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FLIGHT RESULTS OF THE PETRUS PULSED PLASMA THRUSTER ON THE 3U CUBESAT
GREENCUBE

Abstract

PETRUS, the Pulsed Electric Thruster of the University Stuttgart, is a scalable coaxial solid propellant pulsed plasma thruster (PPT) designed at the Institute for Space Systems of the University of Stuttgart. Solid propellant PPT offer a reliable and robust form of propulsion to micro and small satellites. Their relative simple setup with out pressure tanks, valves and piping reduces complexity and cost and the lack of hazardous propellants allows for a broader range of launch opportunities as it does not pose a danger to other spacecraft on a rideshare. PETRUS is a scalable design and can be used in different roles and weight classes of spacecraft. It has already been scaled to energy levels of 1 J to 68 J and successfully tested in vacuum chambers. The flight on GreenCube will be the first in-orbit demonstration of this thruster family. GreenCube is a 3U CubeSat build and operated by the Sapienza University of Rome that will be launched on the maiden flight of Vega C which is projected to take place in the second quarter of 2022. Its main payload is a cultivation module that will grow and observe microgreens inside the satellite. The PETRUS propulsion module is a secondary payload on the CubeSat. It houses four PETRUS 1J thrusters that share a capacitor bank in the so called tuna can volume. After the mission of the main payload of GreenCube is finished, the capabilities of PETRUS will be demonstrated. During operation the basic functionality of the thruster, its interaction with other systems of the satellite as well as its lifetime in orbit will be monitored. The thrust of the prototype will be determined by applying off-centre thrust to the satellite and observing its change in attitude and rotation rates using the attitude determination system of GreenCube. The data collected during the flight of GreenCube will be compared to ground-based test to verify and if necessary improve the design of PETRUS and allow its use on future space mission.