

ASTRODYNAMICS SYMPOSIUM (C1)
Mission Design, Operations & Optimization (2) (5)

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MISSION DESIGN OF DESTINY+

Abstract

DESTINY+ is a small-sized and high performance deep space vehicle proposed for public offering small-sized plan space science mission of ISAS/JAXA. DESTINY+ is injected into an extended elliptical orbit launched by Epsilon rocket. The orbit is spiraled upward by the low-thrust of IES. And the swing-by is designed to give DESTINY momentum to Asteroid Phaethon flyby. After Phaethon flyby, DESTINY+ plan to go back to Earth for gravity assist and go to another asteroid. DESTINY+ has several mission objectives, including: demonstration and experiment of space technology of interplanetary voyage; Phaethon flyby with reusable probe; compact avionics as for Engineering mission, and the investigation of the process to the end of evolution of primitive body; the limitation of initial state and the evolution process of the meteor shower dust as for Science mission. This paper discusses DESTINY+'s low-thrust trajectory design and the related system analysis. As for the spiral upward trajectory phase, the low-thrust trajectory is optimized by the multi-objective optimization using genetic algorithm. In this phase, we minimize the time of flight, the passage time of radiation belt, the work time of IES and the shadow time. After the spacecraft reaches to the moon's path, it utilizes the moon swing-by several times to connect to the transfer trajectory for Asteroid Phaethon. Parallel to the trajectory design, the radiation effect analysis, thermal environmental analysis, attitude analysis and ground station visibility analysis for operation are achieved. From these study, we can show the feasibility of the mission design of DESTINY+.