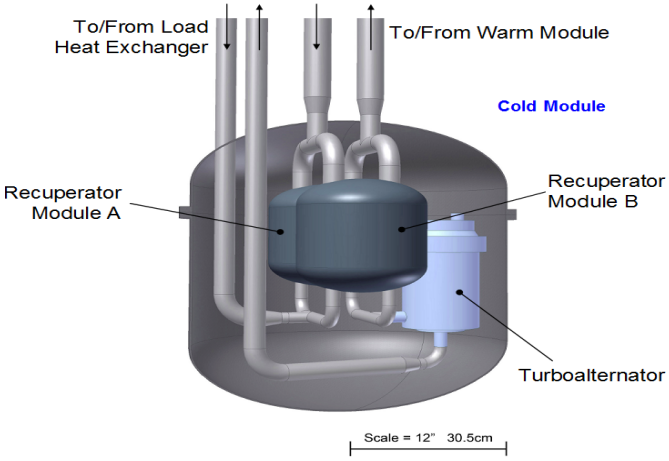
A Turbo-Brayton Cryocooler for Aircraft Superconducting Systems

Creare LLC
PI: Mark Zagarola Proposal #A2.01-9150

OBJECTIVES

The overall objective of this program is to develop an extremely lightweight, high-performance *Cryoflight* cryocooler that is optimized for cooling superconducting devices in an electric aircraft. This project addresses the need for lightweight, high-performance recuperators optimized for this application, a critical component in the cryocooler.



Cryocooler Cold Module With Recuperator Modules

ACCOMPLISHMENTS

NOTABLE DELIVERABLES PROVIDED:
We delivered a final report and a design report that describe the results of our design, analysis, and testing efforts.

KEY MILESTONES MET:
We completed a number of risk reduction trials, including fabrication and performance tests, and used the results to update our design models. We then used these models to optimize the design of our heat exchanger. We fabricated components for one heat exchanger module but experienced a critical failure in the heat exchanger core during final assembly. We devoted the remainder of the project to testing to optimize the design of the heat exchanger.

FUTURE PLANNED DEVELOPMENTS

PLANNED POST-PHASE II PARTNERS:
Our plan is to partner with Turbo Cryogenics, a spin-off from Creare, to market and provide the cryocooler technology.

PLANNED/POSSIBLE MISSION INFUSION:
The proposed *Cryoflight* cryocooler development effort will support NASA's long-term goal to increase aircraft efficiency and reduce aircraft emissions and noise. By providing a cryocooler optimized to meet the aggressive power density target required for aircraft systems, we will remove a key obstacle hindering the development of superconducting aircraft.

PLANNED/POSSIBLE COMMERCIALIZATION:
The primary private sector application for this cryocooler is for cooling superconducting devices. Apart from hybrid turboelectric aircraft, other transformational initiatives that rely on HTS technologies include power transmission systems, large-scale offshore wind turbines, high-efficiency data centers, and electric ship systems.

Expected TRL Range at the beginning and end of Contract: **Beginning: 3** **End: 3**

CONTRACT (CENTER) **NNX13CC07C (GRC)**	**SOLICITATION-PHASE** **SBIR 2011-II**
SUBTOPIC **A2.01 Materials and Structures for Future Aircraft**	**TA** **Cryogenic/Fluid Systems**

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