

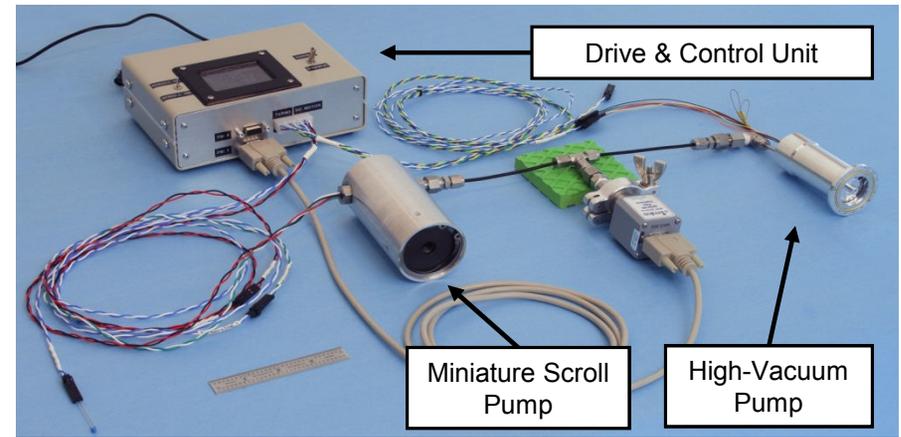
S1.09-9459 – Compact Vacuum Pump for Titan Lander Missions

PI: Paul H. Sorensen  
Creare Inc. – Hanover, NH 03755

Identification and Significance of Innovation

A compact vacuum pump is highly sought after by the science community, since it provides a hard vacuum in a compact, low-power package that can directly be used in both planetary and Earth atmospheres. Creare has developed highly miniaturized, hybrid turbomolecular/molecular drag pumps (TMP/MDPs) that are capable of generating the necessary high vacuum and directly exhaust to the Martian atmosphere. The purpose of the research conducted under this SBIR project is to design, build, and test a rough pump that can be compactly integrated with an existing Creare hybrid turbomolecular/molecular drag pump design to exhaust directly to Earth and Titan atmosphere.

Expected TRL Range at the end of Contract (1–9): 5



Technical Objectives and Work Plan

The overall goal of the Phase II project is to develop and test a complete vacuum system capable of generating a high vacuum (~10<sup>-8</sup> torr) and exhausting to a pressure in excess of 1 atm in a compact, low power consumption package optimized for supporting portable analytical instruments.

To achieve this overall goal, in Phase II we designed and constructed a stand-alone roughing pump with a tailored motor drive, mated the pump with a TMP/MDP to form a compact vacuum system for benchtop testing, and developed custom control electronics for the integrated pumping system. The benchtop pump was tested extensively under normal laboratory conditions, as well as in varying environmental conditions representative of specific applications of interest to NASA.

NASA and Non-NASA Applications

Planetary atmospheric and solid sample analysis using mass spectrometers and electron microscopes include planned missions to Mars, Venus, Jupiter’s moons, and the major moons of Saturn (notably Titan), and will require vacuum pump capabilities exceeding current technology. Terrestrial applications within NASA include atmospheric sampling instruments in support of several space-based remote atmospheric sensing systems. Another NASA application that would benefit from such a vacuum system would be an air sampling instrument for the International Space Station. Commercial applications include portable MS systems used for air sampling, radioactive material identification, homeland security applications, etc.