

28th IAA SYMPOSIUM ON SMALL SATELLITE MISSIONS (B4)  
Small Space Science Missions (2)

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VENUS 2023: A PHOTON-ENABLED PLANETARY SMALL SPACECRAFT MISSION FOR  
DECADAL SCIENCE

**Abstract**

Rocket Lab is moving up the value chain with the Photon small spacecraft and down the value chain with spacecraft components, built around the acquisition of Sinclair Interplanetary. Low-cost access to space and advancements in small satellite technology, manufacturing, and operations are leading to cost-effective solutions in remote sensing, communications, Earth observation, and more. These trends will also spur the proliferation of Decadal-class small satellite missions to planetary destinations in the coming years by academia, government, and commercial operators.

With frequent and reliable launch for small spacecraft largely solved by the ascendancy of Rocket Lab's Electron launch vehicle in the small launch market, the introduction of Rocket Lab's Photon spacecraft and deep space mission architecture will now revolutionize small satellite access beyond Earth orbit to the Moon, Mars, and deep space.

Photon incorporates the strong flight heritage of Rocket Lab's Curie propulsion system with high power generation, high-accuracy attitude determination and control, radio communication, custom solar panels, sensors, actuators, and unique software solutions, to enable a range of low-cost science missions. As a self-sufficient small spacecraft capable of long-duration interplanetary cruise, mission-configurable Photons can be deployed on Rocket Lab's Electron launch vehicle as a dedicated payload or from other launch vehicles as a rideshare spacecraft.

A demonstration of these deep space capabilities will be launched by Rocket Lab on a privately-funded science exploratory mission to Venus in 2023. Rocket Lab will take advantage of planetary alignment to deploy a custom Photon spacecraft on a flyby trajectory of Venus, where a small probe will be entered and travel through Venus' cloud layer between 45km – 60km to conduct measurements of potential phosphine that will be transmitted via Photon (acting as a telecommunications relay) back to Earth. While in early concept stages, the probe is expected to include approximately 3kg of instruments that will collect roughly 270 seconds of data on its descent. This mission concept has the potential to result in significant scientific return at unprecedented low cost for scientists, researchers, and academia.

This presentation will outline Rocket Lab's approach for accessing planetary science targets, review the status of Rocket Lab's 2023 mission to Venus, and explore additional Photon science mission concepts for Venus and other planets.