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DESIGN AND TEST OF DRAG AUGMENTATION SYSTEM FOR DE-ORBITING KARDSAT NANO-SATELLITE

Abstract

Increasing the number of satellites in Low Earth Orbit (LEO) has accelerated concerns such as on-orbit collisions. This will damage satellites and cause a chain reaction that generates space debris. Furthermore, as strong growth of highly integrated technology and small rocket technology, cost of development and the entry of barriers to LEO access for nano- and micro-satellites continually decrease. It leads to concern that uncontrolled small satellites will be threatened to near satellites during their mission life. For this reason, the IADC (Inter-Agency Space Debris Coordination Committee) proposed 25-year rule to resolve this matter. In this presentation, we discussed the design and testing of drag augmentation system on the KARDSAT (KARI Rendezvous & Docking demonstration SATellite) developed by KARI (Korea Aerospace Research Institute) to meet the regulation by realizing the awareness of the problem in LEO. The KARDSAT is consisted of two nano-satellites, Target and Chaser (3 U & 6 U) and the main mission of the KARDSAT is rendezvous & docking the two satellites. The drag augmentation system is applied to the Target for the post-mission disposal (PMD). Since should do in a manner that does not reduce original performances with which the Target have, we designed the drag augmentation system small and light as well. The system requires less than 1 U size and mass, also no needs to control or operation after deployment. This system can be roughly divided into three parts of membrane, boom, and deployment. At first, as a role to maximize atmospheric drag, we used 25 μm thickness mylar film for membranes and the area is about 9 m^2. And booms applied to deployable CFRP that has 0.3 mm thickness and 2.12 m length for support membranes. Deployment part especially can be designed to two methods of passive and active according to electrical power. The passive method uses the torque of the boom coiled in deployer without electrical power. The other method, active method, uses a small motor with some electrical power. As each method has both strengths and weaknesses, we compared each method in terms of size, mass, and stabilization. This presentation explains the design of the drag augmentation system and concludes with a discussion on testing and trade-off study performed with several candidates of EQM (Engineering Qualifying Model). The implication of the drag augmentation system for KARDSAT will contribute to meet the 25-year rule for nano- and micro-satellites.