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

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A SERIES OF DE-ORBIT MECHANISMS 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. The Space Robotics Laboratory (SRL) of Tohoku University has been very active in satellite development activities for years. The first one is the 50kg-class micro-satellite SPRITE-SAT (renamed as RISING-1 after the launch) launched in 2009, and the second one is the CubeSat RAIKO launched by the HTV on Japanese H-IIB launcher and deployed from the ISS in 2012. SRL is also now completing the flight model of the third satellite RISING-2, and is developing the engineering model of the fourth satellite RISESAT, which are both 50kg-class micro-satellites. Due to the above mentioned background, SRL has initiated a development activity of a series of sail deployment mechanisms in order to actively de-orbit used microsatellites by means of residual atmospheric drags. This mechanism was named as De-Orbit Mechanism or just DOM and has square-formed thin film. SRL has identified needs in several different mass and size categories, and defined four different sizes of DOM. These are named as DOM-500, DOM-1500, DOM-2500, and DOM-4500, according to the edge lengths of each film in millimeters. After successful verification, the DOM-500 was installed on the RAIKO, which is planned to be deployed in this summer. The DOM-1500 was installed on the RISING-2, which is planned to be launched in 2013 by the Japanese H-IIA launcher. The DOM-2500 is installed in RISESAT which is also planned to be launched in 2013. The DOM-4500 is now under development, which is planned to be installed on larger micro-satellites with the mass of about 100 kg or more. This paper will summarize the results of qualification tests, such as vibration tests, thermal vacuum test, atomic oxygen test, as well as the results of functional tests of the largest model DOM-4500. Also the orbit demonstration results of RAIKO is planned to be included to this paper, which shall illustrate the validity of the design of the mechanism in real-life mission.