



NASA SBIR 2011 Phase I Solicitation

S3.04 Propulsion Systems

Lead Center: GRC

Participating Center(s): JPL, MSFC

The Science Mission Directorate (SMD) needs spacecraft with more demanding propulsive performance and flexibility for more ambitious missions requiring high duty cycles, more challenging environmental conditions, and extended operation. Planetary spacecraft need the ability to rendezvous with, orbit, and conduct in situ exploration of planets, moons, and other small bodies in the solar system (http://www.nap.edu/catalog.php?record_id=10432). Future spacecraft and constellations of spacecraft will have high-precision propulsion requirements, usually in volume- and power-limited envelopes.

This subtopic seeks innovations to meet SMD propulsion requirements, which are reflected in the goals of NASA's In-Space Propulsion Technology program to reduce the travel time, mass, and cost of SMD spacecraft. Advancements in chemical and electric propulsion systems related to sample return missions to Mars, small bodies (like asteroids, comets, and Near-Earth Objects), outer planet moons, and Venus are desired. Additional electric propulsion technology innovations are also sought to enable low cost systems for Discovery class missions, and eventually to enable radioisotope electric propulsion (REP) type missions.

The focus of this solicitation is for next generation propulsion systems and components, including high-pressure chemical rocket technologies and low cost/low mass electric propulsion technologies. Specific sample return propulsion technologies of interest include higher-pressure chemical propulsion system components, lightweight propulsion components, and Earth-return vehicle propulsion systems. Propulsion technologies related specifically to planetary ascent vehicles will be sought under S3.08 Planetary Ascent Vehicle. Propulsion technologies related specifically to Power Processing Units will be sought under S3.05 Power Management and Storage.

Chemical Propulsion Systems

Technology needs include:

- Pump or alternate pressurization technologies that provide for high-pressure operation (chamber pressures > 500 psia) of spacecraft primary propulsion systems (100- to 200-lbf class) using Earth storable or space storable bipropellants.

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- Catalytic and non-catalytic ignition technologies that provide reliable ignition of high-performance (Isp > 240 sec), nontoxic monopropellants for power-limited spacecraft.

Electric Propulsion Systems

This subtopic also seeks proposals that explore uses of technologies that will provide superior performance for high specific impulse/low mass electric propulsion systems at low cost. These technologies include:

- Thrusters with efficiencies > 50% and up to 1 kW of input power that operate with a specific impulse between 1600 to 3500 seconds.
- An efficient (>60 %), dual mode thruster that is capable of operating in both high thrust (>60 mN/kW) and high specific impulse (>3000 sec) modes for a fixed power level.
- High power electric propulsion thrusters (up to 25 kW) and components including cathodes, ion optics, low sputtering materials with long life (>1x10⁸ N-s), high temperature insulators with low secondary electron emission, and high temperature, low electrical resistivity wire.

Proposals should show an understanding of the state of the art, how their technology is superior, and of one or more relevant science needs. The proposals should provide a feasible plan to develop fully a technology and infuse it into a NASA program.

Note to Proposer: Topic X2 under the Exploration Mission Directorate also addresses advanced propulsion. Proposals more aligned with exploration mission requirements should be proposed in X2.