SPACE DEBRIS SYMPOSIUM (A6)
Mitigation and Standards (4)

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A SAIL DEPLOYMENT MECHANISM FOR ACTIVE PREVENTION AND REDUCTION OF SPACE DEBRIS

Abstract

Recently small satellite development activities became popular throughout the world and the number of satellites being developed and launched a year is becoming larger. Many of these satellites are launched into orbits where they remain orbiting around the Earth for centuries in vain even after their mission life time. It became recently a world's serious concern that these space debris prevent human beings from safe space development and exploration activities in the near future. Therefore there is a great interest on debris prevention and reduction methods. Tohoku University has been very active in satellite development activities for years and has already successfully developed, tested, and launched its first microsatellite SPRITE-SAT (renamed as RISING-1 after the launch), and is completing the second microsatellite RISING-2. Due to the above mentioned background, Tohoku University has also initiated a development activity of sail deployment mechanisms in order to de-orbit the used microsatellite by means of the residual atmospheric drags. The mechanism itself has a cylinder form and utilizes unique deployable booms which can be folded down very compactly. The stored thin film inside the mechanism is pulled out of the case by the deployment force produced by the booms. The engineering model of this mechanism is now under development, which exemplary has a diameter of 20 cm, a thickness of 5cm, and a mass of about 0.5 kg for deploying 1.4 m square thin film. This size is meant to be sufficient for de-orbiting of the second microsatellite RISING-2 with a mass of about 41kg within 25 years. It is estimated that the volume of the mechanism can be reduced down to 2/3 for the flight model. The third microsatellite RISESAT with a mass of about 50 kg is planned to be equipped with a 4 m square sail. The important characteristic of this mechanism is that the size of the sail can be modified very easily depending on the requirements of the spacecraft. Preparing different sizes of sails, this kind of de-orbit mechanism can become the standard prevention and reduction measures of space debris. This paper describes the basic idea of this sail deployment mechanism and proposes an efficient way of space debris mitigation for future space activities.