Japan Geoscience Union Meeting 2014
(28 April - 02 May 2014 at Pacifico YOKOHAMA, Kanagawa, Japan)

PEM09-14 会場:211 時間:4 月 28 日 12:30-12:45

深宇宙探査技術実験機 DESTINY から太陽極域探査機 SOLAR-D へ
From Deep Space Explorer DESTINY towards Solar Polar Region Observer SOLAR-D

川勝 康弘 [1*]
KAWAKATSU, Yasuhiro[1*]

[1] 宇宙航空研究開発機構
[1]ISAS/JAXA

DESTINY which stands for ”**D**emonstration and **E**xperiment of **S**pace **T**echnology for **IN**terplanetary vo**Y**age” is a mission candidate for the next space science small program. The next mission is planned to be decided in 2014, and the select one is scheduled to be launched in 2018.

As illustrated in the Figure, DESTINY will be launched by an Epsilon launch vehicle and firstly placed into a low elliptical orbit, where then its altitude raised by the use of ion engine. When the orbit raising reaches the Moon, DESTINY subsequently is injected into transfer orbit for L_2 Halo orbit of the Sun-Earth system by using lunar gravity assist. Upon arrived at L_2 Halo orbit, DESTINY will conduct its engineering experiment as well as scientific observations for at least a half year. If conditions permit, DESTINY will leave L_2 Halo orbit, and transfer to the next destination.

On the way to L_2 Halo orbit, DESTINY will conduct demonstration and experiment on key advanced technologies for future deep space missions. Major items of the technology demonstration are listed as follows.

1) Ultra-Lightweight solar panel.

In order to generate large electric power to run μ20 ion engine, ”Ultra-Lightweight Solar Panel”, which is under development at JAXA, is applied and its performance is evaluated. This solar panel is estimated to achieve power to mass ratio at least double to conventional ones. Future application is expected in outer planet probes (JMO, MELOS) or probes with large ion engines.

2) Large scale ion engine μ20.

DESTINY is inserted into an elliptical orbit and reaches to a Halo orbit by its own orbital maneuver. For this maneuver, a large ion engine (μ20) which is under R&D at JAXA will be adopted and its performance is evaluated. This ion engine has thrust five times as much as μ10 used by Hayabusa and will be expected to be applied to large probes such as SOLAR-D or Hayabusa Mk2.

3) Advanced thermal control.

In order to manage large amount of heat generated by the large ion engine, advanced thermal control techniques by way of Loop Heat Pipe will be adopted.

4) Orbit determination under low thrust operation.

DESTINY will reach to Halo orbit by running ion engine over long duration. In order to reduce burdens to shut down the ion engine each time of orbit determinations, orbit determination under ion engine operation is conducted and its performance is evaluated.

5) Automatic/autonomous onboard operation.

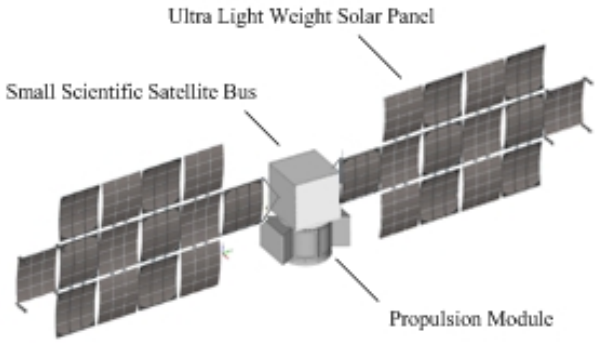
In order to increase the efficiency of operation, autonomous and highly functioned spacecraft management system is developed demonstrated on board. This technique is expected to be adopted especially in the deep space missions usually operated under severe communication condition.

The technologies demonstrated by DESTINY will be applied to various future solar system exploration programs. One of them is a solar polar region observer, SOLAR-D, which is planned to be launched in 2020s.

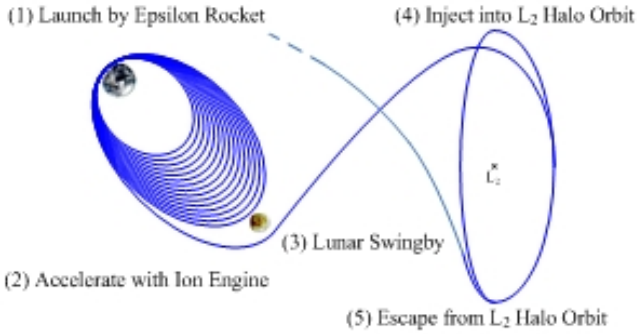
SOLAR-D aims at the observation of the polar region of the Sun from out-of-ecliptic view point. It requires the observation from the high latitude point of the Sun, namely 45deg. To observe the Sun from the high latitude point, the space observatory (spacecraft) must be on the orbit largely inclined with the ecliptic plane. It is not an easy task to inject the spacecraft into the orbit largely inclined with the ecliptic plane. The mission plan under consideration supposes the use of solar electric propulsion, whose major technology challenges are going to be demonstrated in DESTINY.

The over view of DESTINY mission, and its effect on the future SOLAR-D mission will be introduced in the presentation.

PEM09-14 会場:211 時間:4 月 28 日 12:30-12:45



DESTINY Overview



Mission Profile