

Occultation and Triangulation Camera (OcTriCam) Cubesat

Deep Space Gateway Science Mission Abstract

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Category: Planetary Science

An opportunity to deploy a spacecraft from the proposed Deep Space Gateway at the Earth-Moon L2 libration point (EML2) would enable important scientific research to be performed to identify solar system objects and precisely measure their orbits with unprecedented accuracy and with unprecedented speed. For example, near-Earth asteroids now can be identified and have their orbits measured with Earth-based telescopes such as the Pan-STARRS survey telescope in Hawai'i and the Hubble Space Telescope (HST), typically by making a sequence of observations on successive nights. By comparison, a camera at Earth-Moon L2, working with a camera on a ground-based telescope or HST, would provide a baseline of order 240,000 km. By comparing two images of the same target obtained from both ends of this baseline, triangulation would enable distances of planetary objects to be measured without the delay of successive nights, and in many cases simultaneously.

Employing binocular viewing with a camera at EML2 and an Earth-based telescope or HST, the process of finding near-Earth asteroids would be accelerated dramatically. The motions of more distant solar system objects could also be measured with greater rapidity. Occultations (eclipses of one planetary body by another or eclipses of astronomical objects by planetary bodies) are used to refine the ephemerides of planets and other solar system objects. They are also used to probe the ring systems of distant planets like Uranus and Neptune. Observations of occultations with HST, Earth-based telescopes and a camera at EML2 would obtain results much faster, using multiple simultaneous observations. (Of course many complementary observations can be performed that are not exactly simultaneous. The point is that triangulation can be obtained without delay times to wait for target motion that are now necessary.)

As mentioned in the report on the Astronomy Decadal Survey, *New Worlds, New Horizons: A Midterm Report* (National Academy Press, DOI: 10.17226/23560, p. 34), the Pan-STARRS survey telescope is operated by NASA primarily as a near-Earth object detector. The proposed spacecraft at EML2 would provide triangulation data that could be combined with Pan-STARRS observations to dramatically improve the rate of target identification and ranging – a significant capability cited in the Decadal Survey Report. Location of near-Earth objects is, of course, an important strategic element in the planetary protection responsibility of NASA.

This mission can be performed with a small spacecraft such as a cubesat, with low-thrust propulsion such as solar electric ion drive. No requirement of astronaut intervention would be necessary post-deployment.

Reference

Solar System's First Interstellar Visitor Dazzles Scientists:

<https://www.nasa.gov/feature/solar-system-s-first-interstellar-visitor-dazzles-scientists>