

IKAROS and Solar Power Sail Mission for a Round Trip to Outer Solar System

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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. 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. The Japan Aerospace Exploration Agency (JAXA) made the world's first solar power sail demonstration of photon propulsion and thin film solar power generation during its interplanetary cruise by IKAROS (Interplanetary Kite-craft Accelerated by Radiation Of the Sun).

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. This paper proposes an solar power sail mission for a round trip to outer solar system. It demonstrates a variety of key technologies requisite for future outer solar system exploration as well as solar power sail technology. This innovative spacecraft is used not only for the cruise science observation but for dust in the outer solar system and Trojan asteroids sample return for the first time in the world.

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