

IAF SPACE PROPULSION SYMPOSIUM (C4)
Electric Propulsion (2) (6)

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EXPERIMENTAL ACTIVITIES ON LOW POWER ELECTRIC THRUSTERS AT CIRA

Abstract

Electric Propulsion is considered as a valid option for an increasing number of different applications, such as from high altitude orbit raising to orbit transfer or high impulse interplanetary scientific missions. Both the consolidation of technologies and even the development of disruptive ones demands huge efforts in terms of experimental activity, characterization and qualification activities before the final integration in the space applications. In fact, the industrial development of electric thrusters relies on the availability of suitable test facilities where on-orbit operations can be simulated with reliability. Moreover, the deepening of complex phenomena occurring requires suitable research facility in order to boost the investigation activities also on the theoretical side.

Given these motivations, CIRA has established the LPEP Project (Low Power Electric Propulsion), focused on low power electric propulsion, aiming at improving MSVC (Medium Scale Vacuum Chamber – running from 2020 at CIRA) capabilities but above all consolidating Hall Effect technology up to 1.5 kW of power and developing new cathodes. The Medium Scale Vacuum Chamber (MSVC), i.e. 2 m of diameter and 4 m of length simulator, has enabled RD activities on engines, characterized by power up to 5 kW. A brand-new Hall Effect thruster (named CRHET-250, 250 W of nominal power and 11 mN of nominal thrust) has been internally designed and has represented the first article, tested in MSVC. The thruster has been coupled with a commercial cathode, provided by HeatWave Labs, and several firing tests have been accomplished reaching for a running time greater than 100 h at different power level. The next step is to extend the firing time and acquire further data to fully characterize the engine and test also mark 2 and mark 3 units. Finally, the experimental activity has been planned to move to the characterization of the internally-designed cathode, named CR-CAT, in the view of its coupling with CIRA engine. At this moment CR-CAT is in the final manufacturing phase.

The present paper gives an overview of CIRA development plan on activities of LPEP Project with a particular focus on the design and test activities regarding CRHET-250 thruster.