

IAF SPACE EXPLORATION SYMPOSIUM (A3)
Moon Exploration – Part 1 (2A)

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DEMOCRATIZING ACCESS TO THE MOON FOR SMALL SATELLITE OPERATORS

Abstract

Since orbital space flights began in 2017, space technology company Rocket Lab has emerged as the industry's global leader in dedicated small satellite launch. Offering frequent, reliable, and affordable services from its launch sites in the United States and New Zealand, Rocket Lab's Electron launch vehicle has reached space 11 times, delivering 48 small satellites to orbit with 100

Expanding beyond launch, Rocket Lab offers a complete end-to-end mission package with the introduction of its Photon satellite platform. Photon enhances the Electron launch vehicle's flight-proven Kick Stage into a customizable satellite bus by integrating high power generation, high-accuracy attitude determination and control, and radiation-tolerant avionics with the stage's Curie propulsion system.

Designed with extended-range missions in mind to lunar flyby, Near Rectilinear Halo Orbit (NRHO), L1/L2 points, or lunar orbit, the Photon platform is ideally used for technology demonstrations, pathfinding and retiring risk, and infrastructure building to support the return of humans to the Moon.

In 2021, Rocket Lab will utilize Photon and Electron to launch and deploy NASA's Cislunar Autonomous Positioning System Technology Operations and Navigation Experiment (CAPSTONE) to a near rectilinear halo orbit around the Moon. In this mission concept, Electron delivers the high delta-V variant of Photon, integrated with the CAPSTONE payload, to a circular parking orbit before a series of burns, or phasing maneuvers, establish increasingly elliptical orbits. Each phasing maneuver is followed by a designed number of phasing orbits at the new apogee altitude before the next maneuver is performed. After the nominal phasing maneuvers are performed, a final burn places Photon on an escape trajectory. The phasing orbit approach enables a precise alignment to mission-specific right ascension of the ascending node and argument of perigee. Photon can continue to fly with the payload, or the payload can be deployed to take advantage of further staging.

This presentation will examine the high delta-V variant of Photon, a mission architecture that enables precise targeting for small spacecraft missions beyond LEO with instrument/payload masses up to 50 kg. This presentation will also include discussion on the realities and benefits of an affordable, dedicated small satellite mission to the Moon aboard a small launch vehicle, thereby eliminating the need for a medium or heavy lift launch vehicle and ensuring democratized access to deep space exploration.