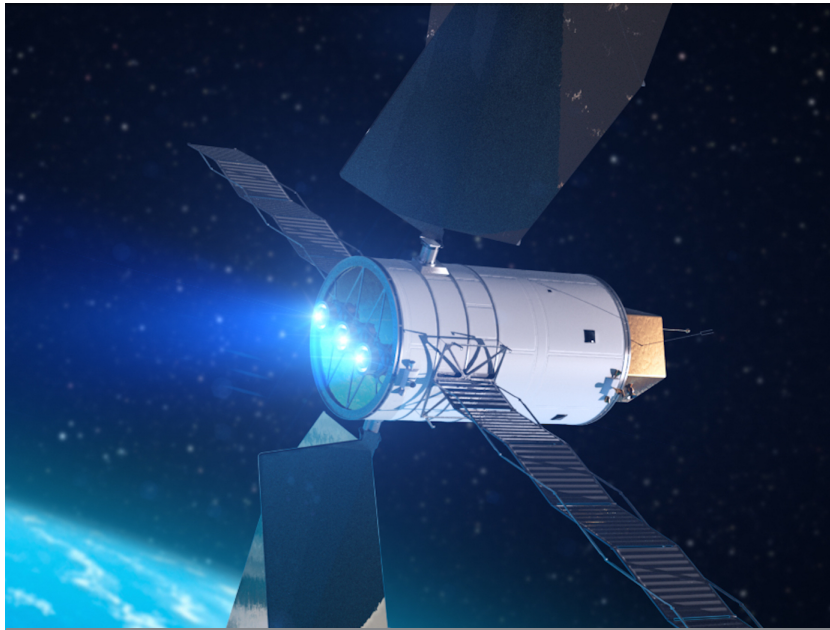


TECHNOLOGY SOLUTION

Propulsion



High Propellant Throughput Small Spacecraft Electric Propulsion Thruster

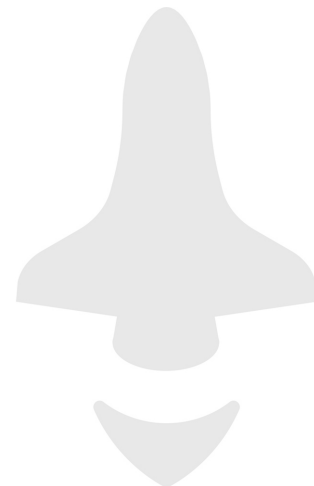
An Advanced Hall effect Thruster Technology

Innovators at NASA's Glenn Research Center have developed a suite of small spacecraft electric propulsion (SSEP) technologies critical to enabling new, ambitious missions into deep space. Advanced SSEP technologies are based on the use of exceptionally fuel-efficient electrostatic Hall effect thrusters with optimized magnetic shielding, achieving massive reductions in propellant mass relative to traditional chemical propulsion systems. NASA's low-power, high-throughput SSEP technology dramatically increases the capabilities of small spacecraft while maximizing reliability and reducing launch costs.

The High Propellant Throughput Small Spacecraft Electric Propulsion thruster is available for licensing on its own, or as a component of NASA's SSEP suite, which is available to U.S. companies through a no-cost, non-exclusive license agreement and companion Space Act Agreement. Click the LEW-TOPS-162: Small Spacecraft Electric Propulsion (SSEP) Technologies link in the Additional Information section for details.

BENEFITS

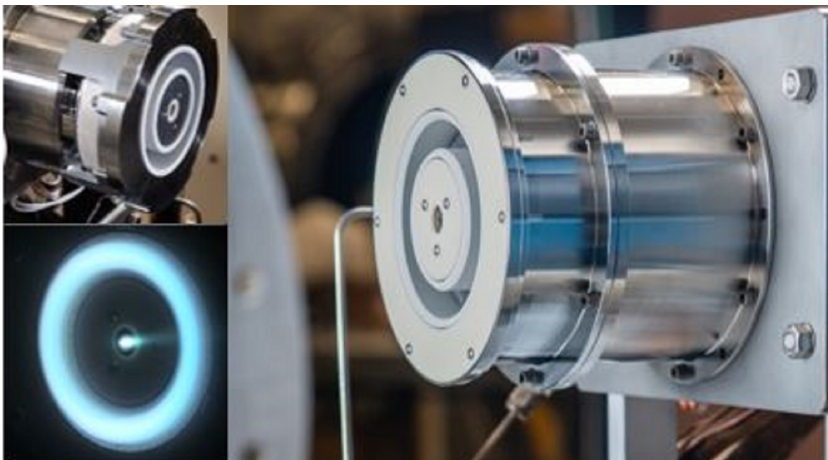
- Increases propellant throughput: propellant throughput of the thruster is 2-5x of existing flight heritage thrusters within the sub-kilowatt thruster power class
- Expands lifetime of thruster components: the optimized magnetic shielding configuration can significantly reduce the front pole cover erosion rate and the discharge channel erosion rate when compared to traditional Hall effect thruster designs, enabling long-life high propellant throughput capability
- Reduced cost: miniaturizes Hall effect thruster technology without loss of substantial performance



THE TECHNOLOGY

NASA's High Propellant Throughput Small Spacecraft Electric Propulsion thruster offers a propellant throughput capability of greater than 120 kg with a nominal thruster efficiency greater than 50%. The new thruster design combines heritage Hall thruster component design approaches with recent NASA GRC advancements in the areas of advanced magnetic circuit design, robust propellant manifolds, and center mounted cathodes. Prototypes of the High Propellant Throughput Small Spacecraft Electric Propulsion thruster have been fabricated and proof-of-concept has been demonstrated.

A significant advancement in the High Propellant Throughput Small Spacecraft Electric Propulsion thruster is NASA's optimized magnetically shielded (OMS) field topology. The new OMS configuration reduces discharge channel erosion rates compared to conventional Hall thrusters, while reducing front pole cover erosion rates compared to traditional magnetically shielded Hall thrusters. This system also includes a largely unibody structure to reduce fabrication cost, increase strength, and optimize thermal management. A coupling plate between the high voltage discharge channel and low voltage thruster body allows more efficient thruster assembly and verification processes. Other design advancements further simplify assembly, improve robustness, and optimize performance.



(Right) The NASA-H71M Pathfinder Model thruster. (Top Left) The NASA-H64M Laboratory Model thruster. Both thrusters are embodiments of the high propellant throughput small spacecraft electric propulsion technology. (Bottom Left) NASA-H71M demonstrated at NASA Glenn Research Center in Vacuum Facility 8

APPLICATIONS

The technology has several potential applications:

- Aerospace: a propulsion system for small spacecraft using Hall effect thrusters
- Commercial space: small satellite constellations, station keeping, orbit raising, missions beyond Low Earth Orbit/ Geosynchronous Equatorial Orbit

PUBLICATIONS

Patent No: 11,540,381

LEW-TOPS-162: Small Spacecraft Electric Propulsion (SSEP) Technologies

Development of a High-Propellant Throughput Small Spacecraft Electric Propulsion System to Enable Lower Cost NASA Science Missions, Benavides, Gabriel F., et al, August 19, 2019 <https://ntrs.nasa.gov/citations/20190030739>

technology.nasa.gov

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NASA's Technology Transfer Program pursues the widest possible applications of agency technology to benefit US citizens. Through partnerships and licensing agreements with industry, the program ensures that NASA's investments in pioneering research find secondary uses that benefit the economy, create jobs, and improve quality of life.

LEW-20041-1, LEW-TOPS-158