MICROGRAVITY SCIENCES AND PROCESSES SYMPOSIUM (A2)
Science Results from Ground Based Research (4)

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GLOBE: THE INNOVATIVE FORCE FIELD FOLLOWER FACILITY FOR SPACE EXPERIMENTS

Abstract

The GLOBE (Gas Lubricated Oil BEarings) is a new facility offering the unique and novel capability of force field follower for experiments performed in microgravity environment. GLOBE exploits the phenomenon of permanent coalescence inhibition due to Marangoni effect. When a liquid drop is heated at a temperature higher than that of a solid surface to which the drop is approached, surface motions arise in the drop due to the variation with temperature of the liquid drop surface tension. Such motions trap the air in between the drop surface and the solid one, giving rise to a soft, friction-less pillow. In such a way, the liquid drop may sustain a load without touching the solid material to which it is faced. The core of the GLOBE facility is a sphere suspended by means of at least four drops. Although the amount of load is very small, in the reduced gravity environment typical of space platforms, like the ISS, such load may correspond to a mass of several kilograms. Each drop hence may be seen as a single friction-less suspension. Being the sphere free to move with respect to the drops, it constitutes a device capable of rotating without friction following an external force field. The GLOBE sphere may also constitute a facility to execute experiments particularly sensitive to vibrations. ESA and ASI financed a combined project to develop a Pre-Qualification Model of GLOBE. A physical-analytical model of the facility has demonstrated that the performances of GLOBE are such to damp vibrations above 1 Hz and to allow the free rotation of the sphere. The GLOBE P-Q Model envisages also the presence of a demonstrative experiment installed inside the sphere. Such experiment is constituted by a special force sensor particularly sensitive to small vibrations and slow rotations. Hence it is a perfect candidate to demonstrate the capabilities of the GLOBE device. Because the sphere is mechanically isolated from the rest of the payload, all the communications with the h/w located inside the sphere is managed wireless. Presently the GLOBE Pre-Qualification model is under system test. It has been proposed to Agencies to fly a technological demonstrator of GLOBE on a sounding rocket of the MAXUS class. A patent for GLOBE is under examination by the European Patent Office for the force field follower capability.