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DESIGN AND VALIDATION OF A 12U CUBESAT TEST PLATFORM FOR THE VERIFICATION AT SYSTEM LEVEL OF MINIATURIZED ELECTRIC PROPULSION SYSTEMS

Abstract

The growing interest of the market in nano-satellites is pushing the technology associated with development of these small platforms Among the enabling technologies, miniaturized electrical propulsion systems (ePS) deeply increase the range of missions performed with multi-unit CubeSats (6U+). Despite to a growing knowledge of the performance and the characteristics of incremental and disruptive technologies, a lack of knowledge exists on the mutual of the propulsion technologies and the new generation of CubeSats. Since 2017, ESA/Electric Propulsion Laboratory and Politecnico di Torino are working together (in the ESA-microProp reserch program) in order to prepare a one-step facility to qualify small satellites equipped with miniaturized ePS. In these years, a 6U platform was developed and validated and a test campaign with helicon plasma thruster was successfully completed and other campaigns are planned to integrate and test other propulsion systems. The present paper deals with the new phase of the ESA-Micrioprop that foresees the design and validation of a 12U CubeSat Test Platform (CTP) able to host ePS with size up-to 100W and to gather unprecedented information about the generated environments inside and around the platform when the ePS is active. The platform has a self-developed avionics representing the technology of a CubeSat made of an Electric Power System able to manage up to 150W, an onboard computer that manage the operations of the entire platform and a UHF communication system. Moreover, a dedicated subsystem, called Electric Propulsion Interface System (EPIS), manages electrical and data interfaces towards a wide range of ePS available on the market or under development. Moreover, EPIS has specific sensors and tools, i.e. temperature sensors, current and voltage sensing circuits, strips of open resistors, magnetometers, silica wafers, EM sensing circuits mounted inside the platform and on the faces. These measurements are merged with the measurements of the ground support equipment normally used for the verification campaign of propulsion system, e.g. faraday cups and Magnetic Field Mapper, allowing to assess the functional behaviour of the integrated system (platform and ePS). CubeSat test platform has already been designed and manufactured, and the validation campaign is scheduled for the end of June.