

SYMPOSIUM ON VISIONS AND STRATEGIES FOR THE FAR FUTURE (D4)
Novel Concepts and Technologies (1)

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POSSIBILITIES OPENED BY ELECTRIC SOLAR WIND SAIL TECHNOLOGY

Abstract

The Electric Solar Wind Sail (E-sail) is a new propulsion technology which was invented in 2006 and which is developed by an international collaboration. First flight experiments will be performed onboard Estonian and Finnish CubeSats in 2013 – 2014, and our aim is to fly a solar wind test mission in 2015-2016. Once developed it will reduce travel times and launch costs to solar system targets and enable qualitatively new types of non-Keplerian orbit missions.

The E-sail taps the momentum flux of the natural solar wind for spacecraft propulsion with the help of long, charged tethers. The system produces a thrust vector which points away from the Sun, but which can be turned at will within an approximately 30 deg cone and whose magnitude can be easily adjusted. According to estimations, a 100 – 200 kg E-sail propulsion unit produces 1 N of thrust at 1 AU and the thrust scales $1/r$.

Possible applications of the Electric Solar Wind Sail include:

- Multi-asteroid touring.
- Kuiper and other distant body fly-bys or impactors.
- Giant planet atmospheric probes.
- Two year sample return mission from Mercury.
- Two years to Saturn.
- Remote sensing of Earth, Sun and planets from engineered non-Keplerian orbits.
- Plasma brake for de-orbiting small satellites.

With these applications, the Electric Solar Wind Sail has the potential to qualitatively change space exploration and to unlock the scientific and economical treasures of the solar system.

Reference: Janhunen, P. et. al. Electric solar wind sail: Towards test missions (Invited article), Rev. Sci. Instrum., 81, 111301, 2010