



NASA SBIR 2009 Phase I Solicitation

X10.01 Cryogenic and Non-Toxic Storable Propellant Space Engines

Lead Center: GRC

Participating Center(s): JSC, MSFC

This subtopic intends to examine a range of key technology options associated with cryogenic and non-toxic storable propellant space engines. The primary mission for the engines will be to support lunar ascent/descent reaction control engines and lunar ascent engines. These engines can be compatible with the future use of in situ propellants such as oxygen, methane, methanol, monopropellants, or other non-toxic fuel blends. Key performance parameters:

- Reaction control thruster development is in the 25-500-lbf thrust class with a target vacuum specific impulse of 325-sec. These RCS engines would operate cryogenic liquid-liquid for applications requiring integration with main engine propellants; or would operate gas-gas or gas-storable liquid for small total impulse type applications.
- Ascent engine development is projected to be in the 3,500-8,000-lbf thrust class with a target vacuum specific impulse of 355-sec. The engine shall achieve 90% rated thrust within 0.5 second of the issuance of the Engine ON Command.

Specific technologies of interest to meet proposed engine requirements include:

- Non-toxic fuel blends or monopropellants that meet performance targets while improving safety and reducing handling operations as compared to current state-of-the-art storable propellants.
- Low-mass propellant injectors that provide stable, uniform combustion over a wide range of propellant inlet conditions.
- High temperature materials, coatings and/or ablatives for injectors, combustion chambers, nozzles and nozzle extensions.
- Combustion chamber thermal control technologies such as regenerative, transpiration, swirl or other

cooling methods which offer improved performance and adequate chamber life.

- Highly-reliable, long-life, fast-acting propellant valves that tolerate space and lunar environments with reduced volume, size, and weight is also desirable.
- Cryogenic instrumentation such as pressure and temperature sensors that will operate for months/years instead of hours.

Research should be conducted to demonstrate technical feasibility during Phase 1 and show a path toward a Phase 2 hardware demonstration, and when possible, deliver a demonstration unit for functional and environmental testing at the completion of the Phase 2 contract.