UPDATE ON THE SCIENTIFIC CHARACTERIZATION OF LUNAR REGIONS OF INTEREST. S.C. Mest[1,2], A. Calzada-Diaz[3], J.E. Bleacher[2], N.E. Petro[2], and R.A. Yingst[1], [1]Planetary Science Institute, 1700 E. Ft. Lowell, Suite 106, Tucson, AZ 85719-2395 (mest@psi.edu); [2]Planetary Geodynamics Laboratory, Code 698, NASA GSFC, Greenbelt, MD 20771, [3]Department of Geology, University of Oviedo, Spain.

Introduction: NASA's Constellation Program Office (CxPO) identified 50 Regions of Interest (ROIs) that represent scientifically high-value locations in preparation for our eventual return to the Moon [1] 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] and the NRC [3]. 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.

Methodology: We have begun evaluating the 50 ROIs (Table 1) [4-6] 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 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 (v. 10.1) is being used to compile the datasets, and generate maps

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

Table 1. Sample of ROIs being studied.

Region of Interest	LAT	LON
Apollo 15 [5]	26.1	3.7
Aristarchus 1	24.6	-49.0
Copernicus [5]	9.5	-18.9
Mare Moscoviense [6]	26.2	150.5
North Pole	89.6	76.2
Orientale 1	-26.2	-95.4
South Pole	-89.3	-130.0

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 M^3 data, as well as Clementine UVVIS and NIR global mosaics (~100 m/pixel; 70ºN and 70ºS) 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 study, 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.

Evaluation of Scientific Objectives: We are using a simple method of evaluating the scientific "value" of a site by ranking each geology-related scientific objective identified by the lunar science and exploration community [2,3] on a scale of 0 to 3 for traverse distances of 5, 10 and 20 km from the ROI site. The ranking relates to the degree to which exploration via traverse could support each subgoal (0 = does not support; 1 = might support; 2 = somewhat supports; 3 = provides most support) at that scale; the results of these rankings are totaled and plotted versus traverse distance from the landing site. Based on this exercise, we expect that, in general, within a limited range of the landing site (10 km), some science can be conducted to support the science goals, whereas extended traverses (40 km) could support significantly more of the science goals. Naturally, as one has the opportunity to collect more samples, gather more data, and increase the amount of terrain studied, the amount of knowledge gained greatly increases; however, it is not clear if more frequent and shorter range sorties are more valuable than less frequent longer range sorties. This simple scheme is the first order type of analysis that is being applied to each ROI. Based on the results from the traverse development and evaluation of LEAG objectives, we will assess this scheme to determine its relevance with regards to observations made via mapping.

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, 121pp. [4] Mest, S.C. et al. (2011) 42nd LPSC, Abs. **#2508**. [5] Dworzanczyk, A.R. and S.C. Mest (2012) 43rd LPSC, Abs. **#2345**. [6] Calzada-Diaz, A. and S.C. Mest (2013) Abs. **#1275**, submitted to 44th LPSC.

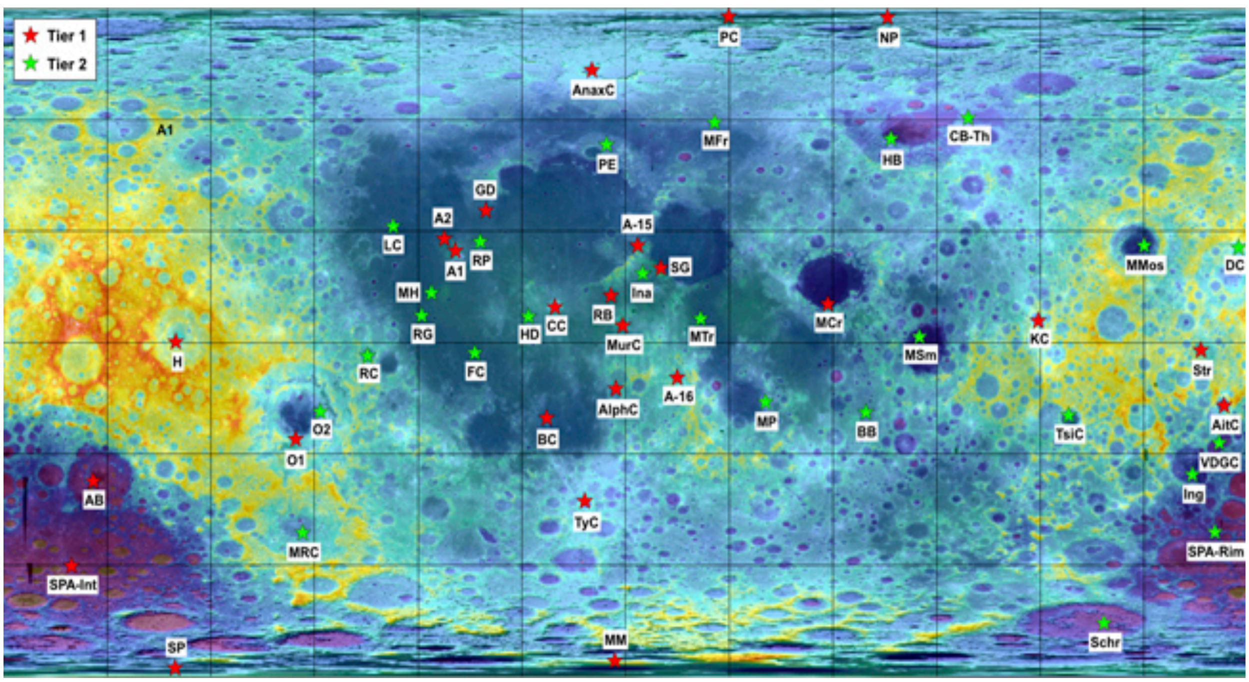

Figure 1. LOLA DEM (128 pixels/degree) over LRO WAC mosaic showing CxPO Tier 1 (red stars) and 2 (green stars) ROIs. Symbols are: NP = North Pole; PC = Peary Crater; AnaxC = Anaxagoras Crater; CB-Th = Compton/Belkovich Th Anomaly; MFr = Mare Frigoris; HB = Humboldtianum Basin; PE = Plato Ejecta; GD = Gruithuisen Domes; LC = Lichtenberg Crater; A1 = Aristarchus 1; A2 = Aristarchus 2; RP = Rimae Prinz; A-15 = Apollo 15; MMos = Mare Moscoviense; DC = Dante Crater; SG = Sulpicius Gallus; Ina = Ina ('D caldera'); MH = Marius Hills; RB = Rima Bode; MCr = Mare Crisium; CC = Copernicus Crater; RG = Reiner Gamma; HD = Hortensius Domes; MurC = Murchison Crater; MTr = Mare Tranquillitatis; KC = King Crater; MSm = Mare Smythii; H = Hertzsprung; RC = Riccioli Crater; FC = Flamsteed Crater; Str = Stratton; A-16 = Apollo 16; AlphC = Alphonsus Crater; MP = Montes Pyrenaeus; AitC = Aitken Crater; BB = Balmer Basin; TsiC = Tsiolkovskiy Crater; BC = Bullialdus Crater; O1 = Orientale 1; O2 = Orientale 2; VDGC = Van De Graaf Crater; Ing = Ingenii; AB = Apollo Basin; TyC = Tycho Crater; MRC = Mendel-Rydberg Cryptomare; SPA-Rim = South Pole-Aitken Rim; SPA-Int = South Pole-Aitken Interior; MM = Malapert Massif; Schr = Schrodinger; SP = South Pole. Projection is Plate Carrée.