

---

**SESSION 13: Reverse Brayton Coolers****Paper 13.2****Thursday ORAL Session****8:30AM**

---

**Testing of a High-Capacity 90 K  
Turbo-Brayton Cryocooler**

*K.J. Cragin, A.L. Niblick, M.V. Zagarola, J.A. McCormick,  
Creare LLC, Hanover, NH*

Creare is developing high-capacity cryocoolers to support planned NASA mission objectives requiring zero-boil-off storage of cryogenic propellants in space. Creare recently demonstrated the performance of a turbo-Brayton cooler designed to meet the needs for long-term storage of oxygen and methane. The cryocooler is a higher-capacity and temperature version of a 20 K cryocooler developed and demonstrated for zero-boil-off storage of hydrogen. The primary cryocooler components – the turbo-compressor, recuperator, and turboalternator – are scaled-up versions of prior designs that have been optimized for the refrigeration load and temperature requirements of this application. The cryocooler was integrated in an Engineering Model configuration for launch vibration testing and to support future ground-based zero-boil-off demonstrations at NASA. Prior to delivery, the system was tested to map thermodynamic performance over a range of refrigeration loads and load temperatures. Random vibration testing was also performed to verify the components can withstand the launch vibration environment. This paper reviews thermodynamic performance and vibration test results for the cryocooler and presents specific power and specific mass estimates for a Flight version of the cooler.