Lunar Roving Prospector: A Long Duration Explorer. M.S. Robinson[1,2], S.J. Lawrence[1], E.J. Speyerer[1], T. Tran[1], D. Wettergreen[3], E.A. Cloutis[4], H.E. Spence[5], K. Klaus[6]. [1]Arizona State Univ., Tempe AZ, [2]robinson@ser.asu.edu, [3]Carnegie Mellon Univ., Pittsburgh PA, [4]Univ. Winnipeg, Winnipeg MB CA, [5]Univ. New Hampshire, Durham, NH, [6]The Boeing Company, 13100 Space Center Blvd., Houston TX, 77059.

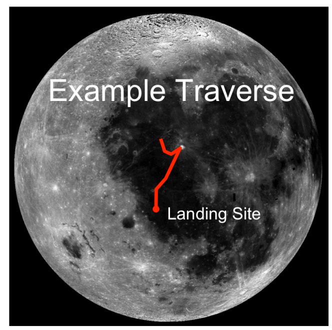
Introduction: As NASA plans for future human exploration beyond low-earth orbit, critical information is needed from the Moon. LRO and LCROSS were designed to provide key information about potential landing sites and resources. However, these missions cannot provide all information about the lunar surface needed to support human exploration. We propose a dedicated Lunar Roving Prospector (**LRP**) to provide ground truth for orbital remote sensing, collect essential measurements to address key scientific and exploration questions, and demonstrate technology required for future human exploration of the Moon.

Objectives: LRP provides a robust, capable platform that travels over 1,000 km during two Earth years, providing information to enable future human exploration. Key goals of the mission include:

- Detect, assay, and map potential resources (identifying and quantifying ISRU potential)
- Provide ground truth for orbital datasets thus improving models and extending results globally
- Determine the nature of regolith structure and its mechanical properties
- Quantify the nature of dust, its environments, and its interactions with systems/humans and demonstrate dust mitigation strategies and technologies
- Measure radiation (primary and secondary) hazards to future human explorers
- Demonstrate precision landing, autonomous navigation, teleoperations, dust mitigation, sampling, and long-duration operations

Mission Concept and Capabilities: LRP will investigate over twenty major (and hundreds of minor) sites. The rover will conduct most measurements during the two Earth weeks of sunlight per lunar cycle, with limited operations during the lunar night. LRP is powered using a Stirling radioisotope generator (SRG) and solar arrays. LRP will travel between exploration sites using supervisory teleoperation and autonomous navigation as needed in context. Its sustained speed of up to 2 km/h (Sojourner 0.0036 km/h, MER 0.036-0.1 km/h, MSL 0.37 km/h) enables it to cover large distances between exploration locations. Furthermore, in order for robots to serve as adjuncts in future human exploration activities, they must move at a human pace.

Any human or robotic interaction with the lunar surface involves the regolith, thus a comprehensive understanding of the regolith is required to facilitate both human and robotic exploration of the Moon. A robotic precursor must characterize the composition and structure of the lunar regolith to provide foresight for future lunar exploration endeavors. LRP instrumentation will determine major mineral abundances and major elemental chemistry, including a key measurement of the presence of OH^-. In addition, instrumentation will enable the measurement of the regolith grain size and morphology at the mm scale. LRP can determine regolith thickness and identify any discontinuities at depth using a sounder and from images of craters. In addition to measuring the regolith structure and composition, onboard instrumentation will characterize variations in magnetic fields and measure background and secondary radiation.



With a range of 1,000 km, a series of high-priority targets for human exploration can be reached in a single mission. One high value traverse initiates in southern Oceanus Procellarum, travels north through regions of unexplained albedo, color, and magnetic anomalies, and a full range of lunar volcanic types and ages and crosses four Constellation regions of interest (Reiner Gamma, Marius Hills, Aristarchus 1 and 2). The two Aristarchus sites provide rich ISRU potential. This traverse is highly complementary to both ESMD and SMD objectives. Many other traverses, including polar, are possible.

Rovers offer many operational advantages over static landers. LRP offers flexibility and the capability to perform wide-scale prospecting that characterize resources over hundreds of square kilometers. Mobility allows assessment of *grade and tonnage* of an ore body – essential information for planning ISRU. The success of a static lander is heavily dependent upon meter scale geology of a landing site. If the resource under assay is not present at the chosen landing site (perhaps only 10 meters away from the target), then the mission fails to meet its primary objectives.

Participatory Exploration: The proposed LRP has outstanding opportunities for immersive public engagement with both passive (live high-definition video streams, 3-D surface panoramas, and daily views of Earth) and participatory (remote rover driving and imaging, collective data analysis, and communication via social media) participation throughout the two-year nominal mission. LRP operations and data analysis will also contribute to developing NASA's future workforce (undergraduates, graduates, and postdocs).