

PRISM-1 LUNAR VERTEX: FIVE INSTRUMENTS AND A ROVER. David T. Blewett^{1,*}, Jasper Halekas², George C. Ho¹, Benjamin T. Greenhagen¹, Brian J. Anderson¹, Sarah K. Vines¹, C. Dany Waller¹, Jörg-Micha Jahn³, Peter Kollmann¹, Brett W. Denevi¹, Heather M. Meyer¹, Rachel L. Klima¹, Leonardo Regoli¹, Joshua T. Cahill¹, Lon L. Hood⁴, Sonia Tikoo⁵, Xiao-Duan Zou⁶, Mark Wieczorek⁷, Myriam Lemelin⁸, Shahab Fatemi⁹, Edward A. Cloutis¹⁰, Ann L. Cox¹, Scott A. Cooper¹, and William F. Ames¹. ¹Johns Hopkins University Applied Physics Laboratory, Laurel, MD 20723, USA. ²Univ. of Iowa, Iowa City, IA. ³Southwest Research Inst., San Antonio, TX. ⁴Univ. of Arizona, Tucson, AZ. ⁵Stanford Univ., Stanford, CA. ⁶Planetary Science Inst., Tucson, AZ. ⁷Institut de Physique du Globe de Paris, France. ⁸Univ. de Sherbrooke, Canada. ⁹Umeå Univ., Sweden. ¹⁰Univ. of Winnipeg, Canada. (*david.blewett@jhuapl.edu)

Introduction: NASA designated Reiner Gamma as the destination for the first Payloads and Research Investigations on the Surface of the Moon (PRISM) delivery (PRISM-1). Reiner Gamma (RG) is home to a magnetic anomaly, a region of magnetized crustal rocks. The RG magnetic anomaly is co-located with the type example of a class of irregular high-reflectance markings known as lunar swirls.

Lunar Vertex was competitively selected for the PRISM-1 RG mission in June of 2021. APL is providing overall management of *Lunar Vertex*, systems engineering, safety and mission assurance, two magnetometer instruments, and rover integration and testing. PRISM payloads will be carried on commercial landers as part of NASA's Commercial Lunar Payload Services (CLPS) program. The PRISM-1 lander and payload are designed for operation during one lunar daylight period.

Lunar Vertex Goals: A lunar magnetic anomaly is a natural laboratory for addressing a wide range of questions in planetary science [e.g., 1, 2]. *Lunar Vertex* has the following goals: 1) Investigate the origin of lunar magnetic anomalies; 2) Investigate the origin of lunar swirls; 3) Determine the structure of the mini-magnetosphere that forms over the RG magnetic anomaly.

Lander Instruments: The mission goals will be accomplished by payload elements on a lander and on a rover. The Vertex Camera Array (VCA, [3]) is a set of cameras fixed-mounted on the lander. VCA images will be used to survey landing site geology and perform photometric modeling of regolith characteristics. VCA was built by Redwire of Littleton, Co., USA, with radiometric calibration done at APL.

The Vector Magnetometer-Lander (VML, [4]) is a suite of fluxgate magnetometers. VML will operate during cruise and descent and on the surface to measure the in-situ magnetic field at multiple altitudes and through varying upstream conditions. Built by APL, VML has a dual ring-core fluxgate sensor mounted at the end of a mast. VML also has four commercial miniature magnetometers arrayed in a tetrahedron near the base of the mast. Gradiometry allows for separation of the natural field from that of the lander.

The Magnetic Anomaly Plasma Spectrometer (MAPS, [5]) measures the energy, flux, and direction of ions and electrons (~8 eV to 18 keV) that reach the surface of the Moon. MAPS is provided by the Southwest Research Institute of San Antonio, Tx., USA.

The NASA Acceptance Review for the lander instruments took place early June 2023. These instruments were delivered to the lander in late June 2023.

Rover and Rover Instruments. The lander will deploy the *Lunar Vertex* rover, which conducts a traverse to obtain measurements both inside and outside the zone disturbed by lander exhaust. The rover provider is Lunar Outpost (Arvada, Co., USA). Delivery of the vehicle chassis to APL was in April of 2023. The rover carries two instruments.

The Rover Multispectral Microscope (RMM, [6]) will collect images of the regolith beneath the rover at 5 wavelengths ~0.36–0.94 μm using active LED illumination. RMM was produced by Canadensys Aerospace (Bolton, On., Canada), with the flight model delivered to APL in March of 2023.

The APL Vector Magnetometer-Rover (VMR, [4]) is a copy of a portion of VML: the array of four mini-magnetometers.

RMM and VMR were installed into the vehicle in the spring of 2023 at APL. Environmental testing of the integrated rover is proceeding at APL during the summer of 2023, with a NASA acceptance review and delivery to the lander to follow.

Lander Selection. NASA selected Intuitive Machines (IM) of Houston, Tx., USA as the provider of the CLPS lander that will deliver *Lunar Vertex* to the Moon. Launch will be no earlier than April 2024. This will be IM's third CLPS delivery using their Nova-C lander.

References: [1] D. Blewett et al. (2021), *Bull. Am. Astron. Soc.* 53(4), DOI: 10.3847/25c2cfef.9295af86. [2] M. Robinson et al. (2020), Lunar Intrepid PMCS report. [3] B.W. Denevi et al. (2023), *LPSC 54th*, abstr. 2355. [4] S.K. Vines et al. (2023), *LPSC 54th*, abstr. 2150. [5] J.M. Jahn et al. (2023), *LPSC 54th*, abstr. 2675. [6] R.L. Klima et al. (2023), *LPSC 54th*, abstr. 2718.