

## MATERIALS AND STRUCTURES SYMPOSIUM (C2)

## Space Structures II - Development and Verification (Deployable and Dimensionally Stable Structures) (2)

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## DEVELOPMENT OF IKAROS MISSION SYSTEM TO EXPAND SOLAR POWER SAIL

**Abstract**

Japan Aerospace Exploration Agency (JAXA) will launch the solar power sail orbiter “Interplanetary Kite-craft Accelerated by Radiation Of the Sun : IKAROS”, in end of May, 2010. IKAROS will demonstrate a new propulsion technology of utilizing photons from the sun for deep space exploration, which is called the Solar Power Sail technology. In a case of the solar system exploration, an ion-propulsion engine is effective as a main propulsion system because it has high specific impulse and it can provide a continuous acceleration. However, the ion-engine needs high electric power in proportion to its performance. The solar power sail technology can be a hybrid engine, which can provide high electric power generated by very thin flexible solar arrays attached on the solar sail, while obtaining acceleration generated on the solar sail by the sun radiation.

The IKAROS is a small demonstrator of the solar power sail technology, as a front-loading demonstration for risk reduction of a future solar power sail mission, and it is a spin type orbiter that deploys a large solar power sail utilizing centrifugal force, in an interplanetary orbit. IKAROS will conduct the following missions, 1)Expand the solar power sail that diameter is 20 meter class, and obtain the characteristic of expanded sail dynamics. 2)Generate electric power using the very thin flexible solar arrays attached on the sail, and evaluate their performance and depletion. 3)Demonstrate the navigation technology utilizing acceleration arisen by photon pressure on the sail. 4)Estimate a length and direction of acceleration vector of photon pressure.

We developed the new mechanical system to expand a larger solar power sail for IKAROS that realizes a two phase expanding method we proposed. The proposed method is composed of two expanding sequences, that is, semi-static expanding sequence (First expanding sequence) and a dynamic expanding sequence (Second Expanding sequence). IKAROS will demonstrate the new expanding method, and we detect and evaluate an expanding sail using rate gyros (RG), acceleration sensor attached to tip of the sail, and monitor camera system. We can verify the function of expanding mechanism and a 20m class solar power sail dynamics in inter-planetary orbit, by sensors as above.

We will report the details of the mission system of IKAROS that applying a new expanding method, and the flight data obtained actually from IKAROS in inter-planetary orbit.