

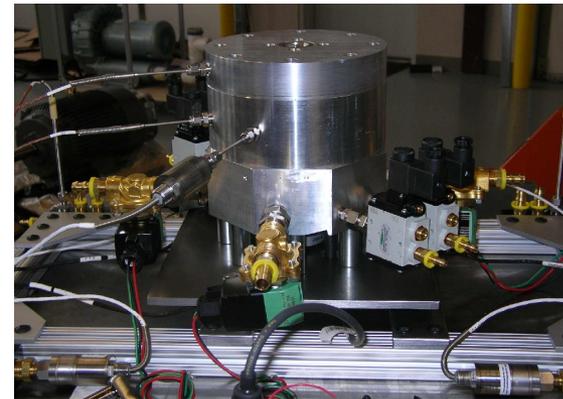
Constant Volume Combustion Engine for Planetary Ascent Vehicles

PI: Roberto DiSalvo, PhD / Streamline Automation, LLC – Huntsville, AL

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Identification and Significance of Innovation

- The Mars Sample Return mission is being planned to return samples of Martian rock, regolith, and atmosphere to Earth for scientific analysis
- A reliable engine that can withstand long periods of cold soak is needed for the Mars Ascent Vehicle that will provide initial boost to transport the samples into Mars orbit
- The Constant Volume Combustion (CVC) engine is an innovative design that combines light weight, low pressure fuel tanks and operates at high chamber pressures
- CVC has exceptional thrust-to-weight ratios
- The proposed bipropellant system (NOP) meets Martian temperature requirements without heating or stirring



Phase 1 Prototype Constant Volume Combustion Engine. Testing demonstrated the feasibility of engine operation.

Technical Objectives

- Refine CVC engine design for Mars Ascent Propulsion
- Select faster actuating fuel and oxidizer injector valves to increase pulse rate and thrust control
- Develop control algorithm to optimize thrust profile
- Fabricate prototype hardware
- Perform hot-fire testing over a range of thrust levels with a non-toxic, low-temperature bipropellant system (N₂O/C₃H₈)

Work Plan

- Refine engine design and optimize injectors
- Develop optimized pulse mode controller
- Analytical thrust predictions
- Prototype hardware fabrication and assembly
- Engine testing to demonstrate thrust control and reliability
- Post-test data reduction and analysis

NASA Applications

- Mars Ascent Vehicle
- Other planetary and small body sample return missions
- Integrate within the current framework of the missions of the In-Space Propulsion Program

Non-NASA Applications

- DACS for Kinetic Kill Vehicles
- Orbital maneuvering and station keeping thrusters

Firm Contacts

- Dr. Roberto DiSalvo – Principal Investigator
(256) 713-1220 ext. 604, Roberto.DiSalvo@StreamlineAutomation.biz
- Mr. Alton Reich, PE – Program Manager
(256) 713-1220 ext. 603, Alton.Reich@StreamlineAutomation.biz