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WRECKER "WIRE DEPLOYMENT MECHANISM KIT FOR DEORBITING PICOSATELLITES"

Abstract

The development of a deployment mechanism for electrical conductive tethers, which will be flying on Estonians first satellite (ESTCube-1 picosatellite) is sketched. This presents the first demo-mission of the electrical Sail (Esail) propulsion concept. The Esail principle was developed by the Finnish Meteorological Institute (FMI). The principle is based on the interaction between a thin electrically positively charged tether (Heytether), and the solar wind protons. During operation, the Heytether (diameter 50m) is electrically charged, thus the cross section for interaction with the solar wind is increased by a factor of 106 compared to the geometric cross section. The advantage of this concept is the low mass of the sail compared to the conventional solar wind sail. Major milestones of the ESTCube-1 mission are the deployment of 10m of tether by the deployment mechanism followed by charging the tether. This will lead to an interaction between the tether and the ionosphere of the earth. The resulting force will be measured to demonstrate the functionality of the Esail concept. Also, the possibility to establish the deployment mechanism as a standard unreeling packet to deorbit pico- and nanosatellites is highlighted in this paper.

The aim of the development was to construct build and verify the unreeling mechanism for 10 m tether in space. Main challenges of this work are volume ($<96 \times 96 \times 20 \text{ mm}^3$) as well as mass ($< 100 \text{ g}$) constraints. The deployment mechanism will be driven by a piezorotator with a total power consumption of 2W. The development results in a protoflight model for the ESTCube-1 satellite. After assembling all parts different qualification tests have been accomplished at DLR test facilities in Bremen. The assembled deployment mechanism was delivered at the end of December 2012 to Estonia for the final integration. Launch is planned to be in April 2013.

Due to the increasing numbers of pico- and nanosatellites missions, the standardization of the deployment mechanism for the mentioned satellite class allows the design of missions which include a so called deorbiting package as a standardized module. This will increase the lifetime of the missions and reduce simultaneously the resulting space debris.

The talk will present the described status and further steps of the work.