

Lightweight, Efficient Power Converters for Advanced Turboelectric Aircraft Propulsion Systems

Extremely efficient cryogenic power conversion technology

NASA is investigating advanced turboelectric aircraft propulsion systems that use superconducting motors to drive multiple distributed turbofans. Conventional electric motors are too large and heavy to be practical for this application; therefore, superconducting motors are required. In order to improve aircraft maneuverability, variable-speed power converters are required to throttle power to the turbofans. The low operating temperature and the need for lightweight components that place a minimum of additional heat load on the refrigeration system open the possibility of incorporating extremely efficient cryogenic power conversion technology. This Phase II project is developing critical components required to meet these goals.

Applications

NASA

- ▶ Turboelectric aircraft propulsion systems
- ▶ High-power drives for superconducting motors
- ▶ High-power and high-power-density cryogenic and wide temperature range power conversion systems:
 - Interplanetary and interstellar spacecraft
 - Satellites
 - Landers
 - Surface base stations on moons or planets

Commercial/Other Government

- ▶ Utility projects to develop superconducting power transmission
- ▶ Superconducting wind turbine generators
- ▶ Distribution systems for large buildings (e.g., data centers, manufacturing plants):
 - MTECH Laboratories is currently working toward a demonstration site of such a distribution system
- ▶ U.S. Navy:
 - Cryogenic motor drive system for the All-Electric Ship program
- ▶ U. S. Department of Energy (DOE):
 - Equipment for superconducting accelerators at DOE national accelerator labs



Phase II Objectives

- ▶ Design, fabricate, and test a cryogenic multichip module, which can be used in applications requiring very high power densities and efficiencies
- ▶ Design, fabricate, and test a cryogenic half-bridge inverter using these modules, demonstrating the potential reduction in size and weight for a given power level as well as ultrahigh efficiency

Benefit

- ▶ Offers small size, low weight, and high efficiency

Firm Contact

MTECH Laboratories, LLC
 Michael J. Hennessy
 mjhennessy@mtechlabs.com
 831 Rte. 67, Bldg. 45C
 Ballston Spa, NY 12020-0227
 Phone: 518-885-6436

Proposal Number: 09-2: A2.01-9471