E.T.PACK - Electrodynamic Tether Technology for Passive Consumable-less Deorbit Kit

The Low Work-function Tether (LWT) is a long conductive tape coated with a material that enhances thermionic and photoelectric electron emissions. It enables spacecraft to de-orbit and/or re-boost without the need for consumables. It interacts passively with its environment (ambient plasma, magnetic field and solar radiation) to exchange momentum with the planet's magnetosphere. E.T.PACK aims at developing a proof of concept for LWTs by breaking through and combining the current frontier of knowledge in three fields: plasma physics, low work function material science and space tethers. These will be integrated into a deorbit kit and a flight simulator for mission analysis. The kit aims to reach Technology Readiness Level 4 and will have two modes of operation: as a fully passive LWT and as a conventional electrodynamic tether equipped with an active hollow-cathode (backup mode). A new coating process for the electride, C12A7 ([Ca24Al28O64]4+(4e-)), will be developed, and used to manufacture a LWT demonstrator. The C12A7 and its extraordinary properties will be also applied to the hollow cathode of the kit, which will include a novel deployment mechanism specifically designed for LWT applications. The complex current exchange of LWTs with the ambient plasma under space-charge-conditions will be studied theoretically, and used to develop accurate simulators. The theory-experiment comparisons will lead to a solid framework for LWT operation and constraints, including thermal, mechanical, optical, electrical, ATOX and UV resistance, and survivability. Hitherto impossible mission scenarios will be explored, thus opening up new horizons in space science and technology. These interdisciplinary activities, placed at the cutting edge of their fields and highly interdependent, make E.T.PACK a high-risk project. This is fully compensated by its potential impact: Europe being the first with access to a reversible in-space propulsion technology free of consumables.

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Find out more: **https://cordis.europa.eu/project/id/828902**