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AMPSS-2.: ADVANCED MICRO-PROPULSION SYSTEM FOR SMALL SATELLITES BASED ON
2-MN HALL-EFFECT THRUSTER

Abstract

Small satellites have become increasingly important for a wide range of applications, due to their compact size, lower cost, and increased accessibility. Electric propulsion systems offer several advantages over chemical propulsion systems, making them an indispensable option for a wide range of applications, particularly for orbital lifetime extension and precise spacecraft positioning. However, the size of powerful electric propulsion systems is often too large for micro-satellites in the size class range of 12U to 18U. Therefore, a small and efficient electric propulsion system would be highly suitable to open up new opportunities for commercial, academic and scientific micro-satellite missions.

The German company Berlin Space Consortium (BSC) has developed a standardized electric propulsion system for micro-satellites, dubbed AMPSS (Advanced Micro-Propulsion for Small Satellites), that uses innovative Hall-effect thruster technology. AMPSS comes in two different versions which can be operated either with Xenon or with Krypton. The overall size of the AMPSS module has the dimensions of a 4U nano-satellite. The AMPSS-2000 configuration is equipped with a 2-mN Hall-effect thruster that has a specific impulse of up to 950 s and a power consumption of 70-110 W. With a tank volume of roughly one liter, a total impulse of several kNs can be achieved. All required AMPSS subsystems, namely the propellant feed and flow control subsystem, the propellant storage unit and the power processing unit (PPU) are accommodated within the volume of the 4U-module.

The AMPSS Hall-effect thruster uses a novel design approach for its cathodes that allow for a starting time of less than one second. Moreover, by applying a specific technology, the erosion of the anode unit ceramics could be reduced to such an extent that the lifetime of the thruster was significantly increased. All AMPSS lifecycle tests are conducted in Berlin using the inhouse vacuum chamber of BSC, while ground qualification testing is performed at certified partner institutions such as the German Space Agency DLR. AMPSS is ITAR/EAR-free and will be commercially available for micro-satellite manufacturers that are looking for a cost-efficient and easy-to-handle propulsion system solution for their upcoming small satellite missions.

Keywords: Electric Propulsion System, Hall-Effect Thruster, Small Satellites, AMPSS, Advanced Micro-Propulsion for Small Satellites