



NASA SBIR 2015 Phase I Solicitation

H2.03 High Power Electric Propulsion

Lead Center: GRC

Participating Center(s): JPL, MSFC

The goal of this subtopic is to develop innovative technologies that can lead to high-power (100-kW to MW-class) electric propulsion systems. High-power solar or nuclear electric propulsion may enable dramatic mass and cost savings for lunar and Mars cargo missions, including Earth escape and near-Earth space maneuvers, and at very high power levels enable piloted exploration missions.

Innovations and advancements leading to improvements in the end to end performance of high power electric propulsion systems are of interest. Methods are sought to increase overall system efficiency; improve system and/or component life or durability; reduce system and/or component mass, complexity, and development issues; or provide other definable benefits. In general, thruster system efficiencies exceeding 60% and providing total impulse values greater than 10^7 N-sec are desired. Specific impulse values of interest range from a minimum of 1500-sec for Earth-orbit transfers to over 6000-sec for planetary missions.

Specific technologies of interest in addressing high power electric propulsion challenges include but are not limited to:

- Advanced concepts for high power plasma thruster systems that provide quantifiable benefits over state of the art high power electric propulsion systems. Proposals addressing advanced technology concepts should include a realistic and well-defined roadmap defining critical technology development milestones leading to an eventual flight system.
- Electric propulsion systems and components that enable the use of alternative space storable propellants, such as condensable or metal propellants and potential in-situ resource derived propellants.
- Advanced manufacturing methods for the fabrication of high power thruster components and associated systems; of particular interest is additive manufacturing for complex parts and components. Figures of merit include lower cost, rapid turnaround, and material and structural integrity comparable to or better than components or systems produced using current fabrication methods.
- Components for inductively pulsed plasma thrusters, in particular highly accurate flow controllers and fast acting valves; and solid state switches capable of high current (MA), high repetition rate (up to 1-kHz), long life (equal to or $>10^9$ pulses) operation.

In addressing technology requirements, proposers should identify candidate thruster systems and potential mission applications that would benefit from the proposed technology.

Phase I Deliverables - Research to identify and evaluate candidate technology applications to demonstrate the technical feasibility and show a path towards a demonstration. Bench or lab-level demonstrations are desirable. The technology concept at the end of Phase I should be at a TRL of 4 to 5

Phase II Deliverables - Emphasis should be placed on developing and demonstrating the technology under simulated mission conditions. The proposal shall outline a path showing how the technology could be developed into mission-worthy systems. The contract should deliver a demonstration unit for functional and environmental testing at the completion of the Phase II contract. The technology concept at the end of Phase II should be at a TRL of 5 to 6.