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HIPATIA: A PROJECT FOR THE DEVELOPMENT OF THE HELICON PLASMA THRUSTER AND ITS ASSOCIATED TECHNOLOGIES TO INTERMEDIATE-HIGH TRLS

Abstract

HIPATIA (HelIcon PlasmA Thruster for In-Space Applications) is a project recently awarded with an European Commission H2020 grant (GA870542) for the development of the Helicon Plasma Thruster (HPT) and the technologies associated to it.

The goal of the HIPATIA Project is to verify the function and performances of an Electric Propulsion System based on the HPT technology, for its application in non-geostationary satellites constellations and other small spacecraft.

The Consortium, led by SENER Aeroespacial, counts with the participation of Universidad Carlos III de Madrid, AIRBUS Defence and Space, the Centre National de la Recherche Scientifique and Advanced Space Technologies. The Partners bring to HIPATIA a solid background in the development, integration and test of Electric Propulsion (EP) Systems.

The HPT is a technology that SENER and UC3M have been jointly developing in the last 5 years. It is a radiofrequency powered plasma propulsion technology that can prospectively offer a good level of performance while eliminating many of the design and manufacturability issues (electrodes, high voltage electronics, and complex fabrication) which have afflicted EP systems to date. Given the relatively simple and robust design of the HPT technology (no grids neither cathodes), HIPATIA has the potential for providing a cost-effective solution for large constellation of small satellites.

The impacts associated to having a disruptive thruster in high TRLs would not be achieved unless the complete EP System has proven its integration and operation consistency. HIPATIA will advance the development status of the HPT up to TRL6-7, but it will also face the integration challenges of a complete

EP System, constituted by the HPT Thruster Unit (TU), the Radiofrequency and Power Unit (RFGPU) that feeds it with power and the Propellant Flow Control Unit (PFCU) that controls the propellant pressure and mass flow. The System will be integrated and verified against the requirements derived from the market needs. Development activities will be complemented with research and experimental tasks, in order to propose design actions to improve the HPT performances.

The paper reviews the market needs for small platforms in-Space propulsion, analysing the needs and requirements imposed to an HPT-based propulsion subsystem. The status of the technologies to be developed and integrated in the HIPATIA Project will be discussed. From this point, the paper explores the Consortium's plans on research and development for taking an HPT-based propulsion subsystem to TRL6 in 2022.