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Space Structures II - Development and Verification (Deployable and Dimensionally Stable Structures) (2)

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DEVELOPMENT AND TESTING OF AN ANTENNA DEPLOYMENT SYSTEM FOR NANOSATELLITE APPLICATIONS

Abstract

The concept of nanosatellites have helped students throughout the world to explore the vast expanse of space. Their compact form factor which makes them feasible for students also imposes several challenges. One of the major challenges is the necessity of deployment systems for antennas. The P-POD used to deploy these nanosatellites requires the antennas to be constrained by the satellite structure during launch. A number of such systems have been developed over the years. However, many factors affect the design of antenna deployment systems for nanosatellites. This paper presents the development of an antenna deployment system by students of Team Anant, BITS Pilani for their 3-U nanosatellite. The antenna arrangement to be deployed consists of a turnstile antenna and a monopole to achieve full duplex communication. The antennas need to be deployed such that the field of view of the imaging payload is not obstructed. Furthermore, the antennas needs to be positioned such that noise due to onboard electronic and magnetic components is minimised. The antenna deployment system should also contain a feedback mechanism. This allows for onboard detection of successful antenna deployment. A number of deployment systems were considered for this purpose. These systems varied in their deployment and feedback mechanisms, materials and antenna orientations. The tests were designed to check errors and delays in deployment, probability of failure, reliability of the feedback mechanism and limit loads. For coiled antenna stowage, the contour of the support was varied and 3D printed for testing the deployment success rates for each contour. Whereas for wraparound antenna stowage, different constraining methods were tested. Analysis were performed to estimate stresses in stowed condition and thermal deformation for different materials. Results from the tests and analysis carried out are discussed and compared. This comparison is used to determine the deployment mechanism, feedback mechanism and materials to be used in the deployment system. A brief description of the finalised antenna deployment system has also been provided.