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Author: Dr. Jose Sergio Almeida
The Brazilian Institute for Space Research - INPE, Brazil

THERMAL-VACUUM TESTS OF THE AMAZONIA-1 SATELLITE TM PERFORMED AT INPE
WITH SUCCESS

Abstract

The Amazonia-1 is a spacecraft under design and construction by the National Institute for Space Research - INPE, in Sao Jose dos Campos, SP, Brazil. With mass of approximately 500kg and carrying a wide-field imager as the main payload, this polar-orbit satellite has as its main mission the monitoring of the Amazon region. For the proper qualification of the spacecraft design, a Thermal Model (TM) representing the proposed philosophy for the thermal conditioning of the satellite during its orbital flight was completely designed and assembled at the Integration and Tests Laboratory - LIT, INPE. During November and December of 2015 this test model was submitted to a comprehensive thermal-vacuum testing campaign, simulating several orbital conditions that this satellite will have to face and to successfully stand during its operational lifetime in space. For this environmental test, the Amazonia-1 Thermal Model, containing dummy boxes representing its operating subsystems and equipment, holding the same thermal-optical properties as the flight model on its surfaces, was accurately prepared with the installation of more than 100 sets of skin-heaters that were then used to provide the expected heat load exchange at each significant section of the spacecraft, the internal heat dissipation of the on-board active subsystems, and also the heat dissipation from the spacecraft active thermal control system. In order to obtain the detailed and continuous temperature data along the test, more than 250 temperature sensors, as type T thermocouples and also thermistors, were installed on meaningful points of the spacecraft and taken to a dedicated data acquisition system. All the skin-heaters were properly electric diagram configured, their cables routed and adequately connected to a cluster of 100 power supplies that, programmed and controlled by computers, could provide the required heat dissipation levels along the test. Loaded in the 6m x 8m Space Simulation Chamber and suspended by stainless-steel cables aiming to get a better thermal isolation from the test set-up, the Amazonia-1 Thermal Model was submitted to a pre-defined sequence of hot and cold cycles, and steady state temperature soaks, where a Thermal Balance procedure was then executed in order to get the required data to be compared to the mathematical thermal modeling, and to fully validate the thermal design of the Amazonia-1 spacecraft. This paper presents details of this spacecraft thermal-vacuum testing campaign.

Keywords: Thermal-Vacuum Tests, Spacecraft Environmental Tests, Space Simulation