

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

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E-REGULUS: DEVELOPMENT OF A 150 W PROTOTYPE OF MAGNETICALLY ENHANCED
PLASMA THRUSTER

Abstract

Over the last decades, CubeSats have been influencing considerably the space market that is changing towards a “New Space Economy”. The main drivers of this new trend respond to 1) reduced cost to access space and 2) versatility of the platforms with respect to traditional satellites. Other key aspects are the opportunity of reducing manufacturing costs and obtain more reliable, flexible and high-performance systems.

In the near future, SmallSat constellations will impact many sectors, from Earth observation to natural disaster monitoring, communication, imaging and internet of things.

However, an on-board propulsion system is needed to exploit all the potential of SmallSats and enable complex mission scenarios, like orbit raising, rephasing manoeuvres, drag compensation, relative position maintenance, and de-orbiting.

In this context, many companies (e.g. Busek, Enpulsion, ThrustMe, Exotrail, and T4i) and research centres are developing new propulsion technologies for small satellites, even though there are only few examples of past missions involving SmallSats with mobility capabilities: STRaND-1 launched in 2013, BRICSat-P and SERPENS launched in 2015. In 2018 Enpulsion accomplished the In-Orbit Demonstration (IoD) of a Field Emission Electric Propulsion.

Also T4i, an Italian company specialized in developing propulsion systems, will perform in 2021 an IoD of its first product, REGULUS, an iodine-fed, self-contained propulsion system based on T4i’s Magnetic Enhanced Plasma Thruster (MEPT). This new propulsion unit is specifically designed for CubeSat platforms and small satellites and is able to provide 0.5-0.6 mN thrust and 550 s of specific impulse at 50 W of input power, with a total impulse up to 3000 Ns.

The aim of this paper is to describe E-REGULUS prototype, a scale up of REGULUS operating in the 50 - 150 W power regime. Developed to meet the mobility demands of bigger platforms (micro-satellites) with respect to REGULUS, E-REGULUS has a modular structure, featuring three main sub-systems contained in a 2.5U envelope: i) the thruster module, housing the MEPT, ii) the fluidics module, containing all propellant flow control elements and iii) the electronics module, which includes all electronic boards. In addition to the three main sub-systems, E-REGULUS also includes a xenon tank, whose size is mission-dependant.

The propulsion system design and the outcomes of the tests performed at T4i and at ESA (European Space Agency) EPL will be presented.

E-REGULUS is currently under development at T4i in the framework of ESA contract and with the partnership of OpenCosmos, TYVAK International and the University of Surrey.