

IAF SPACE PROPULSION SYMPOSIUM (C4)  
Electric Propulsion (1) (5)

Author: Dr. Vanessa Vial  
SAFRAN, France, vanessa.vial@safrangroup.com

Dr. Olivier Duchemin  
SAFRAN, France, olivier.duchemin@safrangroup.com

Dr. Giovanni Codutti  
SAFRAN, France, giovanni.codutti@safrangroup.com

Mr. David Le Méhauté  
SAFRAN, France, david.le-mehaute@safrangroup.com

Mr. Julien Rabin  
SAFRAN, France, julien\_rabin@yahoo.fr

## EXTENDED QUALIFICATION LIFE TEST OF THE PPS®5000 HALL THRUSTER UNIT

**Abstract**

The PPS®5000 is a 5-kW-class Hall thruster designed to a lifetime requirement corresponding to a minimum total impulse capability of 11.7 MN.s. The qualification of the Thruster Unit has been pronounced at an intermediate milestone into the life test, establishing the flight-worthiness of the thruster for its first flight applications. To date, over 20 Flight Models have been produced and acceptance tested. The life test continues, however, in order to demonstrate a total impulse capacity well above the state of the art, and to allow more ambitious missions. Prior to completing the CDR, two qualification-standard models, EQM1 and EQM2, were produced and tested in order to finalize the design verification for those areas that were not fully covered by testing of the development hardware models. Immediately following the CDR, a third qualification-standard unit (EQM3) was built to the approved design, and finally a Qualification Accompaniment Model (QAM) unit was built to support entry into series production. All qualification-standard units (EQM1, EQM2 and EQM3) underwent acceptance testing as well as the complete suite of qualification-level mechanical environment tests. EQM2 and EQM3 are mostly used to support qualification-accompaniment tests such as PPU coupling tests, multi-thruster firing tests, detailed plume characterization or EMC/EMI characterization. At the time of the CDR, the EQM1 unit had already passed all environment tests to qualification levels and durations (and above), and had already accumulated close to 1,700 hours of life testing. Since the CDR had confirmed its design with only minor evolutions, it was considered as most schedule-effective for the program to simply continue with further life testing of the EQM1 unit to support the primary qualification test sequence.

As of beginning of February 2021, the EQM1 thruster had accumulated more than 12,800 hrs of operation and 5,630 ON/OFF cycles, amounted to a total impulse of over 11.6 MN.s, with thruster performance remaining remarkably stable. The life test is about to enter into an extension of the demonstration to cover a more ambitious objective of 14.5 MN.s for longer-term missions. This life test extension is expected to be completed by the end of 2021. This paper will focus on the on-going qualification life test as of summer 2021. In particular, the new demonstration level achieved now make the PPS®5000 the world's most powerful and highest-total-impulse-capable Hall thruster either qualified, or in qualification.