Flight Result of IKAROS Deep Space Solar Sail Demonstrator

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Abstract. Japan Aerospace Exploration Agency (JAXA) launched a solar sail demonstration spacecraft “IKAROS” on May 21, 2010. IKAROS was launched together with JAXA’s Venus climate orbiter “AKATSUKI (Planet-C)” as an interplanetary piggy-back payload. The launch vehicle is H2A and was launched from Tanegashima space center.

JAXA has been proposing a concept of “Solar Power Sail” for future deep space exploration. It combines the concept of solar sail (photon propulsion) with a larger power generation by flexible solar cells attached on the sail membrane. IKAROS is the precursor mission to demonstrate the key technologies for the solar power sail concept, which are (1) deployment of large sail in space, (2) solar power generation by means of thin film solar cells attached on the sail, (3) confirming the acceleration by solar radiation pressure attracted on the sail and (4) demonstration of the interplanetary guidance and navigation of the solar sail spacecraft.

IKAROS successfully deployed a 20m-span sail on June 9, which was confirmed by attitude telemetry, ground-based Doppler measurement and several camera images taken by IKAROS itself. Since then IKAROS has performed interplanetary solar-sailing taking advantage of the Earth-Venus leg of the interplanetary trajectory. The spacecraft mass is 310kg and is equipped with a rectangular flexible solar sail which weighs 15kg with the thickness of 7.5um at minimum. The solar sail is deployed and kept extended by centrifugal force of the spacecraft spinning.

We declared the completion of the nominal operation in the end of December 2010 when IKAROS successfully passed by Venus with the assist of solar sail. IKAROS is now in the extended mission phase, where we attempt to perform some ambitious experiments using IKAROS system.

This paper describes the overview of IKAROS spacecraft system, how the world’s first interplanetary solar sailer is operated and what is achieved so far.