

MATERIALS AND STRUCTURES SYMPOSIUM (C2)
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THERMAL TESTS ON LARES SATELLITE COMPONENTS.

Abstract

LARES Satellite was successfully launched on the 13th of February 2012 with the first flight of the new launcher, VEGA. LARES is designed to test Einstein general relativity, it is a laser ranged satellite, made of high density tungsten alloy, weights 387 kg and carries 92 cube corner reflectors (CCR) made of fused silica. The satellite is performing well and is tracked by the International Laser Ranging Service. A series of tests to qualify the design of the CCRs and the relevant mounting system has been performed in the Thermal Vacuum Chamber of Sapienza University of Rome. Temperatures of the units under test inside the chamber were monitored using thermal probes and were controlled using resistive heaters (qualified for operation in vacuum environment). Sun simulator and liquid nitrogen cooled walls are used to simulate space conditions. A breadboard made of the same batch material of the satellite body, carrying a cube corner reflector, has been used to measure the thermal gradient between the front face and the back faces of the CCR exposed to simulated space environment. This test is required to indirectly check distortion of the CCR. The high quality optical window on the Thermal Vacuum Chamber allows to test the optical properties of the CCR while exposed to simulated space environment. The possibility of painting the satellite to control the temperature and reduce the gradients on the CCRs has been evaluated. At first a white painting has been proposed, but later this possibility was discarded due to the high change of optical properties of the painting once in orbit. A much more stable black painting was proposed instead; while counterintuitive, the high emissivity of black paint would have lowered the temperature of the satellite and the gradients on the CCRs. In the paper all the issues described above will be discussed in depth and the results of the thermal tests will be reported and analyzed.