INTEGRATING LROC-NAC, LOLA, AND LROC-WAC DERIVED ILLUMINATION MOSAIC FOR PRELIMINARY NORTH POLE ROVER MISSION PLANNING.

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Introduction: The purpose of this work will be to describe a methodology for using recently acquired Lunar Reconnaissance Orbiter data sets to identify potential rover driving routes from high-illumination regions on the rim of Peary/Whipple crater to candidate small, low-illumination craters on the floor of Peary. This preliminary work will be utilized to derive baseline design requirements for a rover to perform a traverse over the identified terrain. Mission planning will include very short duration sorties to collect samples from within permanently shadowed areas of small craters on the floor of Peary.

Method: The authors have utilized a variety of software tools for data manipulation, analysis, and visualization including MATLAB, USGS ISIS, and ASU's JMARS for Earth's Moon. The three primary data sets utilized are the polar stereographic LROC-WAC illumination mosaic, the LROC-NAC North Pole mosaic, and gridded LRO LOLA topography data. Individual LROC-NAC images can be projected as necessary to provide context in areas that appear as poorly illuminated in the NAC mosaic. Candidate locations are identified based on proximity to terrain elements identified previously (specifically high-illumination ridges and small, low-illumination craters). For the purposes of this document the authors have focused primarily on the areas of the North Polar Region that appear to be best illuminated, the northeastern and southwestern rims of Whipple crater. Candidate low-illumination craters are typically in the range of 200 to 1000 meters in diameter and are identified from the LROC-WAC derived illumination mosaic.

Preliminary results: Initial analysis indicates that there are two approaches of note for generating baseline rover design requirements (see figure 1). The first involves a relatively short, approximately 8 kilometer descent from the northeastern rim of Whipple to a candidate small crater on the floor of Peary. The peak slope along this route is approximately 22°, with average slopes in the vicinity of 15°. After the initial 8 km descent to the first candidate crater there are four identifiable candidate craters within 5 km and over twenty within 10 km. Changes in elevation are minimal after the initial 8 km descent.

The second approach begins at the southwestern rim of Whipple crater and proceeds down the southern slope. Peak slopes along this route are about 15°, with average slopes of less than 10°. While this route is significantly longer, taking 30 km to reach the floor of Peary, there are six identifiable candidate craters near the route, the first at about 5 km distance.

Conclusions and future work: The approaches identified appear to be possible considering the capabilities of previous and proposed lunar rovers[1]. A variety of areas have been identified for further refinement including temporal simulation of illumination conditions to optimize for routes and schedules with best availability of solar power, estimation of surface properties along proposed routes, investigation of candidate crater illumination at superior resolutions using LROC-NAC data, and integration with data on the potential presence of water ice from the mini-RF instrument.

References: [1] Kring D. A. (2006) *Lunar Mobility Review*, Lunar Exploration Initiative.

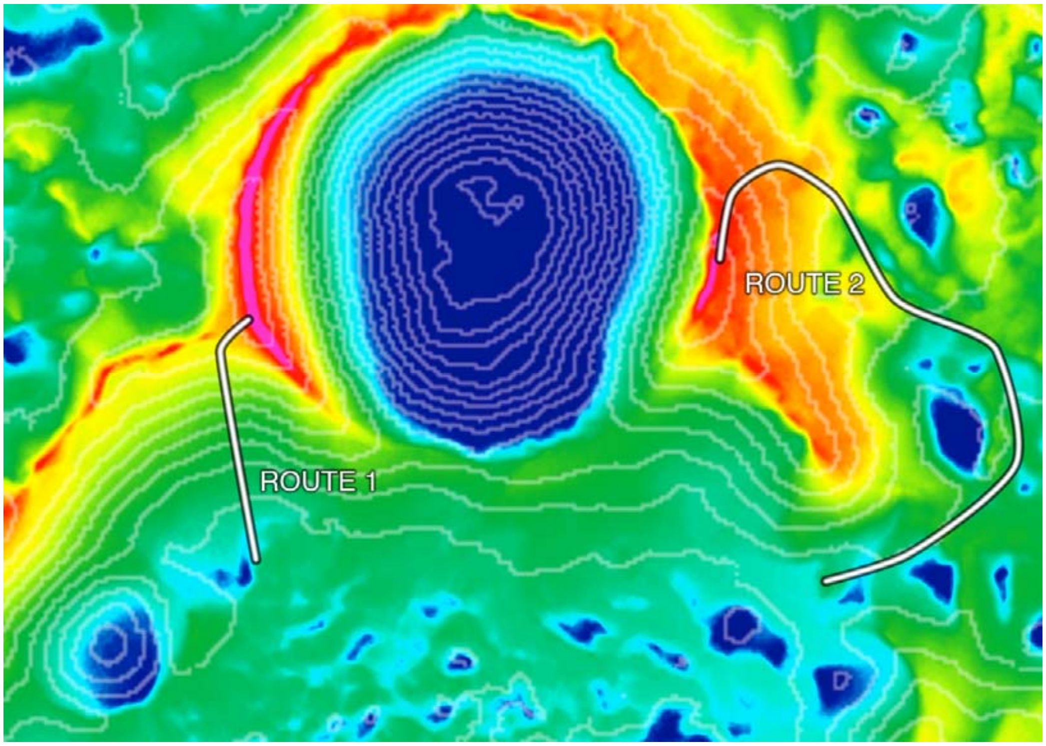

Figure 1: LOLA contour lines are at 200 meter spacing, illumination map is polar stereographic projected LROC WAC illumination map by NASA/GSFC/Arizona State University.

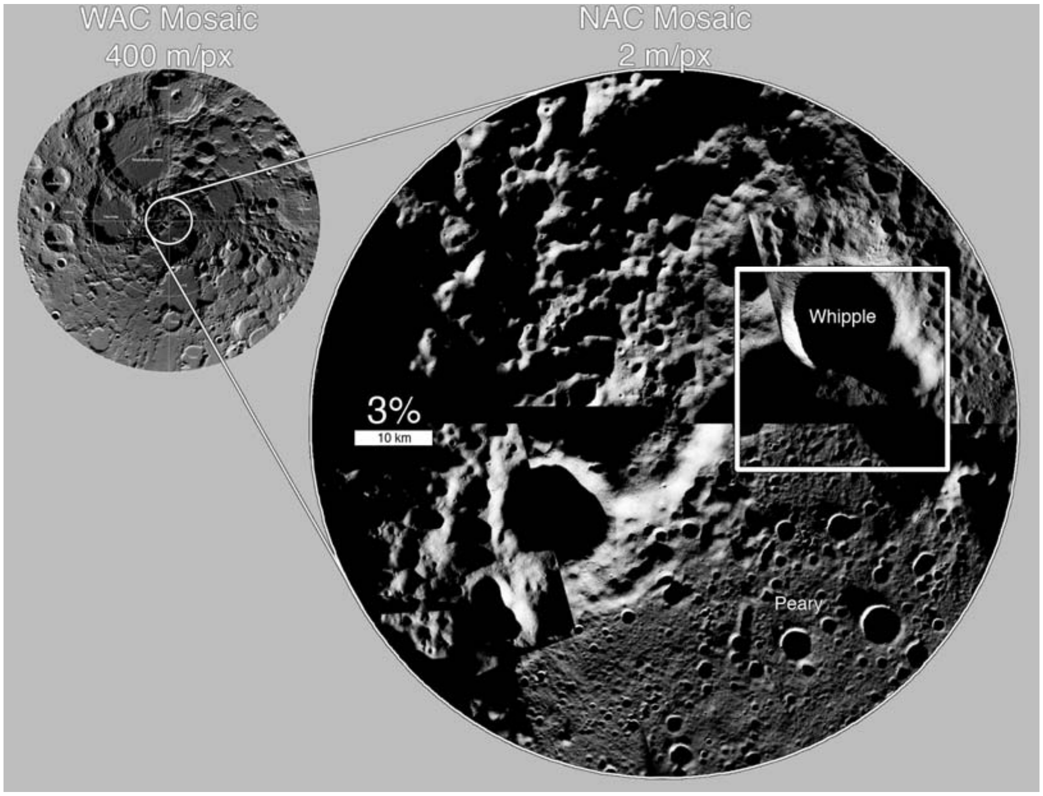

Figure 2: Area of focus is indicated by white box in NAC mosaic inset. Whipple and Peary craters are labeled. NAC and WAC mosaics by NASA/GSFC/Arizona State University.