

**VERITAS, A GROUND TRUTH MISSION INTO A DEEP LUNAR PSR.** G. F. Sowers<sup>1</sup>, C. Dreyer<sup>2</sup>, and C. Purrington<sup>3</sup>, <sup>1</sup>Colorado School of Mines, 1610 Illinois Street, Golden CO 80401, [gsowers@mines.edu](mailto:gsowers@mines.edu), <sup>2</sup>Colorado School of Mines, 1610 Illinois Street, Golden CO 80401, [cdreyer@mines.edu](mailto:cdreyer@mines.edu), <sup>3</sup>Colorado School of Mines, 1610 Illinois Street, Golden CO 8040, [cpurrington@mines.edu](mailto:cpurrington@mines.edu).

**Introduction:** Veritas, (Volatile Exploration and Resource Identification via Testing, Analysis and Sensing) is a concept for a ground truth mission into a deep lunar PSR (permanently shadowed region). It is intended to provide initial ground truth to calibrate remote sensing data and anchor geologic models of the formation of lunar volatile deposits.

Volatiles such as water and methane are key to the sustainability of space exploration and will underpin most economic activities in space. Volatiles are essential for life and can be used as rocket propellants. They are common throughout the solar system, existing in many forms, often in the form of ices, frozen on cold bodies. Developing sources of volatiles in space will dramatically lower the cost of exploration and enable robotic and human spaceflight missions not currently possible and/or affordable.

An increasing body of remote sensing data indicates that volatiles exist in the permanently shadowed regions (PSRs) of the Moon. This is augmented by the single data point in Cabeus crater provided by LCROSS that indicated 5.6% water ice by mass as well as many other volatile species in lower abundances. However, no direct measurements of these volatiles have yet been made and no spacecraft has landed in a PSR.

Named for the Roman goddess of Truth, the Veritas payload suite is designed to provide Ground Truth in at least one location of the existence, abundances and characteristics of volatiles near the poles of the Moon. Veritas is designed to function within the cold and dark of a lunar PSR for 24 hours using battery power provided by the lander. Most of the instruments are at very high TRL allowing for the earliest possible mission date to inform resource exploration and development activities in support of Artemis program planning. Veritas has been sized to utilize the Lockheed Martin McCandless lander, but is compatible with any CLPS lander of equivalent capability.

In addition to providing early data to inform exploration planning, Veritas is a necessary precursor to long term sustainability initiatives being pursued through the NASA's LSII project. Furthermore, Veritas directly addresses many of the most critical Science goals for the Moon regarding the nature and characteristics of the polar volatiles.

The Veritas payload suite consists of three main components: operational/non-scientific capabilities,

scientific payloads onboard the lander, and deployable scientific payloads. The operational capabilities include power, data acquisition, data processing and communications. The onboard scientific capabilities include sample acquisition including a drill and a scoop, sample analysis, imagery, neutron and gamma ray spectrometry, and ground penetrating radar (GPR).

The innovative deployable sensor packages are called squirrels. Upon landing, six squirrels will be spring-ejected to travel 200 meters from the lander in a hexagonal pattern to provide data on the region surrounding the lander. Each squirrel is equipped with a radio beacon for precise location as well as a neutron spectrometer and a GPR. The array of GPR transmitters and receivers provided by the lander and the squirrels will provide an unprecedented view into the PSR subsurface, giving volatile distributions with depth across an area of over 100,000m<sup>2</sup> to a depth of 10m.

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