LUNAR BEAGLE: THE SCIENTIFIC PACKAGE FOR ANSWERING IMPORTANT QUESTIONS ABOUT LUNAR WATER AND POLAR VOLATILES. E.K. Gibson[1], C.T. Pillinger[2], L. Waugh[3], I.P. Wright[2], M.R. Sims[4], D.S. McKay[1], and L. Richter[5]. [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]EADS Astrium, Stevenage, UK, [4]Dept. of Space Sciences, Leciester University, Leicester, UK and [5]Deutsches Zentrum fur Luft- und Raumfarht, DLR Cologne, Germany. [everett.k.gibson@nasa.gov].

The Lunar Beagle package 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 of the Moon.

The Lunar Beagle payload can operate with minimal human interaction or completely autonomously on the lunar surface. This system is analogous to the ALSEP instruments used on the Apollo missions. The adaptation of scientific payloads developed for other planetary missions, such as those of Beagle 2, has the major advantage of having already established resource requirements, including mass, power and data transmission capabilities and cost.

The Beagle 2 payload was designed to operate on the Martian surface in an autonomous manner. It can be easily adapted to operate autonomously on the lunar surface and is suitable for both a robotic lander or a human mission. In a human mission, once deployed on the surface, Lunar Beagle would require minimal crew interaction and could send data directly back to Earth without further crew attention. Its size allows for inclusion with a lunar rover mission. Key instruments include a magnetic sector mass spectrometer to analyze volatile species [H, D/H, water abundances and other potential carbon containing molecules (i.e., hydrocarbons?)] trapped in cold regions of the moon, instruments for assessing elemental composition of the lunar soils and rocks, and a range of spectrometers capable of fully determining rock and soil mineralogy.

The Gas Analysis Package (GAP) instrument suite was the most sophisticated mass spectrometer ever sent to Mars, and the first with a real chance of documenting isotopic biosignatures in the soil and rock record. Application of the Beagle technology to answer the lunar hydrogen and H_2O question seems obvious. Measurement of the isotopic composition of polar volatiles will distinguish whether the water and associated volatiles are derived from cometary volatiles, the solar wind, a magmatic source and/or meteoritic. The presence of a lunar vacuum will significantly reduce the mass and power requirements for the GAP and simplify its design and operation, compared to the baseline Martian design that includes a vacuum pump.

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. Extensively testing already done on Earth can be used for evaluation of the Beagle concept applied to the Moon.

The instrumentation onboard the Lunar Beagle with its Gas Analysis package (GAP) and Position Adjustable Workstation (PAW) sampling arm can provide science answers (i.e. *in situ* noble gas ages) and document potential lunar resources. The primary Beagle sampling device (MOLE) can obtain subsurface samples and would be ideal for seeking out subsurface ices. The GAP can provide information on hydrogen abundances in the lunar polar regions, possible ice concentrations beneath the surface, and provide direct abundances and isotopic measurements of any trapped meteoroid or cometary volatiles in the permanently shadowed regions. Hydrogen isotopic compositions will assist in the identification of its origin (i.e. solar wind or cometary). These measurements will provide keystone data points which can be utilized in answering the lunar availability question and assist in planning for "living off the land concepts".