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THE ADEO PASSIVE DE-ORBIT SUBSYSTEM ANALYSIS, BREADBOARDING & CRITICAL DESIGN: PAVING THE WAY FOR A IN ORBIT DEMONSTRATION IN 2020+

Abstract

The ADEO subsystem is a scalable drag augmentation device that uses the residual Earth atmosphere

present in Low Earth Orbit applicable for passive de-orbit of satellites between 1 kg to 1000kg. For initiation of the de-orbit maneuver a large surface is deployed which multiplies the drag effective surface of the satellite. Thereby the drag force is increased as well causing accelerated decay in orbit altitude. Advantageous about a drag augmentation device is that it does not require any active steering and can be designed for passive attitude stabilization thereby making it applicable for non-operational, tumbling spacecraft as well. The ADEO subsystem consists of four deployable CFRP booms that span four sail segments in a truncated pyramid shape configuration. While the sails are made of an aluminum coated polyimide foil, its coating thickness was chosen such that it provides sufficient protection from the space environment. The current activity commenced in August 2018 and has the goal to provide a fully qualified Proto-flight Model (PFM) for a follow up In Orbit Demonstration as early as Summer 2020. Currently, the team passed the Preliminary Design Review and breadboarding and life tests will be carried out until Summer 2019 leading to the critical design in Fall and a start of PFM manufacturing in Fall 2019. The ADEO2 PFM consists of a 5m x 5m dragsail deployed by four CFRP booms. To enable a passive deployment, the electronic inside ADEO forsees a watchdog routine that is able to detect if the satellite is dead and with the help of an onboard battery to deploy the sail after a certain time in orbit. Reference missions were already selected by Airbus DS and QinetiQ for the sail subsystem to be used on after the successful IOD mission.

Additionally in this paper, the results of the NABEO nanosatellite dragsail will be presented that was launched onboard the Rocket Lab Electron Rocket "It's Business Time" in November 2018.