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THERMAL LOADS SIMULATION ARRAY IN A TYPICAL SATELLITE THERMAL CONTROL SURFACE.

Abstract

The space simulation testing aims to qualify and accept the satellite thermal control system, to both the choice of devices or simulation arrays of external thermal loads must ensure the extreme conditions of application of maximum and minimum loads during the simulation. Usually the devices and arrangements (thermal loads simulation technique), used in tests focusing on the hot cases (maximum loads), damaging the minimum load conditions (cold cases) due to blockage regions created by these testing arrangements. The objective of the proposed work is to investigate the effect of blockage caused by an experimental arrangement of external thermal loads, without contact with the satellite surface, and this arrangement ensures uniformity and intensity of external thermal loads in hot and cold test cases. The experimental apparatus was mounted in a cylindrical thermal vacuum chamberof 1 meter in diameter by 1 meter deep (1x1m TVC) which simulates the space environment. The apparatus consisted of a conventional thermal control surface, which was a 410x510x10 mm honeycomb coupon covered with multilayer insulation blankets (MLI) with cutouts provided in four radiator areas, which were one (1) white paint radiator and three (3) optical solar reflectors (OSR); its back surface was covered by skin heaters films to simulate the internal dissipation characteristics of a satellite surface; and an arrangement of electrical resistance strip flexible with same dimensions of the coupon to simulate the external thermal loads. Also, radiometers sensors were used to measure the absorbed external loads by thermal control surface, thermocouples were installed on both sides of the coupon, and measurements of thermal radiative properties on the surfaces of thermal control were performed. The principal results were obtained in a high vacuum environment (10-7 Torr) in a 1x1m TVC at the Integration and Testing Laboratory (LIT) of the National Institute for Space Research (INPE). In order to guarantee that the thermal loads emanated only from the experimental apparatus, the chamber was kept at a temperature of –180C. Several tests were carried out alternating the thermal loads. The complete data results were provided by LIT data acquisition system, which handles 500 measurement channels with acquisition at 30 second intervals, was used. From this information, the heat fluxes are calculated and presented in the form of graphs.