DESTINY Mission Overview

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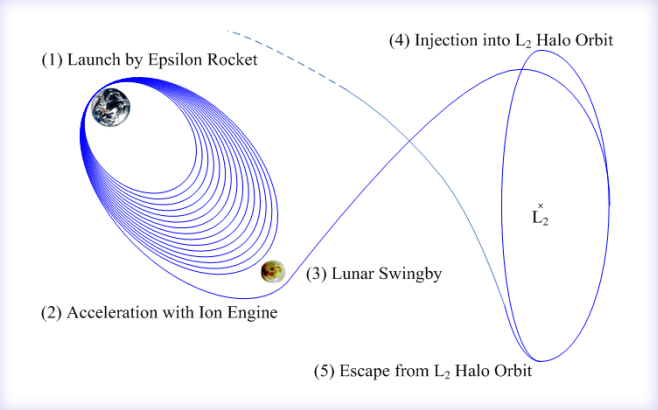
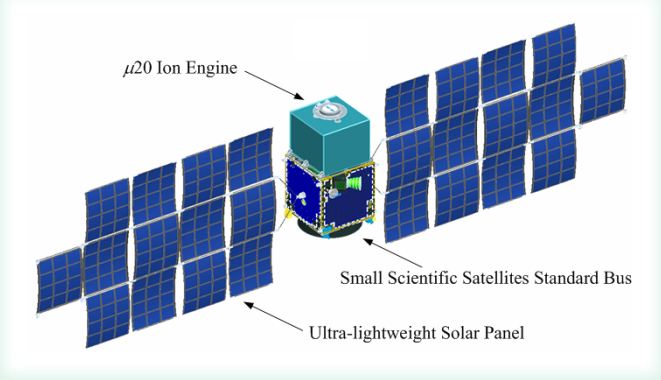
DESTINY which stands for "**D**emonstration and **E**xperiment of **S**pace **T**echnology for **IN**terplanetary vo**Y**age" is a mission candidate for the third mission of ISAS small science satellite series. DESTINY prioritizes the validation of key advanced technology for future deep space missions. The selection of the third mission is scheduled in the former half of 2013. If it is successfully selected as the third mission, it is expected to be launched in 2018.

Mission Profile



DESTINY is launched by an Epsilon launch vehicle, JAXA's next-generation solid fuel rocket. DESTINY is firstly placed into a low elliptical orbit. DESTINY raises its altitude by use of an ion engine, and reaches the moon after about 1.5 year cruise. DESTINY is subsequently 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 a half year after the lunar swingby, DESTINY conducts its engineering experiment as well as possible scientific observations for at least a half year. If conditions permit, DESTINY leaves L_2 Halo orbit, and transfer to the next destination.

Spacecraft System



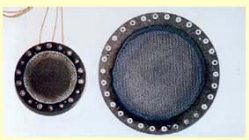
DESTINY achieves high astronautic capability by use of a large scale/high efficiency ion engine system μ20. The system is realized compactly by use of ultra-lightweight solar panels and an advanced thermal control system with loop heat pipes. Advanced communication and data handling technology, such as Ka band downlink and sophisticated onboard management software, are validated on DESITNY. The system is realized with relatively low cost by use of the ISAS small scientific satellites standard bus, whose size is approximately 1m cube. The total mass of the spacecraft at the launch is 400kg, and the power is 4kW approximately.

Engineering Experiments

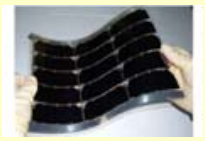
DESTINY conducts demonstration and experiment of key advanced technology for future deep space missions.

High Performance Electric Propulsion Vehicle

Large Scale Ion Engine μ20
Scale up from μ10 (of Hayabusa).
Thrust: 40mN, Isp: 3800sec.



Ultra-Lightweight Solar Panel
Thin film solar cells and frame type supporting structure. 100W/kg.



Advanced Thermal Control
Efficient heat transfer and heater power reduction by loop heat pipes.

Advanced Spacecraft Operation

Advanced Communication System
Ka band downlink and high efficiency GaN SSPA.

Automatic/Autonomous Onboard Operation
Script type command and randomly accessible onboard recorder.

Orbit Determination under Low Thrust Operation

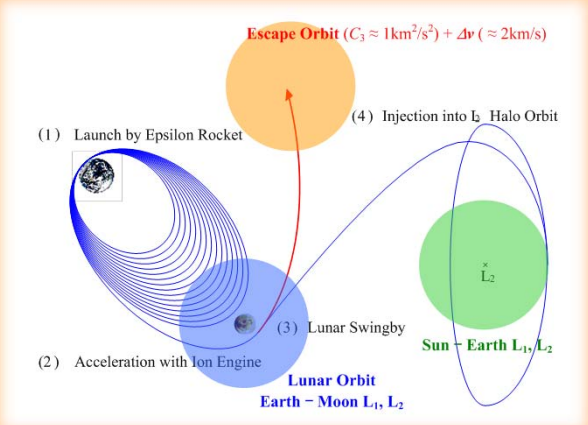
Mission & Orbit Design

High Energy Mission by Epsilon Rocket
Launch trajectory optimized for high energy mission.

Halo Orbit Transfer and Maintenance
Spiral up to the moon, and transfer to L_2 Halo by a stable manifold.

Significance of DESTINY

DESTINY is built on ISAS small scientific satellite (SSS) standard bus and launched by Epsilon launch vehicle. This configuration realizes relatively low mission cost, and results in the increase of mission opportunity under limited budget.
The basic concept of DESTINY is to equip large scale/high efficiency ion engine system, μ20 on SSS standard bus. This powerful propulsion system enables DESTINY to spiral up from its initial low elliptical orbit to the moon. This concept yields useful variation of the mission concept. First, Lunar orbiting missions and Earth – Moon L_1/L_2 missions are obviously possible. The use of lunar swingby drastically extends its reachable space to the edge of the Earth system (Sun – Earth L_1/L_2) or even to its outside.



Variations of DESTINY Mission Concept