Paper ID: 82226
student

52nd IAF STUDENT CONFERENCE (E2)
Student Team Competition (3-GTS.4)

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DESIGN OF 3U LEOPARD CUBESAT WITH DEPLOYABLE SOLAR PANELS FROM INTEGRATION TO STRUCTURAL AND VIBRATION ANALYSIS

Abstract

LEOPARD (Light intensity Experiment with On-orbit Positioning and satellite Ranging Demonstration) is a 3-unit (3U) research CubeSat with various mission objectives such as observation of the horizon with a multispectral camera, onboard processing of Earth-origin one-way radio ranging signal (OPERA), single event latch-up (SEL) detection, total ionization dose measurement for onboard commercial off-the-shelf components, solar panel deployment demonstration with shape memory alloy, and measurement of magnetic field independent components of stray and natural fields. For the solar panel deployment mechanism, a shape memory alloy will be utilized with a heater mechanism to open the panels in a controlled manner. In this study, the design of the LEOPARD satellite is presented from a structural point of view. First, the satellite assembly method and integration steps will be described. Second, structural analysis will be presented from modal analysis to fastener analysis, and simulation of stress distributions and validation of structural integrity have been performed with finite element analysis. Additionally, vibration testing analysis will investigate the CubeSat's response to mechanical excitations during launch, ensuring against dynamic loads. LEOPARD used a slot-type design for subsystem integration that has been used in our previous satellites, and the novelty of the structure design comes from the deployment mechanism and method. Finally, the LEOPARD engineering model is under testing, and the operation is expected to begin in the second half of 2024.