

MATERIALS AND STRUCTURES SYMPOSIUM (C2)
Space Structures 1 - Development and Verification (Space Vehicles and Components) (1)

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QUALIFICATION TESTS ON THE OPTICAL RETRO-REFLECTORS OF LARES SATELLITE.

Abstract

LARES Satellite has been successfully launched on February 13th 2012 with the first flight of the new European Launcher VEGA. The passive, laser ranged satellite carries 92 cube corner reflectors (CCR). Due to its high density LARES represents the known orbiting object with the highest mean density in the solar system. This property makes it an almost perfect proof particle in the gravitational field of Earth. LARES is now operational and it is tracked by the International Laser Ranging Service stations. It will be used to test General Relativity and in particular the fact that the rotating Earth drags spacetime. The satellite design is quite innovative in the use of tungsten alloy as a structural material; indeed, the satellite body has been machined from a single piece of high density sintered alloy. The sintered alloy is characterized by a porous surface, that shall be carefully cleaned before the integration of the optical components, in order to avoid contamination of the back faces of the reflecting prism due to the degassing and deposition of contaminants from the metal. Two cleaning procedures have been identified, to be performed on LARES. One procedure consisted in chemical cleaning with different solvents and cleaning agents; the second procedure consisted in a chemical cleaning followed by degassing in a high vacuum oven. The cleanliness procedures have been tested on breadboards reproducing the satellite materials. The breadboards were tungsten alloy cylinders, carrying a cube corner reflector. The test was performed in the Thermal Vacuum Facility of Sapienza University in Rome. The breadboards were maintained in simulated space environment to allow degassing of possible contaminants from the metal and the deposition of contaminants on the back faces of reflective prisms. A careful visual inspection of the prisms mounted on the breadboards was performed after each test. Several breadboards have been tested simulating different conditions. Since the deposition of contaminants on the back faces of the CCR could have altered the optical properties of the whole prism, acting as a coating, the CCR was tested on the optical table to verify if the far field diffraction pattern was modified by contaminants. The result of the test was used to qualify the cleaning procedure to be used on LARES satellite flight model. In the paper some detail on the LARES mission and on the scientific objectives will be described along with all the details on this qualification process.