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THERMAL VACUUM TESTS CAMPAIGN FOR THE AMAZONIA 1 SATELLITE

Abstract

This work presents the Thermal Vacuum Tests Campaign for the Amazonia 1 satellite. Launched in February 2021 from Indian Satish Dhawan Space Center, Amazonia 1 is the first Earth observation satellite completely designed, tested and operated by Brazil. With 640 kg and dimensions of 2.6 x 7 x 1.7 m, it was developed at the Brazilian National Institute for Space Research (INPE) with some partners from the national industry. Amazonia 1 operates at 750 km in a polar orbit and has a Wide Field Imaging Camera capable of observing a range of 850 km with 60 m of resolution. All of its subsystems are currently operating nominally, with performance exceeding specifications. The objective of the mission is to provide remote sensing data to monitor deforestation, especially in the Amazon region, to monitor agriculture, ocean coast, water reservoirs, and to help mitigate natural disasters. The tests campaign were carried out from August to October, 2020 at INPE. The most important tests were the Thermal Balance Test (TBT) and Thermal Cycling Test (TCT). The main objective of the TBT was to verify the performance of the thermal design in flight conditions, providing experimental data to validate the thermal mathematical model used. The TCT were the purposes of test the functionality and electrical properties of each subsystem of the Amazonia 1 at the extreme thermal and vacuum conditions. The testing campaign included the Global Leak Test; the Bakeout of the TBT and TCT tests setup, including an infrared array assembly based on Nickel-Chrome strips, used to impose external heat flux on the satellite, the satellite mechanical support, and a thermal controlled RF cables cage. Additionally, a DryRun was performed before the TBT and TCT. Skin heaters were employed to simulate the absorbed heat fluxes by the Multi-layer insulation and by the satellite radiators. Another Global Leak Test was performed after the TCT. All these tests were conducted using a 6 x 8 x 7.5 m thermal vacuum chamber with temperature range from -196oC to +150oC and cryogenics and turbomolecular pumps (< 10-6 Torr). Thermistors and thermocouples were used to monitor the temperature in the satellite, chamber and auxiliary setup. Radiometers were used for controlling the intensity of heat flux. This work presents the tests philosophy, the details of the test setup designed for the space simulation of this satellite, as well as the results in terms of thermal, vacuum and leakage behavior.