LUNAR FLASHLIGHT: EXPLORATION AND SCIENCE AT THE MOON WITH A 6U CUBESAT. B. A. Cohen[1], P. O. Hayne[2], B. T. Greenhagen[3]; D. A. Paige[4], [1]NASA Marshall Space Flight Center, Huntsville AL 35812 (Barbara.A.Cohen@nasa.gov), [2]Jet Propulsion Laboratory, Pasadena CA 91109, [3]Applied Physics Laboratory, Johns Hopkins University, Laurel MD 20723; [4]UCLA, Los Angeles, CA 90095.

Introduction: Recent reflectance data from LRO instruments suggest water ice and other volatiles may be present on the surface in lunar permanently-shadowed regions, though the detection is not yet definitive [1, 2]. Understanding the composition, quantity, distribution, and form of water and other volatiles associated with lunar permanently shadowed regions (PSRs) is identified as a NASA Strategic Knowledge Gap (SKG) for Human Exploration. These polar volatile deposits are also scientifically interesting, having the potential to reveal important information about the delivery of water to the Earth-Moon system.

Mission: In order to address NASA's SKGs, the Lunar Flashlight mission will be launched as a secondary payload on the first test flight (EM1) of the Space Launch System (SLS), currently scheduled for 2018. The goal of Lunar Flashlight is to determine the presence or absence of exposed water ice and map its concentration at the 1-2 kilometer scale within the PSRs. After being ejected in cislunar space by SLS, Lunar Flashlight maneuvers into a low-energy transfer to lunar orbit and then an elliptical polar orbit, spiraling down to a perilune of 10-30 km above the south pole for data collection. Lunar Flashlight will illuminate permanently shadowed regions, measuring surface albedo with point spectrometer at 1.1, 1.5 1.9, and 2.0 μm. Water ice will be distinguished from dry regolith in two ways: 1) spatial variations in absolute reflectance (water ice is much brighter in the continuum channels), and 2) reflectance ratios between absorption and continuum channels. Derived reflectance and water ice band depths will be mapped onto the lunar surface in order to distinguish the composition of the PSRs from that of the sunlit terrain, and to compare with lunar datasets such as LRO and Moon Mineralogy Mapper.

Updates: We will provide a current status of the Lunar Flashlight mission science and architecture, enabling a low-cost path to science and in-situ resource utilization (ISRU) by identifying ice deposits for expanded human exploration.

References: [1] Gladstone, G. R., et al. (2012) JGR 117, CiteID E00H04. [2] Zuber, M. T., et al. (2012) Nature, 486, 378-381.