RESULTS FROM SCIENTIFIC CHARACTERIZATION AND TRAVERSE DEVELOPMENT OF THE APOLLO 15 AND COPERNICUS CRATER REGIONS OF INTEREST. A.R. Dworzanczyk[1] and S.C. Mest[2,3], [1]Regis High School, 55 E 84th Street, New York, NY 10028 (renatadw@optonline.net); [2]Planetary Science Institute, 1700 E. Ft. Lowell, Suite 106, Tucson, AZ 85719-2395 (mest@psi.edu); [3]Planetary Geodynamics Laboratory, Code 698, NASA GSFC, Greenbelt, MD 20771.

Introduction: In 2009, NASA's Constellation Program Office identified 50 Regions of Interest (ROIs) on the Moon that represent the types of locations future landed missions might go [1]. Detailed analysis of the 50 ROIs is important. Identifying the location of the first landed mission to the Moon in over 35 years will require consideration of safety and engineering constraints, as well as maximizing the scientific return. In order to select an "ideal" landing site, preliminary detailed characterization of the surface properties of potential sites must be conducted. Analyses like that presented here – incorporating 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 two ROIs – Apollo 15 and Copernicus crater.

Methodology: We have begun evaluating 2 of the 50 ROIs (Table 1) using a variety of Lunar Reconnaissance Orbiter, Chandrayaan-1, 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 [3,4]. The relative scientific value of each ROI is be evaluated by constructing hypothetical traverses within the area defined by Constellation 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. Two ROIs Studied

Location	**Latitude**	**Longitude**
Apollo 15	26.1	3.7
Copernicus crater	9.5	-18.9

ROI Characterization:

Morphologic Characterization: The geology, topography, and surface morphology around each ROI are being characterized by (a) image and multispectral analyses leading to (b) production of geologic and geomorphic maps of the ROI, which constitutes a 40x40 km area, (c) analysis of stratigraphic and cross cutting relationships, and (d) calculation of impact crater size-frequency distributions for geologic units and determination of unit ages.

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 lunar topographic data – LRO LOLA DEM (128 pixels/degree) and individual tracks – to characterize the topography of the surface.

Digital Geologic Mapping: Geologic mapping is an important tool used to understand the evolution of planetary surfaces [e.g., 5-9], the goal of which is to place surface features into stratigraphic context in order to develop a sequence of events for the evolution of a surface [5]. Mapping 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, along with visible structural features, in order to identify the relative roles of impact cratering, volcanic, tectonic and gradational processes in shaping the surface.

Spectral Characterization: We are utilizing currently released M3 data, as well as Clementine UVVIS and NIR global mosaics (~100 m/pixel; 70ºN and 70ºS) to assist in characterizing the surface materials at most of the 50 ROIs.

ROI Traverse Development: The relative scientific values of each ROI are being assessed by (a) developing hypothetical traverses of each site for distances of 5, 10, and 20 km from the ROI center, and (b) evaluating the scientific goals that could be addressed by astronauts both along the traverses and within the ROI area as a whole. For this research, hypothetical traverses for each ROI are developed based primarily on the geologic assessment, that is, a traverse is 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 Constellation [1], which is ultimately limited by current lunar exploration architecture.

Results:

Geologic Characterization: The Apollo 15 ROI (Fig. 1) is located along the edge of Mare Imbrium near the Apennine mountain range. Mapping this site shows the ROI is occupied largely by volcanic plains with exposures of highland materials, which are likely remnants of the Imbrium basin rim. The Copernicus ROI (Fig. 2) is centered on the floor of Copernicus crater just north of the crater's central peak; Copernicus crater is located in eastern Oceanus Procellarum and is estimated to be ~800 million years old. Mapping has identified several units within the ROI zone that exhibit various textures (smooth, knobby, rough) that likely consist of impact melt materials.

Traverse Development: Traverse development in the Apollo 15 ROI focused on exploration of Hadley Rille and other potentially volcanic features in the vicinity, and on the actual Apollo 15 landing site. Traverse Development in the Copernicus Crater ROI focused on the different types of crater floor material (which varies in iron content) and on the central peak and its potential for uplifted lunar material. Each traverse was plotted to maximize visits to large craters, so as to sample the various geological strata.

References: [1] Gruener, J.E. and B.K. Joosten (2009) LRO Science Targeting Meeting, Abs. **#6036**. [2] Mest et al. (2011) 42nd LPSC, Abs. **#2508**. [3] LEAG (2009) The Lunar Exploration Roadmap, LPI. [4] NRC (2007) The Scientific Context for Exploration of the Moon, 121pp. [5] Carr et al. (1976) Stratigraphy and Structural Geology, in A Geological Basis for Exploration of the Planets, NASA SP-417, 13-32. [6] Carr et al. (1984) The Geology of the Terrestrial Planets, NASA SP-469, 317pp. [7] Greeley, R. and M.H. Carr (1976) A Geological Basis for Exploration of the Planets, NASA SP-417. [8] Wilhelms, D.E. (1987) The Geologic History of the Moon, U.S.G.S. Prof. Paper 1348, 302pp. [9] Wilhelms, D.E. (1990) *Geologic Mapping*, in Planetary Mapping, 208-260.

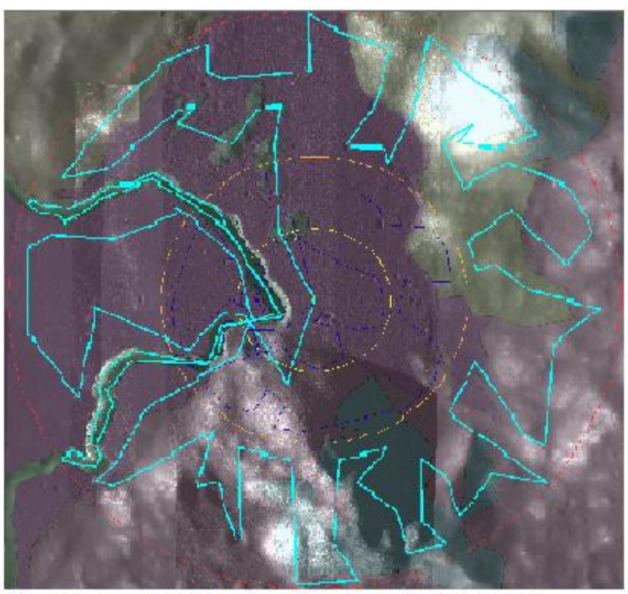

Figure 1. Apollo 15 Landing Site with largest traverse highlighted and topographic features color-coded.

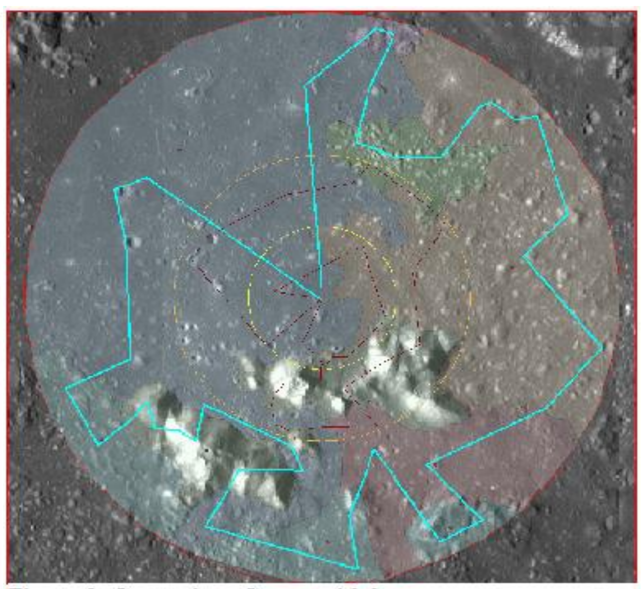

Figure 2. Copernicus Crater with longest traverse highlighted and topographic features color-coded