

IAF SPACE PROPULSION SYMPOSIUM (C4)
Electric Propulsion (4)

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QUALIFICATION STATUS OF THE PPS®5000 HALL THRUSTER UNIT

Abstract

The PPS(R)5000 is a 5-kW-class Hall thruster currently under qualification at Safran, with flight hardware production on-going in parallel. The thruster design is sized for 5 kW of discharge power and a minimum total impulse capability of 11.7 MN.s, with the objective of reaching 14.5 MN.s. It has demonstrated significant thermal margins through the extensive testing performed over the course of the pre-development and development activities. This design has also been demonstrated to possess growth potential up to 7 kW permitted by specific internal architecture. The complete development of the PPS(R)5000 was approved to start in January 2013, with the thruster being proposed for European programs including Neosat and Electra, both programs approved at the Naples European ministerial conference of November 2012. Since, satellite prime contractors Thales Alenia Space and Airbus Defense and Space have jointly selected, along with the European Space Agency (ESA), Safran's PPS(R)5000 for their new-generation telecommunications satellite platforms now being developed through the Neosat program, that includes the delivery of complete shipsets of plasma thrusters, along with design studies and testing, for the two prime contractors' respective next-generation platforms. These two platforms will be optimized for all-electric propulsion systems, used to raise the satellite into final orbit after release from the launcher, and to keep it in its assigned operational orbit (station-keeping). Qualification of the Thruster Unit to a technical requirements specification encompassing the Neosat requirements is

on-going. Three qualification-standard units (EQM1, EQM2 and EQM3) underwent acceptance testing as well as the complete suite of qualification-level mechanical environment tests: quasi-static; harmonic and random vibration tests; as well as shock tests. A specific added value of EQM2 was that, following the above test sequence, the thruster underwent a second random vibration test sequence, but this time a Power Spectrum Density (PSD) 3 dB above the qualification levels was applied. This was a higher-risk test sequence designed to provide additional confidence on design areas where analyses alone could not decisively conclude on robustness margins. Lastly, EQM2 and EQM3 are also used to support qualification-accompaniment tests such as PPU coupling tests and multi-thruster firing tests. By beginning of March 2019, the EQM1 thruster had accumulated 6,680hrs of operation and 1382 ON/OFF cycles. This amounted to a total impulse of over 6.485MN.s. The paper will provide a complete overview of the PPS®5000 development with a focus on the qualification status through the on-going life test as of Fall 2019.