

**Briefing Chart**

**NASA SBIR/STTR Technologies**

**Thermal Management of Superconducting Electromagnets in VASIMR Thrusters**

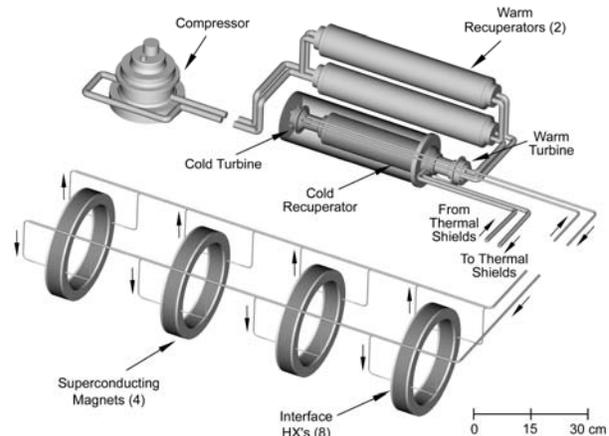
**Dr. Anthony Dietz / Creare Incorporated, Hanover, NH**

**Proposal No.: 03-II.F&.01-8219**

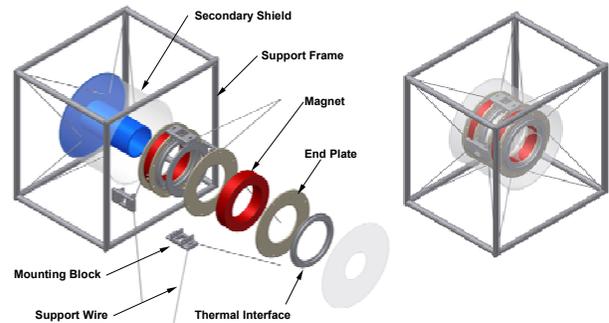


**Identification and Significance of Innovation**

- Advanced propulsion such as VASIMR engine are key to future space exploration
- Thermal management of the high temperature superconducting (HTS) magnets is one of the most significant engineering challenges facing VASIMR developers
- Proposed innovation is a high-capacity turbo-Brayton cryocooler for thermal management of VASIMR electromagnets
- Proposed system is based on a space-qualified cooler developed by Creare and currently operating on the Hubble Space Telescope
- Turbo-Brayton coolers are ideal for space applications as they are lightweight, compact, efficient, vibration-free, highly reliable, modular, and easily integrated.
- The technology scales well to higher capacities, unlike systems based on other cycles
- Feasibility demonstrated in Phase I. Team are experts in turbomachinery and HTS magnets



**High Capacity Turbo-Brayton Cryocooler Integrated with VASIMR Electromagnets**



**Magnet Thermal Isolation and Support**

**Technical Objectives and Work Plan**

Phase II: Demonstrate thermal management of a HTS magnet using a turbo-Brayton cryocooler:

- Build and demonstrate a brassboard system
- Address specific technical issues on: thermal loads, magnet temperature uniformity, system integration and system performance
- Deliver magnet, interface heat exchangers, and thermal isolation and support structure for use in NASA/JSC development engine

Phase III: Build and deliver Engineering Model (EM) cryocoolers for test and evaluation. Transition to systems for flight units through licensing and teaming.

**NASA and Non-NASA Applications**

- VASIMR engines for space exploration
- Applications requiring high-capacity cryocoolers for cryogen storage or gas liquefaction and separation
- Cooling for HTS magnets, improving on current magnet technology widely used in MRI machines
- Other HTS magnet applications include motors, generators, transmission lines etc.

**Contact**

Dr. Anthony Dietz, Creare Inc.  
602-640-2310, [ajd@creare.com](mailto:ajd@creare.com)