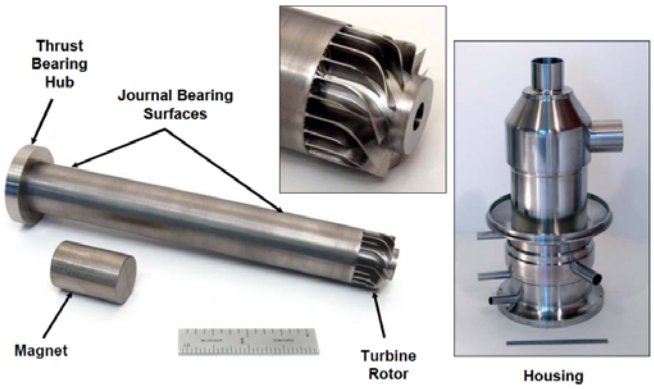
BRIEFING CHART

NASA SBIR/STTR Technologies
An Advanced Wet Expansion Turbine for Hydrogen Liquefaction
PI: Mark V. Zagarola / Creare Incorporated, Hanover, NH
Proposal No.: 10-X10.01-8855

Identification and Significance of Innovation

This proposal is responsive to a NASA need for efficient small- to medium-scale hydrogen liquefaction technologies to support future earth-based, planetary, and lunar surface missions. On this Phase I/II program, Creare will build and test a cryogenic wet expansion turbine for use in a hydrogen liquefier. The expansion turbine will be reliable, compact, lightweight, and efficient and will be able to operate in a two-phase system. It will have the innovative option of recovering the expansion work through use of an alternator instead of dissipation work through a brake wheel. This approach greatly simplifies controls, improves reliability, and reduces system mass and input power.

Expected TRL Range at the beginning and end of Contract (1–9): 3 to 4



Photographs of 2 kW Air Force Turboalternator Developed by Creare. The design of this turbo-alternator will serve as the baseline for the proposed wet expansion turbine.

Phase I Technical Objectives

- What are the specifications of the expansion turbine?
- What are the technologies used in the expansion turbine?
- What is the design of the expansion turbine?
- What is the performance of the expansion turbine?

Work Plan

Phase I: We will achieve our Phase I technical objectives by performing the design, analyses, and trade studies needed to complete a preliminary design of the expansion turbine. The overall result will be accurate assessments of thermodynamic performance, mass, volume, and technical risk.

Phase II: We will build and test an expansion turbine at prototypical operating conditions.

NASA Applications

The result of this Phase I/II program will be a turboexpander for a small- to medium-scale hydrogen liquefier. The turboexpander will be lightweight, compact, efficient, and reliable and suitable for use in future earth-based, planetary, and lunar surface missions.

Non-NASA Applications

The commercial potential of an advanced turboalternator or turboexpander are significant and include cooling for laboratory- and industrial-scale gas separation, liquefaction, storage, and transportation systems; high-temperature superconducting magnets in motors and magnetic resonance imaging systems; liquid hydrogen fuel cell storage for the automotive industry; and commercial orbital transfer vehicles and satellites.

Contacts

Dr. Mark V. Zagarola, mvz@creare.com, 603-640-2360

Non-Proprietary Data
No ITAR Restricted Data