

Study of asteroid tracking mirror of telescopic camera onboard DESTINY+

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DESTINY⁺ (Demonstration and Experiment of Space Technology for INterplanetary voYage with Phaethon flyby and dUst Science) mission plans to conduct high-resolution imaging during close flyby of asteroid (3200) Phaethon, which is considered as a parent body of Geminid meteor shower. The Telescopic CAmera for Phaethon (TCAP) is planned to perform high-resolution imaging of the surface of Phaethon with an imaging rate of more than 1 frame per second and with a spatial resolution down to 3.5 m/px at closest approach. Since the relative flyby speed and closest distance to Phaethon are expected to be 30 to 40 km/s and about 500 km, it is significantly difficult to track the asteroid only by the rotation of the spacecraft itself. Therefore, an asteroid tracking system is required for TCAP to obtain unblurred high-resolution images. We have conducted conceptual studies of the tracking mirror to satisfy scientific requirements. To realize the designed concept, we have developed a simple breadboard model of the actuator of tracking mirror. The breadboard model consists of a rotating mirror, a 2-phase stepping motor and its driver, a motor reducer, and a FPGA board to control the driver. We show that the pointing and tracking accuracy of the breadboard model generally satisfy the required performance and discuss further improvements based on motor dynamics model.

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