Update for the Lunar Ice Cube Mission. Pamela E. Clark[1], Ben Malphrus[2], Nathan Fite[2], Jacob Schabert[2], Sarah Wilczewski[2], Kevin Brown[2], Cliff Brambora[3], David Folta[3], Terry Hurford[3], Deepak Patel[3], William Farrell[3], Dennis Reuter[3], Michael Tsay[4], Matt Grubb[5], Kris Angkasa[1], [1]Jet Propulsion Laboratory, California Institute of Technology (pamela.e.clark@jpl.nasa.gov), [2]Morehead State University, [3]NASA/GSFC, [4]Busek, [5]NASA/IV&V.

Overview: Lunar Ice Cube, to be launched in 2020, is a deep space cubesat mission with the goals of demonstrating 1) a cubesat-scale instrument capable of addressing NASA HEOMD Strategic Knowledge Gaps related to lunar volatile distribution (abundance, location, and transportation physics of water ice), and 2) cubesat propulsion, via the Busek BIT 3 RF Ion engine.

Payload: The payload consists of one instrument: BIRCHES [1], Broadband IR Compact High-resolution Exploration Spectrometer. The versatile instrument, being developed by NASA GSFC, is designed to provide the basis for amplifying our understanding of the forms and sources of lunar volatiles in spectral, temporal, spatial, and geological context as function of time of day and latitude. BIRCHES is a compact version (1.6 U, 3 kg, 10-20 W) of OVIRS on OSIRIS-REx, a point spectrometer with a cryocooled HgCdTe focal plane array for broadband (1 to 4 micron) measurements. The instrument will achieve sufficient SNR (>100) and spectral resolution (</= 10 nm @ 3 microns) through the use of a Linear Variable Filter to characterize and distinguish spectral features associated with water. An adjustable field stop allows as to change the footprint dimensions by an order of magnitude, to adjust for variations in altitude and/or incoming signal. The compact and efficient AIM microcryocooler/IRIS controller is designed to maintain the detector temperature below 115K. In order to maintain the cold temperature (<220 K) of the optical system (all aluminum construction to minimize varying temperature induced distortion), a special radiator is dedicated to optics alone.

Mission Design: Science data-taking with the BIRCHES payload will occur primarily during the science orbit (100 km x 5000 km, equatorial periapsis, nearly polar), highly elliptical, with a repeating coverage pattern that provides overlapping coverage at different lunations. Science orbit data-taking will last approximately 6 months, 6 lunar cycles, allowing for sufficient collection of systematic measurements as a function of time of day to allow derivation of volatile cycle models.

Development Status: All subsystems except the payload will have been delivered by late March. BIRCHES will complete operational environmental testing by the end of April, to be delivered in early May. Spacecraft integration will occur throughout April, May, and June, with final operational environmental testing to be completed in mid-July.

References: [1] Clark P.E. et al. (2017) SPIE Proceedings 9978, 99780C, doi:10.1117/12.2238332.