

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

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LARGE SCIENTIFIC SATELLITE TESTED WITH SUCCESS AT LIT-INPE 6M X 8M SPACE
SIMULATION CHAMBER

Abstract

Comprehensive and stressing thermal-vacuum tests of satellites are required to ensure their qualification and proper operation during orbital flight. Making good use of the 6m x 8m Space Simulation Chamber recently installed at LIT-INPE facilities in Brazil, a large scientific satellite from an international cooperation was fully tested and qualified in this Laboratory in order to comply with the program requirements. This 9-month testing campaign in Brazil also included vibration and acoustic tests, mass properties measurement, alignment and EMI/EMC tests. Running non-stop during 19 days, this spacecraft thermal-vacuum test sequence included several cases of a Thermal Balance Test to verify computer thermal modeling and a Thermal Cycling Test to confirm proper operation of spacecraft under extreme temperature conditions. It required a significant amount of work in terms of preparation and test setup, including a special and dedicated spacecraft thermal envelope to simulate the heat transfer taking place at the spacecraft external surfaces. Taking advantage of a good design of the thermal system of this space simulation chamber in terms of a division and independent thermal zones of the shrouds, more appropriate heat flux reproduction to and from the spacecraft under test could be successfully obtained. In addition, a special and dedicated power dissipation system in terms of spacecraft internal heat load was prepared and used, providing complementary thermal conditioning for the required orbital flight simulation. Besides an explanation of the test philosophy, this work presents comprehensive details of the test setup designed and adopted for the space simulation of this particular scientific satellite, as well as the results in terms of thermal behavior of the vacuum chamber and its thermal control subsystems. Taking into consideration that at least five countries were directly involved in this project, the handling and control of distinct work and operational procedures philosophies, including possible contrasting cultures, also presented a special challenge for the proper management of this campaign.

Keywords: Space Simulation, Spacecraft Testing Techniques, Thermal Vacuum Chamber