19th IAA SYMPOSIUM ON SPACE DEBRIS (A6)
Mitigation - Tools, Techniques and Challenges - SEM (4)

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DEORBIT KIT DEMONSTRATOR MISSION

Abstract

In Low Earth Orbit, it is possible to use the ambient plasma and the geomagnetic field to exchange momentum with the Earth's magnetosphere without using propellant. A device that allows an efficient momentum exchange is the electrodynamic tether (EDT), a long conductor attached to the satellite. EDT technology has been demonstrated in several past missions, being the Plasma Motor Generator mission

(NASA 1993) one of the most successful. Nevertheless, it is not until today that reality has imposed a strong need and a concrete use case for developing this technology. In March 2019, the European Commission granted to a European consortium a 3M FET-OPEN project entitled Electrodynamic Tether technology for PAssive Consumable-less deorbit Kit (E.T.PACK). After completing its design phase, the consortium started the manufacturing and testing of a Deorbit Kit Demonstrator (DKD) breadboard based on EDT technology. The objective of ETPACK is to reach Technology Readiness Level equal to 4 by 2022. At the same time, the team is working on getting financial support by means of a follow-on project that would end in the In Orbit Demonstration by the end of 2024. Currently two other projects are running in parallel with E.T.PACK by E.T.PACK's partners: a 135k industrial PhD sponsored by the Comunidad de Madrid and focused on the avionic system of the DKD, and an INNOVATION LAUNCHPAD project funded with 100k by the European Commission to investigate the commercialization of the deorbit kit. The DKD is a standalone 24-kg satellite with the objective to demonstrate the performances of the improved EDT solution and validate its ultra-compact deployment system. The DKD is composed of two modules that will separate in orbit extending a 500-m long tether. The deployed bare-Aluminum tether will capture electrons from the ambient plasma passively and the circuit will be closed in the ionosphere with the help of an active electron emitter. E.T.PACK tether will take advantage of several novelties with respect to the mission flown in the past that will allow to optimize the power consumption, the tether length, the system volume and mass. Once successful demonstrated in orbit, the team plans to develop a suite of EDT systems capable of deorbiting satellites between 200 and 1000kg from an altitude up to 1200km in a few months. The work presents the current design status of the de-orbit kit demonstrator breadboard, the simulations of the system deorbit performances and the development approach.