propellant. The technology being developed by NASA to meet this objective is a reverse turbo-Brayton cycle cryocooler capable of removing 20 Watts (W) of heat at 20 Kelvin (K). This hardware was recently tested at Creare LLC in a vacuum chamber to simulate a relevant mission environment. This testing demonstrated the hardware's functionality and established a baseline for the cryocooler's capabilities. Additional NASA led characterization testing is underway and will provide a broader picture of the operational capability of the cryocooler. This paper will discuss the results of this recent testing, along with highlighting the applications for high capacity cryocoolers on future NASA missions, such as Nuclear Thermal Propulsion (NTP) and a sustainable lunar architecture.