NASA SBIR/STTR Technologies

Constant Volume Combustion Engine for Planetary Ascent Vehicles

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

Proposal No: S3.08-9507

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

Constant Volume Combustion Engine Undergoing Proof-of-Concept Testing

Technical Objectives

- Evaluate CVC engine concept for Mars Ascent Propulsion
- Design key components using advanced numerical simulations
- Fabricate prototype hardware
- Design and evaluate pulse-mode firing sequence using NASA GFSSP analysis code
- Perform demonstration hot-fire testing with a non-toxic, low-temperature capable bipropellant system (N2O/C3H8)

Work Plan

- Develop Performance Models of CVC Engine
- Reciprocating Thrust Valve (RTV) and Nozzle Design
- Pulse-Mode Cycle Analysis
- Demonstration Hardware Fabrication and Assembly
- Initial Development Testing
- 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