World Academy of Science, Engineering and Technology
International Journal of Aerospace and Mechanical Engineering
Vol:15, No:02, 2021

Deorbiting Performance of Electrodynamic Tethers to Mitigate Space Debris

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Abstract : International guidelines recommend removing any artificial body in Low Earth Orbit (LEO) within 25 years from mission completion. Among disposal strategies, electrodynamic tethers appear to be a promising option for LEO, thanks to the limited storage mass and the minimum interface requirements to the host spacecraft. In particular, recent technological advances make it feasible to deorbit large objects with tether lengths of a few kilometers or less. To further investigate such an innovative passive system, the European Union is currently funding the project E.T.PACK – Electrodynamic Tether Technology for Passive Consumable-less Deorbit Kit in the framework of the H2020 Future Emerging Technologies (FET) Open program. The project focuses on the design of an end of life disposal kit for LEO satellites. This kit aims to deploy a taped tether that can be activated at the spacecraft end of life to perform autonomous deorbit within the international guidelines. In this paper, the orbital performance of the E.T.PACK deorbiting kit is compared to other disposal methods. Besides, the orbital decay prediction is parametrized as a function of spacecraft mass and tether system performance. Different values of length, width, and thickness of the tether will be evaluated for various scenarios (i.e., different initial orbital parameters). The results will be compared to other end-of-life disposal methods with similar allocated resources. The analysis of the more innovative system’s performance with the tape coated with a thermionic material, which has a low work-function (LWT), for which no active component for the cathode is required, will also be briefly discussed. The results show that the electrodynamic tether option can be a competitive and performant solution for satellite disposal compared to other deorbit technologies.

Keywords : deorbiting performance, H2020, spacecraft disposal, space electrodynamic tethers
Conference Title : ICSD 2021 : International Conference on Space Debris
Conference Location : Amsterdam, Netherlands
Conference Dates : February 08-09, 2021