The Lunar Ice Cube Mission. P. E. Clark[1], Ben Malphrus[2], Dennis Reuter[3], Robert MacDowall[3], Dennis Reuter[3], Robert MacDowall[3], David Folta[3], Avi Mandell[3], Cliff Brambora[3], Deepak Patel[3], William Farrell[3], Noah Petro[3], Stuart Banks[3], Kurt Hohma4[3], V. Hruby[4], [1]Jet Propulsion Laboratory, California Institute of Technology (pamela.e.clark@jpl.nasa.gov), [2]Morehead State University, [3]NASA/GSFC, [4]Busek.

Lunar Ice Cube, a science requirements-driven deep space exploration 6U cubesat mission, has just been selected for the NASA NextSTEP slot on the EM1 launch. We are developing a compact 'workhorse' instrument for this high priority science application. We focus on lunar exploration because of the Moon's accessibility as a stepping stone to the rest of the solar system, combined with its suitability as an analog with extreme range of conditions and thus an ideal technology testbed for much of the solar system. The recent announcement of opportunities to propose to fly one of 11 cubesats on EM1 has generated a plethora of proposals for 'lunar cubes'.

Over the course of this year, we have conducted the equivalent of a pre-phase A study for a lunar orbital mission with a focus on the payload instrument. Subsystems include state of the art cubesat attitude control, propulsion (for transportation from GEO, GTO or Earth escape to lunar capture), communication, power, thermal and radiation protection systems providing lunar orbital operation of a cubesat bus. Based on this work, we have concluded that a 6U bus with state of the art cubesat systems already available or now being built and tested can support a high priority science orbiter in cislunar space. Particular challenges for lunar cubesats are remote communication, navigation and tracking, thermal and radiation protection in a volume, power, and bandwidth constrained environment.

Despite the fact that 6U deep space capable cubesat buses and deployers are now available, the development of CubeSat instruments capable of providing focused, high priority science, so critical to achieving the potential for low cost planetary exploration promised by the CubeSat paradigm, lags behind. A major challenge is the development of compact yet sufficiently robust and sensitive versions of successful instruments in a 'funding starved' environment. In response to both of these challenges, we are developing BIRCHES, Broadband InfraRed Compact, High-resolution Exploration Spectrometer, a miniaturized version of OVIRS on OSIRIS-REx. BIRCHES is a compact (1.5U, 2 kg, <5W) point spectrometer with a compact cryocooled HgCdTe detector for broadband (1 to 4 micron) measurements at sufficient resolution (10 nm) to characterize and distinguish important volatiles (water, H_2S, NH_3, CO_2, CH_4, OH, organics) and mineral bands. It has built-in flexibility, using an adjustable 4-sided iris, to maintain the same spot size regardless of variations in altitude (by up to a factor of 5) or to vary spot size at a given altitude, as the application requires.