THE *LUNAR VERTEX* VECTOR MAGNETOMETERS: STATUS AND EFFORTS IN ANTICIPATION OF ARRIVAL AT REINER GAMMA. Sarah K. Vines[1], C. Dany Waller[1], Brian J. Anderson[1], Shahab Fatemi[2], David T. Blewett[1], Jasper Halekas[3], George C. Ho[1], and the *Lunar Vertex* Vector Magnetometer and Rover Engineering Teams[1], [1]Johns Hopkins University Applied Physics Laboratory, Laurel, MD 20723, USA, [2]Umeå Univ., Sweden. [3]Univ. of Iowa, Iowa City, IA.

The first Payloads and Research Investigations on the Surface of the Moon (PRISM1) lander mission targets the Reiner Gamma (RG) swirl and magnetic anomaly [1]. To study the anomaly and the relationship of the "mini-magnetosphere" to surface albedo variations, the *Lunar Vertex* investigation will carry a suite of science-grade and commercial fluxgate magnetometers on the lander (Vector Magnetometer – Lander; VML) and commercial magnetometers on a dedicated rover (Vector Magnetometer – Rover; VMR). Measurements during descent by VML and during surface operations by VML and VMR (VMx) will characterize the altitudinal variation and surface magnetic field across contrasting albedo regions of a strong magnetic anomaly [2]. Characterization of the surface strength and structuring of the RG anomaly by VMx is also vital for understanding interactions with the space plasma environment and electromagnetic processes occurring on and near the lunar surface which may impact future surface activities.

Instrumentation and Current Status: VML is comprised of a tetrahedral array of four commercial fluxgate magnetometers mounted on the bottom of a 0.5-meter mast, with a science-grade, dual-ring core fluxgate magnetometer built at the Johns Hopkins Applied Physics Laboratory (APL) mounted at the top of the mast (Fig. 1, left). VML will be located at the top of the Intuitive Machines (IM) Nova-C lander. VMR is comprised of a tetrahedral array of four commercial fluxgate sensors mounted on a 0.2-meter mast, located on the top deck of the Lunar Outpost (LO) rover (Fig. 1, right). The tetrahedral arrays of VMx are used in a novel form of magnetic gradiometry [3], and VML also uses the array with the APL-built fluxgate magnetometer for additional inboard-outboard corrections [4]. Both developed and assembled at APL, VML and VMR underwent calibration and performance characterization at APL. VML also completed environmental testing at APL, and was delivered to IM for integration with the Nova-C lander. VMR was integrated with the LO rover and has been undergoing environmental testing and additional calibration as an integrated assembly on the rover at APL.

Preparing for Reiner Gamma Observations: To prepare for *Lunar Vertex* operations and key measurements from VML during cruise and descent, modeling efforts are underway [5, 6, 7]. Time series profiles along synthetic trajectories for varying solar wind and magnetosheath conditions are constructed. Exploring cases of upstream plasma conditions representative of the solar wind and interplanetary magnetic field, magnetosheath plasma and magnetic field, and the magnetotail populations and magnetic field at lunar distances provides constraints on relative variations of the surface field at the *Lunar Vertex* landing site during the mission.

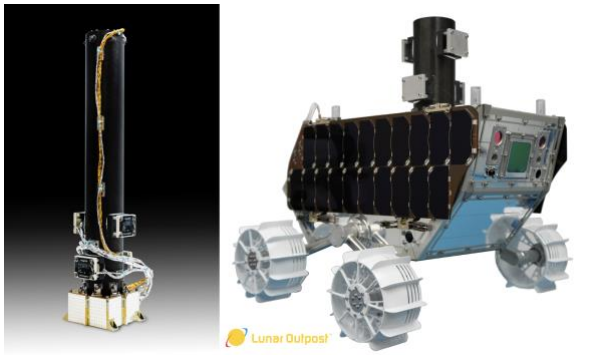

Fig. 1. *(left) The Lunar Vertex VML assembly (photo credit: APL). (right)The Lunar Vertex rover, with a mass model of VMR on the rover top deck (photo credit: Lunar Outpost).*

Additionally, opportunities for multi-mission observations and additional measurement validation may be available for VML prior to descent and for VMx surface operations. With the timing of *Lunar Vertex* operations, ARTEMIS data can be used as an upstream monitor throughout the mission, and data from concurrent missions and payloads, such as ARTEMIS and potentially KPLO at low lunar altitudes, may be used in conjunction with VMx measurements to provide more comprehensive observations of the lunar electrodynamic environment at RG.

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References: [1] Blewett D.T. et al. (2021), *Bull. Am. Astron. Soc.*, doi: 10.3847/ 25c2cfeb.9295af86. [2] Vines, S.K. et al. (2022), *AGU 2022*, Abstract #P45A-08. [3] Waller C.D. et al. (2023) *LPSC 54th*, abstr. 1820. [4] Ness, N. F. et al. (1971), *J. Geophys. Res.*, doi: 10.1029/JA076i016p03564. [5] Vines S.K. et al. (2023) *LPSC 54th*, abstr. 2150. [6] Fatemi, S. et al. (2017), *J. Phys. Conf. Ser.*, doi: 10.1088/1742-6596/837/1/012017. [7] Waller C.D. et al. (2022) *Front. Astron. Space Sci.*, doi: 10.3389/fspas.2022.926018.