

Development and Testing of a Lab-Scale Electro-Chemical Hydrogen Refrigerator

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Eta Space and NASA have been developing a lab-scale Electro-Chemical Hydrogen Refrigerator (ECHR) capable of providing isothermal heat exchange for applications in the 20-kelvin range. The cryocooler utilizes an electro-chemical compressor paired with Joule-Thomson expansion to cool the hydrogen working fluid down to its saturation point within a purpose-built cold box, designed and manufactured by the Cryogenics Test Laboratory at NASA Kennedy Space Center. The use of electro-chemical compression allows the cycle to operate with no moving parts presenting several key advantages for a variety of applications. Testing of the integrated system occurred in Eta Space's cryogenic test facility where the system was able to achieve and maintain saturated temperatures at low pressure. Results of this test campaign demonstrate the feasibility of the ECHR concept in practice.