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PPS®X00 HALL THRUSTER : A GAME CHANGER TO SECURE LEO/MEO CONSTELLATIONS PROPULSION

Abstract

The PPS®X00 is the subkilowatt-class Hall Thruster of the Safran portfolio designed to match the propulsive needs of LEO/MEO small satellites. Its development program, achieved with the support of the CNES, the European Space Agency, the European Union and with internal fundings, aims at maturing technologies leading to a compact and highly cost efficient product massively marketable within 2023.

Following the ultimate objective of offering a low-cost efficient solution in very stringent time-to-market constraints, Safran applied a risk-managed development plan by considering the internal architecture of the cathode as a critical technology itself, by focusing the anode block development on the maturation of technological bricks, and by multiplying test early in the development.
As a result, the prototype, engineering and structural models show that the right architectural choices have been made, with performance beyond the state of the art.
The successful Preliminary Design Review passed in October 2020, validated the thruster design on technical, cost and production-ability. All the necessary outputs were available: technical maturity (TRL 6+), necessary justifications, mitigation of risks associated to critical technologies, conformity with both technical and market requirements, and industrial prerequisite.
Endurance test of EM thruster demonstrated 500kN.s with Xenon alongside a 2500 cycles test campaign of an EM cathode in diode mode, demonstrating almost 50% of the thruster life capability. The EM thruster has also been characterized with Krypton, with performance comparable to SoA.

The development is progressing according to plan, and the Critical Design Review is planned in 2022. The design validations already obtained mitigate the development top risks and confirm the design is on the right track to meet the market demands, be it on performance or cost aspects. The next step activities will enable to further characterize and mature our technology, with a partial endurance test (750KN.s / 3500 cycles) demonstrating 75% of the thruster capability. Alongside this campaign, a cathode will perform 11000 cycles in diode mode to fully justify the cathode thermo-mechanically. An additional endurance test will permit evaluating the lifetime of the PPS®X00 with Krypton.

Industrialization will continue, through the production of the first flight models. The supply chains will be consolidated and secured especially regarding the geopolitical situation. The procedures will be refined and the operators will be trained throughout the production of the development models as well as thrusters dedicated to the industrialization. The acceptance test means preparation is well engaged.