

High Duty Cycle, Extended Operation Constant Volume Combustion Engine

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Identification and Significance of Innovation

- NASA is planning future missions that will be performed at or near the surface of planets or small bodies that will require higher duty cycles and/or extended operation
- These will require a reliable, robust engine that can withstand long periods of cold soak
- 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 CVC engine can control thrust by varying both the duty cycle and the engine throat area making it highly throttleable



Prototype Constant Volume Combustion Engine: Hot-fire testing demonstrated the feasibility of engine operation.

Technical Objectives

- Demonstrate multi-mode thrust modulation (deep throttling) through the use of pulse modulation combined with throat throttling techniques
- Demonstrate performance levels under high duty cycle, extended operation
- Study the engine scaling/similarity relationships pertinent to SMD missions

Work Plan

- Modify the current CVC engine to enable throat throttling
- Develop the logic for Multi-Mode Control
- Initial development testing
- Post-test data reduction and analysis
- Scaling and similarity study

NASA Applications

- Astrophysics missions
- Heliophysics missions
- Mars, other planetary and small body sample return missions
- Other in-space propulsion missions

Non-NASA Applications

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

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