

UPDATE ON THE SCIENTIFIC CHARACTERIZATION OF LUNAR REGIONS OF INTEREST. S.C. Mest^{1,2}, A.R. Dworzanczyk³, A. Calzada-Diaz⁴, J.E. Bleacher², N.E. Petro², and R.A. Yingst¹, ¹Planetary Science Institute, 1700 E. Ft. Lowell, Suite 106, Tucson, AZ 85719-2395 (mest@psi.edu); ²Planetary Geodynamics Laboratory, Code 698, NASA GSFC, Greenbelt, MD 20771, ³Regis High School, 55 E 84th Street, New York, NY 10028, ⁴International Space University, Illkirch-Graffenstaden, France.

Introduction: NASA's Constellation Program Office (CxPO) has identified 50 Regions of Interest (ROIs) that represent scientifically high-value locations in preparation for our eventual return to the Moon [1] either by astronauts or robots. These ROIs are geologically diverse and spatially distributed, thus allowing each site to address a variety of scientific goals and objectives, such as those described by LEAG [2]. While the value of these ROIs relative to one another is a critical component, such as for landing site selection, detailed analyses of these sites have not been conducted in a comprehensive way that utilizes all available data or at the landing site scale.

In order to select an "ideal" landing site, preliminary detailed characterization of the surface properties of potential sites must be conducted. Analyses at this scale that incorporate geologic mapping, traverses, and evaluation of each ROI's scientific "value" (e.g., their potential for scientific return) have not been conducted since Apollo, and are necessary to accurately assess any potential landing site for the next series of human or robotic missions to the Moon. Here we present new LASER-funded work to evaluate the 50 ROIs.

Methodology: We have begun evaluating 7 of the 50 ROIs (Table 1) using a variety of LRO, Chandrayaan-1, Kaguya, Clementine, Apollo and Lunar Orbiter data to (1) characterize the geology, topography and surface morphology of each ROI and examine the spatial and temporal variability of geologic processes within a 40x40 km area around each ROI, and (2) assess the relative scientific "value" of each ROI with respect to their ability to address key scientific objectives identified by the lunar science and exploration community [2,3]. The relative scientific value of each ROI is to be evaluated by constructing hypothetical traverses within the area defined by CxPO up to distances of 5, 10 and 20 km from the ROI location, and estimating the scientific return using the results from mapping. ESRI ArcMap Geographical Information System (GIS) software is being used to compile the datasets, and generate maps

Table 1. Five ROIs currently being studied.

| Region of Interest | LAT | LON |
|--------------------|-------|--------|
| Apollo 15 | 26.1 | 3.7 |
| Aristarchus 1 | 24.6 | -49.0 |
| Copernicus | 9.5 | -18.9 |
| Mare Moscoviense | 26.2 | 150.5 |
| North Pole | 89.6 | 76.2 |
| Orientele 1 | -26.2 | -95.4 |
| South Pole | -89.3 | -130.0 |

ROI Characterization:

Morphologic: Each ROI is being characterized using images and topography to identify and map structures (crater rims, ridges, faults, etc.), analyze surface morphologies and characterize geologic units, identify geologic contacts, and determine stratigraphic relationships. Geologic mapping and surface analyses are based primarily on LRO LROC (~50 cm/pixel), Kaguya Multi-band Imager (~20 m/pixel), Clementine UVVIS 750 nm (100-325 m/pixel) and HIRES (7-20 m/pixel) images, Lunar Orbiter IV and V images (~100 m/pixel), and Apollo MappingCam, Pancam, and Hasselblad images. In addition, we are using the most up-to-date lunar topographic data – LRO LOLA DEM (128 pixels/degree) and individual tracks – to characterize the topographic expression of the surface.

Spectral: We are utilizing currently released M³ data, as well as Clementine UVVIS and NIR global mosaics (~100 m/pixel; 70°N and 70°S) to characterize surface materials at most of the 50 ROIs.

Digital Geologic Mapping: Geologic mapping of the lunar surface at the ROI-scale is important because it allows complex surfaces to be characterized based upon physical attributes, thereby allowing discrete material units to be defined. The distributions of these units are then mapped in order to identify the relative roles of impact cratering, volcanic, tectonic and gradational processes in shaping their surfaces.

ROI Traverse Development: For this research, hypothetical traverses from each ROI are being developed. Plotting the traverses is based primarily on the geologic assessment, that is, a traverse will be developed so that it maximizes its ability to observe and/or sample as many of the geologically significant features, units, etc. within an ROI area as possible. We are limiting our area of exploration to the maximum 40x40 km area identified by Cx [1], which is ultimately limited by current lunar exploration architecture.

References: [1] Gruener, J.E. and B.K. Joosten (2009) LRO Science Targeting Meeting, Abs. #6036. [2] LEAG (2009) *The Lunar Exploration Roadmap*, LPI. [3] NRC (2007) *The Scientific Context for Exploration of the Moon*, 121 pp.