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SPACE EXPLORATION SYMPOSIUM (A3)
Small Bodies Missions and Technologies (Part 2) (4B)

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DESTINY+: TECHNOLOGY DEMONSTRATION AND EXPLORATION OF ASTEROID 3200 PHAETHON

Abstract

DESTINY+, which stands for "Demonstration and Experiment of Space Technology for INterplanetary voYage," is a mission candidate for the next space science small program. DESITNY+ is a high performance deep space transportation system whose maximum delta-v capacity is 5km/s, and maximum payload mass is 200kg. DESTINY is based on the previously developed small scientific standard satellite bus system, and extended by five novel technologies. The key technologies to realize DESTINY+ are, the ion engines, the ultra-light weight solar panel, advanced thermal control devices, novel mission orbit design, and small high specification newly developed bus components. DESITNY+ also demonstrates multiple fly-by explorations of near earth objects (NEO) by using instruments on DESTINY+ mother ship and its daughter probe "PROCYON mini". The first target NEO is one of the most unusual comet-asteroid transition bodies, 3200 Phaethon, which has dust tails. Asteroid (3200) Phaethon is a parent body of the Geminids meteor shower. While most of the parent bodies of meteor showers are comets, cometary activity of Phaethon has only been reported near its perihelion at 0.14 AU. Phaethon is likely a comet to asteroid transitional body. Na depletion is reported from visible spectroscopic study of the ground observation of the Geminids meteoroid. Since an expected temperature by solar heating at 0.14 AU is not high enough to sublimate Na from Na-bearing phases, the observed Na depletion is likely derived from surface materials of the parent Phaethon. Na depletion does not occur in chondritic materials, but does occur in differentiated chondrites, such as primitive achondrites, which are subject to melting and segregation of Na-rich silicate melts. Phaethon may hold a signature of comet-asteroid transition body and primitivedifferentiated material. Because of its small perihelion distance, dehydration of the surface material by solar heating is expected, but some primitive, hydrous material may still reside in its interior. Phaethon is an ideal body to understand on-going thermal evolution of primitive bodies in the solar system. Further, Phaethon is among the largest potentially hazardous asteroids (PHAs), of which cross the Earth's orbit. Thus, Phaethon is a critical mission target both in the context of science and planetary defense. In this paper, we present the outline of mission plan, the system design, and key technologies of DESTINY+.