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MICROGRAVITY ACTIVE VIBRATION ISOLATION SYSTEM ON PARABOLIC FLIGHT

Abstract

The Microgravity Active Vibration Isolation System (MAIS) aims at reducing on-orbit vibrations, providing a better controlled lower gravity environment for microgravity physical science experiments. The MAIS will be launched on Tianzhou-1, the first cargo ship of the China Manned Space Program. The principle of the MAIS is to suspend with electro-magnetic actuators a scientific payload, isolating it from the vibrating stator. This is a degree of freedom (DOF) motion control technique using position and acceleration sensor feedback. The MAIS includes four parts: a main body, a controller, a laptop and a power module. The main body is constituted by a stator and a floater, along with three position sensors, three accelerometers, eight Lorentz actuators and signal processing circuits. The controller is a computer

with seven electronic boards with VPX standard, programmed with operating software and control algorithms. The laptop is the interface for monitoring and operating. As the suspension force is very small, the MAIS can only work in a zero-g environment. The 'Deutsches Zentrum für Luft- und Raumfahrt e.V.' (DLR, German Aerospace Centre) granted a flight opportunity on its 27th parabolic flight campaign to test the MAIS during September 2015. The experiment was conducted on the A310 ZERO-G aircraft managed by the French company Novespace, a subsidiary of the 'Centre National d'Etudes Spatiales' (CNES, French Space Agency). The experiment results confirmed that the 6-DOF motion control technique was effective, and that the vibration isolation performance fulfilled perfectly the expectations based on theoretical analyses and simulations. As the MAIS main purpose is to provide a quieter environment on manned platforms in low earth orbit for microgravity experiments, increasing their chances of success and their scientific outcomes, the results of scientific experiments and technology tests obtained with the MAIS will be used to improve future space based research. This paper will present the design of the MAIS and the experiment results obtained during the parabolic flight campaign.