

IAF MATERIALS AND STRUCTURES SYMPOSIUM (C2)
Space Vehicles – Mechanical/Robotic/Thermal/Fluidic Systems (7)

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THERMAL BALANCE AND THERMAL VACUUM TEST OF THE CBERS-4A SATELLITE
PERFORMED AT INPE, BRAZIL.

Abstract

CBERS-4A is part of the China-Brazil Earth Resources Satellite cooperation program, as a spacecraft dedicated to remote sensing purposes. Measuring approx. 1.8 x 2.0 x 2.6, weighing approx. 1730 kg, and carrying multispectral, panchromatic wide-scan and wide-field cameras, this satellite was put in a 778km, sun-synchronous orbit on December 2019 by the Chinese Long March 4 launching vehicle. The CBERS 4A Thermal Balance Test (TBT) and Thermal Vacuum Test (TVT) were performed from March 18 to April 5, 2019 at the Integration and Testing Laboratory (LIT) of the Brazilian National Institute for Space Research (INPE). As one of the critical phases of the assembly, integration environmental testing campaign of the spacecraft, the thermal balance test was carried in order to verify the performance of the thermal design in the flight conditions and to generate useful information to adjust and refine the thermal mathematical model (TMM) while the Thermal Vacuum Test main purpose was to test the functionality of the CBERS 04A at the extreme thermal conditions, under high vacuum environment. For this purpose, the CBERS-4A spacecraft was loaded into the LIT-INPE mailbox-shaped 6m x 8m Space Simulation Chamber, when a special metallic but fully vented enclosure was positioned around the spacecraft, this enclosure containing an engineered array of heating strips, designed and built in house aiming to produce thermal radiation for the heat input simulation during these flight tests of the spacecraft. This array of heating strips was powered by a set of 100 DC power supplies, programmed to deliver current to this infrared array following a specific plan of heat flux simulation profile on top of the spacecraft external surfaces, while the thermal-vacuum chamber thermal shrouds were maintained at liquid nitrogen temperature during the nineteen days of tests. A number of radiometers were installed at selected sections of the spacecraft surfaces aiming to measure the heat fluxes of the impinging thermal radiation. A comprehensive Data Acquisition System was used to acquire and to record a significant amount of test data in terms of temperature, heat flux, voltage, current etc. During these tests, an Electrical Ground Support Equipment was built at the side of the chamber in order to operate several subsystems and components of the spacecraft. This article presents the details and results from the Thermal-Vacuum Tests campaign of the CBERS-4A satellite.