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

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EGSE IN SPACECRAFT THERMAL VACUUM TESTS FOR ACCURATE POWER
MEASUREMENTS AND MINIMIZATION OF POWER SUPPLIES

Abstract

This paper presents details of the electrical setup implemented at the Integration and Testing Laboratory (LIT) of the National Institute for Space Research (INPE), in Sao Jose dos Campos, SP, Brazil firstly developed to support the Thermal Balance Test (TBT) of CBERS 3&4 (China-Brazil Earth Resources Satellite) Thermal Model (TM), and to be used as necessary. The CBERS 3&4 TM TBT took place from September 22nd to October 6th, 2009, using the 6x8-meter Thermal Vacuum Chamber. Dedicated electrical ground support equipment (EGSE) known as "Shunt-Box" which reduces the number of power supplies used, and provides precise current and voltage samples for the data acquisition system scanners was developed. The paper presents the assemblage of one hundred high-end remotely programmable power supplies, the wiring harnesses and connectors, the electrical grouping of thermal loads according to the heat fluxes to be dynamically simulated, the use of equalization resistors, and the path configuration of six 50-branch Shunt-boxes. The evaluation of uncertainty concerning current measurements, calibration factors, temperature drifts, and power calculation are also described. The paper also presents technological aspects in constructing and operating EGSEs as well as designing electrical circuits for supplying energy to hundreds of skin heaters attached to the spacecraft TM, and tubular cal-rod heaters forming infrared arrays that simulate external thermal loads. Some details of the data acquisition system, power calculation, and calibration factors for overall measurement accuracy of +/-1% are also discussed.