MATERIALS AND STRUCTURES SYMPOSIUM (C2)
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RESULTS FROM THE THERMAL BALANCE TESTING OF THE CBERS 3-4 SATELLITE TM

Abstract

This paper details the approach adopted and applied on the Thermal Balance Tests (TBT) of the CBERS 3&4 (China-Brazil Earth Resources Satellite) Thermal Model (TM), successfully performed at the Integration and Tests Laboratory –LIT, National Institute for Space Research – INPE, in Sao Jose dos Campos, SP, Brazil, from September 22nd to October 6th, 2009. The CBERS 3&4 satellites are part of the Chinese-Brazilian cooperative space program, which includes the design, building and launching. Measuring approximately 3.2 x 1.8 x 3.1m and weighting more than 1.5 ton, these spacecrafts will carry four cameras for remote sensing purposes. For the TBT, the skin-heaters technique was adopted as an economical and efficient alternative to solar simulation. So, skin-heaters were installed on the radiators and multi-layer insulation (MLI) panels to simulate their absorbed external heat flux. In addition, 88 dummy boxes simulating the actual spacecraft subsystems were instrumented with skin-heaters providing the expected thermal dissipation during the selected orbital and electronic operating phases. A total of the 174 power electrical circuits were designed to simulate internal and external thermal loads and these electrical circuits were connected to 96 power supplies. For thermal monitoring purposes, more than 550 temperature sensors were installed on selected points of the spacecraft so their data could be recorded during the execution of the whole test. Particularly for this campaign it was developed a special thermal set up, such as a refrigerating plate, thermal interface, radiometers and infrared array (IRA). Making good use of the recently built 6m x 8m Space Simulation Chamber, the CBERS Thermal Model was submitted to high-vacuum environment (pressure less than 1.3x10-3 Pa) while the TVC shroud temperature (heat sink) remained at 100K. During the TBT a series of 10 phases, including hot and cold cases, was executed to verify the performance of the thermal design in flight conditions and to provide experimental data in order to validate/correct the thermal mathematical model. Details and the main results from this thermal balance tests are presented in this paper.