Paper ID: 11322
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15th SYMPOSIUM ON SMALL SATELLITE MISSIONS (B4)
Generic Technologies for Nano/Pico Platforms (6B)

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UNICUBESAT: A TEST FOR THE GRAVITY-GRADIENT SOLAR ARRAY BOOM

Abstract

The design and manufacturing of a boom for gravity gradient stabilization have different critical issues, in particular due to the deployment system and the boom rigidity after the deployment. In the case of a gravity boom for a picosatellite like a cubesat the difficulties increase considering the small volume available inside the structure for the boom stowed configuration. The attitude subsystem designed and manufactured by GAUSS group for UNICubesat-GG satellite allows to deploy two booms in two opposite directions with the distance between the two tip mass of about 1 meter after the complete deployment. Moreover, giving the small size of the cubesat, the external surfaces available for the use of photovoltaic panels are small. This is a limit for the operative time of the satellite since the batteries can not be completely regenerated during charging. For this reason the system designed for gravity gradient stabilization fulfills also another important task: it can provide additional area for the solar arrays than it is available in a normal cubesat. The system is installed inside the cubesat and uses some deployable plates connected by hinges with torsion system. These surfaces unfold simultaneously in opposite directions giving limited disturbances to the satellite attitude. The booms open outside the satellite, taking with them two opposite faces of the cubesat. Finally the plates will be blocked forming a plane surface. In this way we obtain a surplus area of about 30 cm2 on each side. This allows the use, on both sides of the deployed surfaces, of 36 additional solar cells with a consequent development of more energy and power. At both ends of the deployed system it is possible to install others subsystems or payloads. The power of these devices is made possible through the use of electrical wires located on the sides of deployment system. The cables are protected by using hollow tubes that are also required to block the deployment of individual surfaces. The boom deployment is activate by a thermal cut system. The deployment system design, manufacturing and the tests performed on it has been described in this paper.