

NASA SBIR/STTR Technologies

A1.03-9346 - A New Cryocooler for MgB₂ Superconducting Systems in Turboelectric Aircraft



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Identification and Significance of Innovation

- High capacity, low temperature cryocooler for cooling MgB₂ superconducting systems
- Extremely lightweight and efficient relative to state-of-the-art commercial cryocoolers
- Enabling technology for turboelectric aircraft
- Benefits
 -Very efficient, low temperature cryocooler (>24% of Carnot cycle)
 -Lightweight (304 kg)
 -Low input power (43 kW for 800 W of cooling at 20 K)
 -Reliable
 -Compact
 -Flexible aircraft integration

Estimated TRL at beginning and end of contract: (Begin: 3 End: 4)

Technical Objectives and Work Plan

Phase I Results

- Determined cryocooler configurations most suited for specific payload configurations
- Developed a design and development/demonstration plan for a lightweight cryocooler optimized for application
- Designed and evaluated maturity/development risks for each component

Phase II Technical Objectives

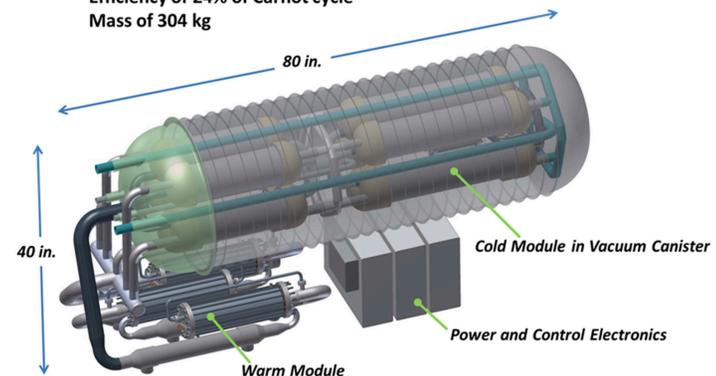
- Finalize technology and design of component with highest risk
- Build and test prototype component
- Increase TRL of cryocooler to 4

Phase II Work Plan

- Perform risk reduction tests
- Select component technology for further development
- Design, fabricate and assemble component
- Test component and assess impact to cryocooler design

Cryoflight-LT Cryocooler

800 W of refrigeration at 20 K
Input power of 43 kW
Efficiency of 24% of Carnot cycle
Mass of 304 kg



NASA Applications

MgB₂ motors, generators and transmission lines for turboelectric aircraft; H₂ cryogenic liquefaction and zero-boil-off storage for in-space propellant depots; CEVs; extended-life orbital transfer vehicles; and extraterrestrial bases.

Non-NASA Applications

MgB₂ motors, generators and transmission lines for commercial turboelectric aircraft; power conditioning and power transmission systems; large-scale offshore wind turbines; high efficiency data centers; and Navy ship systems

Firm Contacts

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NON-PROPRIETARY DATA