



NASA SBIR 2011 Phase I Solicitation

X2.03 Electric Propulsion Systems

Lead Center: GRC

Participating Center(s): JPL, MSFC

The goal of this subtopic is to develop innovative technologies for high-power (100 kW to MW-class) electric propulsion systems. High-power (high-thrust) electric propulsion may enable dramatic mass and cost savings for lunar and Mars cargo missions, including Earth escape and near-Earth space maneuvers. At very high power levels, electric propulsion may enable piloted exploration missions as well. Improved performance of propulsion systems that are integrated with associated power and thermal management systems and that exhibit minimal adverse spacecraft-thruster interaction effects are of interest. Innovations are sought that increase system efficiency, increase system and/or component life, increase system and/or component durability, reduce system and/or component mass, reduce system complexity, reduce development issues, or provide other definable benefits. Desired specific impulses range from a value of 2000 s for Earth-orbit transfers to over 6000 s for planetary missions. System efficiencies in excess of 50% and system lifetimes of at least 5 years (total impulse > 1 x 10⁷ N-sec) are desired. Specific technologies of interest in addressing these challenges include:

- Long-life, high-current cathodes (100,000 hours).
- Electric propulsion designs employing alternate fuels (ISRU, more storable).
- Electrode thermal management technologies.
- Innovative plasma neutralization concepts.
- Metal propellant management systems and components, and cathodes.
- Low-mass, high-efficiency power electronics for RF and DC discharges.
- Lightweight, low-cost, high-efficiency power processing units (PPUs).
- PPUs that accept variable input voltages of greater than 200V and vary by a factor of 2-to-1.
- Direct drive power processing units.
- Low-voltage, high-temperature wire for electromagnets.

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- High-temperature permanent magnets and/or electromagnets.
 - Application of advanced materials for electrodes and wiring.
 - Highly accurate propellant control devices/schemes.
 - Miniature propellant flow meters.
 - Lightweight, long-life storage systems for krypton and/or hydrogen.
 - Fast-acting, very long-life valves and switches for pulsed inductive thrusters.
 - Superconducting magnets.
 - Lightweight thrust vector control for high-power thrusters.
 - Fast-starting cathodes.
 - Propellantless cathodes.
 - High temperature electronics for power processing units.

Note to Proposer: Subtopic S3.04 under the Science Mission Directorate also addresses in-space propulsion. Proposals more aligned with science mission requirements should be proposed in S3.04.