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ENVIRONMENTAL TEST CAMPAIGN OF A 12U CUBESAT TEST PLATFORM EQUIPPED WITH
AN AMBIPOLAR PLASMA THRUSTER

Abstract

CubeSats are becoming important space platforms for achieving a broad set of mission goals, such as science and Earth observation and technology demonstration. These missions require the improvement of the CubeSat capabilities, such as orbit change and raising, formation flying, and proximity operations. In this sense, miniaturised electric propulsion systems (ePS) are valuable enabling technology. To increase the ePS readiness level, it is essential to assess the mutual interactions between the ePS and the other onboard systems favouring the integration of the ePS at system level. The paper proposes the results obtained

during the test campaign in relevant environment performed by a 12U CubeSat Test Platform (CTP), developed in the ESA-Prop roject, supported by the ESA Propulsion Laboratory and led by Politecnico di Torino, with REGULUS-50-Xe, an Ambipolar Plasma Thruster designed and developed by T4i. CTP has a 12U primary structure, where up to 8Us can accommodate the ePS and the remaining 4U the CubeSat subsystems and two 160 Wh batteries. CTP gathers unprecedented information on the mutual impact of propulsion system on the CubeSat technology and vice versa. Examples are internal thermal fluxes, power consumption in different modes of operation of the platform and ePS, electromagnetic field generation and magnetic fields. CTP is equipped with RF sensing circuits (tuned in different frequency ranges), Line Impedance Stability Network, temperature sensors, current and voltage sensing circuits, and magnetometers. These measurements are fused in post processing with the acquisitions made by sensors and instruments, such as Faraday cups and Magnetic Field Mapper, installed outside the CTP and inside the test chamber. Moreover, CTP manages the housekeeping data acquisition and handling, commands execution, power distribution, battery recharging, and communication via wired and radio-frequency links with the ground support system (GSS) where the operators control the test operations. The paper describes the integration process of REGULUS-50-Xe inside CTP and the tests in laboratory conditions performed in the University of Padova Plasma Propulsion Facility and it shows the results of the environmental test performed in the Small Plasma Facility at ESTEC, that includes short and long duration firing at different power levels.