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VCUB1 BRAZILIAN CUBESAT THERMAL VACUUM TESTS CAMPAIGN

Abstract

This work describes the Temperature Cycling Tests (TCT) of the AOCS/TMTC systems and service module of the VCub1 CubeSat and the Thermal Vacuum Test (TVAC) of the VCub1 Proto Flight Model (PFM). Launched on April 14th 2023 from the Vandenberg Launch Base, in California, in the United States of America by SpaceX's Falcon 9 rocket, Vcub1 is the first high-performance nanosatellite completely designed, tested and operated by a national industry in Brazil and this is the first remote sensing mission carried out by a national private company, Visiona Tecnologia Espacial. Despite being in the nanosatellite class size, 12 kg, 6U, VCub1 has a highly sophisticated architecture and state-of-the-art mission equipment. VCub1 has characteristics of larger satellites such as a control system with sensor data fusion capability, an ultra-stabilized platform and an autonomous system, identification and correction of faults, and also has a reflex camera (OPTO 3UCAM), with a resolution of around 3 m at 500 km altitude with R, G, RE and NIR spectral bands. The satellite uses the software-defined satellite concept and can be reconfigured in flight to develop new applications. Its bi-directional UHF data collection system is initially aimed at hydro-meteorological data collection applications but can fulfill various civil and military communications and IoT missions. With a National Embedded Software, Vcub1 should allow the validation in space of onboard data management, communications, telemetry and orbit and attitude control software, designed for satellites of the Brazilian Space Program. The main objective of the mission is to validate the satellite's architecture and its onboard software, in order to be able to use them in larger satellites. Here we present the results of the tests, that were performed in May, September and December, 2022 respectively, using the Integration and Testing Laboratory (LIT) facilities of the Brazilian National Institute for Space Research (INPE). The TCTs of the AOCS/TMTC systems and service module were carried out in a Climatic Chamber with controlled humidity and the TVAC of the VCub1 PFM was performed in a Thermal Vacuum Chamber, using a specific setup to impose external heat

flux on the satellite, consisting of an infrared cage and a power supply and control system (PSCS). The aim of the tests was to demonstrate the components capacity to comply with the functional requirements when submitted to acceptance temperature and pressure, during the Space Simulation.