LUNAR BEAGLE: A SCIENCE PACKAGE FOR MEASURING POLAR ICE AND VOLATILES ON MOON. E.K. Gibson[1], C.T. Pillinger[2], D.S. McKay[1], I.P. Wright[2], M.R. Sims[3], L. Richter[4], L. Waugh[5] and the Lunar Beagle Consortium. [1]KR, ARES, NASA Johnson Space Center, Houston, TX 77058. [2]Planetary and Space Sciences Research Institute, The Open University, Milton Keynes MK7 6AA, UK. [3]Dept. of Space Sciences, Leicester University, Leicester, UK. [4]Institute for Space Sciences, DLR, Bremen, Germany. [5]EADS-Astrium, Stevenage, UK. [everett.k.gibson@nasa.gov].

The Beagle 2 science package developed to seek the signatures of life on Mars is the ideal payload to use on the lunar surface for determining the nature of hydrogen, water and lunar volatiles found in the polar regions [1]. It can support the Space Exploration and Constellation Programs. The Beagle 2 scientific package has been selected by NASA for the Lunar Science Sortie Opportunity (LSSO) Concept Study. The Lunar Beagle package is envisioned as a separate payload on a lunar surface lander, or deployed by an astronaut, or carried by a lunar rover.

The Beagle system is analogous to the ALSEP instruments used on the Apollo missions [2]. It could operate with minimal human interaction or completely autonomously after deployment on the lunar surface.. The adaptation for sortie missions of scientific payloads developed for other planetary missions, such as the Beagle 2 science payload, has the major advantage of having already established engineering requirements, mass, power, data transmission rates, and costs [1]. A lunar modification of Beagle 2 should require decreased system overhead because of the elimination of the entry aeroshell, the vacuum system and possibly other components already budgeted for elsewhere in the carrier mission(s).

The Beagle 2 payload consisting of the Gas Analysis Package, Sample Acquisition System with subsurface sampling device, the mole, suite of scientific instruments (i.e. XRF, Mossbauer, cameras and spectrometers, power supply), was designed to operate on the Martian surface in a completely autonomous manner [1]. The key instrument is a magnetic sector mass spectrometer to analyze volatile species H, D/H, water abundances and other potential carbon and nitrogen containing molecules [3,4] trapped in cold regions of the moon. The Gas Analysis Package (GAP) combined a number a number of mass spectrometric functions including static and dynamic operation. It was the first instrument with a full chance of documenting *in situ* isotopic signatures in the soil and rock record.

Best of all, the Beagle instrument package has already been designed, built, extensively tested in the laboratory, and flight qualified for the mission to Mars. Extensive testing already done on Earth demonstrate its sensitivity, precision and other operational parameters. The primary Beagle 2 sampling device (mole) can obtain subsurface samples as deep as two meters and would be ideal for seeking out subsurface ices [1] and implanting subsurface geophysical science instruments. The mole is envisioned to operate in two modes: (a) a subsurface sample collection device for obtaining samples for the Sample Handling and Processing Device prior to introduction into the furnaces connected to the mass spectrometer. and (b) emplacement of subsurface sensors such as seismic, heat flow, thermal conductivity and water detection; a variety of subsystems such as an onboard ion trap mass spectrometer are available for the instrumented mole. New power supply concepts are being investigated which may offer alternatives [5] and allow lunar night operations.

The Beagle payload is the ideal suite of instruments which are at a high degree of technology readiness for answering the critical questions about volatiles in permanently shadowed regions of the moon, including lunar transient environments and potential contamination of the lunar environment by human development on the moon.

References:

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