LEMS: LUNAR ENVIRONMENT MONITORING STATION. C. A. Malespin[1], M. Benna[1,2], E. Raaen[1], M. Sarantos[1], N. C. Schmerr[3], L. Dai[4], and Z. Zhao[4], [1]NASA Goddard Space Flight Center, Greenbelt, MD, mehdi.benna@nasa.gov, [2]University of Maryland Baltimore County, Baltimore, MD, [3]University of Maryland College Park, College Park, MD, [4]Arizona State University, Tempe, AZ.

Introduction: The Lunar Environment Monitoring Station (LEMS) is an instrument concept funded by NASA's Development of Advanced Lunar Instrumentation Program, and undergoing maturation at the Goddard Space Flight Center's Planetary Environment Laboratory (PEL).

LEMS is a compact, autonomous, and self-sustaining instrument package that will enable the long-term, in-situ, monitoring of the lunar exosphere. The Station will be capable of collecting daily in-situ measurements of exospheric composition for a nominal duration of 2 years from its deployment on the surface of the Moon. Additionally, the instrument package will accommodate a miniature seismometer that will be capable of continuously monitoring the Moon's seismic activities in order to constrain the structure of the lunar interior. At the end of its development, LEMS will be a flight-ready, opportunistic investigation that can be deployed as a secondary payload from manned or robotic, commercial or scientific missions. Once delivered and deployed on the lunar surface, LEMS will require no additional support from the primary mission.

Science Imperatives: The planetary community has recognized that solar system exploration must fill gaps in our knowledge concerning surface boundary exospheres, the most commonly found type of atmosphere in the solar system (surrounding e.g., asteroids, Mercury, and numerous moons). Likewise, planetary interiors remain largely unexplored, and seismology from Apollo gave us our first glimpse of the inner workings of the Moon. At the Moon, these tasks are of higher priority in light of the imminent restart of manned and unmanned lunar exploration for both scientific and commercial purposes.

For the exosphere, this renewed era of lunar exploration has the potential of overwhelming the natural environment of the Moon and displacing the balance of various reservoirs of volatiles. New long-lived seismic stations will advance Decadal science priorities while establishing hazards to future exploration missions. A strategy of long-term in-situ monitoring of the lunar exosphere is important for our understanding of the dynamics of surface boundary exospheres in general, and for determining the response of the lunar environment at various time scales to injections of exotic materials from natural or manmade events. This in-situ, long-term approach readily lends itself to concurrently monitoring the seismicity of the Moon as well.

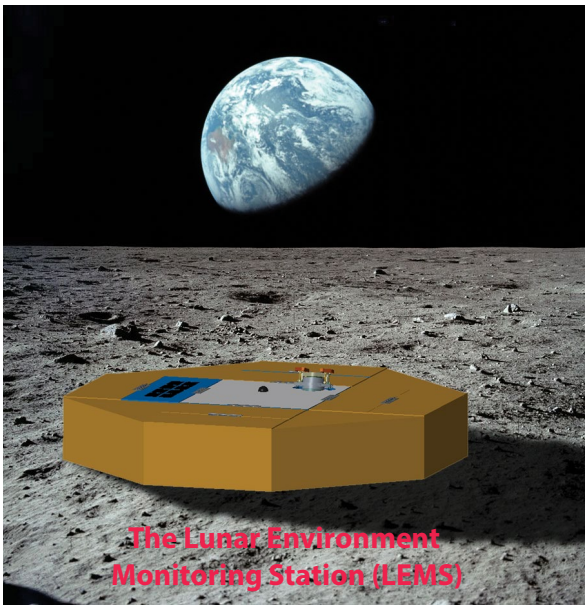

Figure 1: The LEMS instrument will enable comprehensive and continuous measurements of the exosphere and its interaction with the space environment, surface and interior of the Moon.

Instrument Description: The LEMS station is comprised of three main elements: a Quadrupole Mass Spectrometer (QMS), a Molecular Electronic Transducer (MET) seismometer, and the Platform that provides power, thermal, and communication resources to the two sensors.

The QMS and its driving electronics are identical in heritage and design to those of LADEE/NMS [1] and MAVEN/NGIMS [2]. The MET sensor, developed at Arizona State University, is based on a novel electrochemical cell that senses the movement of a liquid electrolyte between electrodes [3]. The architecture of the Platform leverages substantial GSFC investments in smallsat/cubesat subsystems that can be easily modifiable for a variety of architectures and mission requirements.

References: [1] Mahaffy P. M. et al. (2014) *SSR, 185,* 27–61. [2] Mahaffy P. M. et al. (2015) *SSR, 195,* 4073. [3] Huang H. et al. (2013) *Sensors 2013, 13,* 4581–4597.