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World's First Flight of Solar Power Sail by IKAROS

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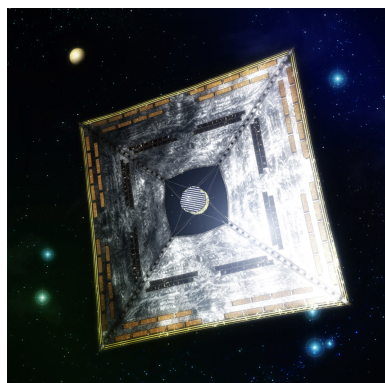
A Solar Sail is a space yacht that gathers energy for propulsion from sunlight pressure by means of a membrane. A solar sail can move forward without consuming propellant as long as it can generate enough energy from sunlight. This idea of a solar sail was born about 100 years ago and we often find it in science fiction novels. The solar sail missions are studied in the world. However it was not realized before IKAROS flight.

A Solar Power Sail is a Japanese original concept that gets electricity from thin film solar cells on the membrane in addition to acceleration by solar radiation. A solar power sail craft can save the fuel using a solar sail and it can also gain the necessary electric power using a vast area of thin film solar cells on the membrane even when it is away from the sun. It can be a hybrid propulsion system with a solar sail by activating the ultra-high specific impulse ion engines with the power generated by thin film solar cells.

The authors have studied an Extended Solar Power Sail mission toward Jupiter and Trojan asteroids via hybrid electric photon propulsion. The mission proposal passed the Mission Definition Review and now is eligible to go into the pre-project phase (Phase-A).

In addition, we applied first for the small technology demonstrator mission, IKAROS as a Front-Loading of new key technical issues of extended solar power sail craft. The proposal was endorsed in fall, 2007. IKAROS (Interplanetary Kite-craft Accelerated by Radiation Of the Sun) demonstrates the membrane deployment and thin film power generation. It is also the world's first actual solar sail flying an interplanetary voyage.

In this paper, the development of hub bus and mission portions of IKAROS is presented and the summary of IKAROS operation is introduced.



Keywords: Solar Sail, Solar Power Sail, Thin Film Solar Cell, Membrane, Deployment