Digital Elevation Models and Derived Products from LROC NAC Stereo Observations

Kyle N **Burns**, Arizona State University, United States (PRESENTER)
Mr Emerson J **Speyerer**, Arizona State University, United States
Dr Mark S **Robinson**, Arizona State University, United States
Thanh **Tran**, Arizona State University, United States
Mark R **Rosiek**, United State Geological Survey, United States
Elpitha **Howington-Kraus**, United State Geological Survey, United States
Brent A **Archinal**, United State Geological Survey, United States

Keyword: ICA and WG IV/7: Exploring the Moon!

Presentation Preference: Oral

One of the primary objectives of the Lunar Reconnaissance Orbiter Camera (LROC) is to gather stereo observations with the Narrow Angle Camera (NAC). The NAC has a pixel scale of 0.5 to 2.0 meters, but was not designed for stereo observations and thus requires the spacecraft to roll off-nadir to acquire these images. Slews interfere with the data collection of the other instruments, so opportunities are currently limited to four per day. These stereo observations are used to generate digital elevation models (DEMs) using a developed process. In order to produce a usable DEM, the emission and incidence angles between stereo images must be similar.

This work describes the processes and techniques used in creating DEMs from LROC NAC stereo observations. A combination of USGS integrated Software for Image and Spectrometers (ISIS) and SOCET SET from BAE Systems are used to generate DEMs. In order to increase positional accuracy over that obtained from a priori LRO position and pointing information, data obtained from the Lunar Orbiter Laser Altimeter (LOLA) is used to register the NAC images and define the geodetic reference frame for the resulting products. A series of processes have been developed to ensure that the DEMs produced are of the highest accuracy and precision. These processes will be described and discussed.

Arizona State University has produced DEMs of more than 110 stereo pairs for 11 Constellation Program (CxP) sites and 30 other regions of scientific interest. Personnel at the USGS Astrogeology Science Center have produced DEMs from all usable stereo pairs at 20 of the CxP sites. The ASU and LROC team have released a collection 11 DEMs in the spring of 2011 and plan to begin releasing a number of NAC DEMs to the Planetary Data System (PDS) over the next year. The CxP DEMs will also be made available soon from the LROC web site and from the Lunar Mapping and Modeling Project portal. For each DEM that is generated, a corresponding shaded relief, color-shaded relief, slope map, and confidence map will also be released. Because these products provide a high-resolution three-dimensional view of the lunar surface, they could be used for site selection, hazard avoidance, and for real-time navigation via terrain matching for any future proposed lunar landings. They can also be used to plan and characterize traverses across the surface to ensure that resources are used efficiently. Geologists can measure parameters such as elevation, slope, and volume to place constraints on composition and geologic history. NAC DEMs will provide scientists and engineers with the best dataset to investigate small-scale geomorphic features of the lunar surface. Such DEMs are also one of the few sources of topographic information at sufficiently high resolution and coverage that they can be used to project and correct color and multispectral data at high accuracy for resource location and scientific purposes such as geologic mapping.