HIGH RESOLUTION TOPOGRAPHY FROM LROC-NAC GEOMETRIC STEREO IMAGES. S. Mattson[1], B. Archinal[2], R. Beyer[3], K. Edmundson[2], B. Gaskell[4], I. Haase[5], E. Howington-Kraus[2], R. Li[6], N. Mastrodemos[7], A. McEwen[1], Z. Moratto[3], J. Oberst[5,8], L. Ojha[1], A. Ortiz[1], M. Robinson[9], M. Rosiek[2], F. Scholten[8], T. Tran[9], and the LROC Team. [1]University of Arizona (smattson@pirl.lpl.arizona.edu), [2]U.S. Geological Survey, [3]NASA Ames, [4]Planetary Science Institute, [5]Technical University Berlin, [6]Ohio State University, [7]Jet Propulsion Laboratory – California Institute of Technology, [8]German Aerospace Center, [9]Arizona State University.

Introduction: The Lunar Reconnaissance Orbiter Camera – Narrow Angle Camera (LROC-NAC) is acquiring images at pixel scales ranging from 0.5-1.5 m, depending on the altitude and camera mode at the time of imaging [1]. Digital Terrain Models (DTMs) are generated from NAC stereo images at 2-5 m grid spacing. Vertical precision is <1 m, given 0.5 m pixels correlated to 0.2-pixel precision and ~20º stereo convergence angle [2]. Several groups on the LROC team are using various methods to generate DTMs [3]. DTM production has contributed to NAC geometric calibration and correction of lens distortion, improving image map projection as well as DTM quality [4,5,6].

Geometric Stereo Imaging: Stereo pairs are acquired by imaging the target area from consecutive orbits, with off-nadir rolls, to minimize resolution and lighting differences between images. Some targets have been imaged from opposite roll angles as well as from the nadir angle, to form stereo triplets. The majority of stereo images are targeted at the 50 Constellation regions of interest [7] to create DTMs for the Lunar Mapping and Modeling Project (LMMP) [8,9]. Science targets are also being imaged in stereo to study tectonic, volcanic and impact features [e.g. 10,11,12].

DTM Production: Results are validated by collaboration and comparison of methods among the various institutions producing DTMs. Arizona State Univ., the U.S. Geological Survey, the Univ. of Arizona, and NASA Ames use USGS ISIS 3 applications (http://isis.astrogeology.usgs.gov) with the commercial photogrammetry software SOCET SET (© BAE Systems). The NASA Ames group is actively developing the publicly available NASA Ames Stereo Pipeline (http://ti.arc.nasa.gov/project/ngt/stereo), which is built on ISIS 3 and is intended to automate DTM production [13]. Ohio State University uses Orbital Mapper software they developed [14] along with the Leica Photogrammetry Suite for manual editing. The group at Technical University Berlin is using the software developed by German Aerospace Center (DLR) that was developed to process Martian stereo imagery [15]. DLR is also contributing NAC DTMs with an emphasis on landing sites.

Ground Control. The Lunar Orbiter Laser Altimeter (LOLA) boresight is aligned with the NAC, providing synchronous altimetric information that aids in controlling the terrain models [16]. Each group producing NAC DTMs uses the LOLA data along with other available topographic models when appropriate for absolute control.

Final Products: The LROC team generally uses a grid spacing of 4 times the source image pixel scale for DTMs to minimize noise. The source images are orthorectified at the pixel scale of the DTM and the original pixel scale. Figure 1 is an example of a 3D perspective view of a NAC orthoimage draped over the corresponding DTM. File formats, metadata standards, and extra products are in development.

Summary: The distribution and precision of NAC DTMs is unprecedented and will greatly assist in lunar exploration planning and scientific analysis.

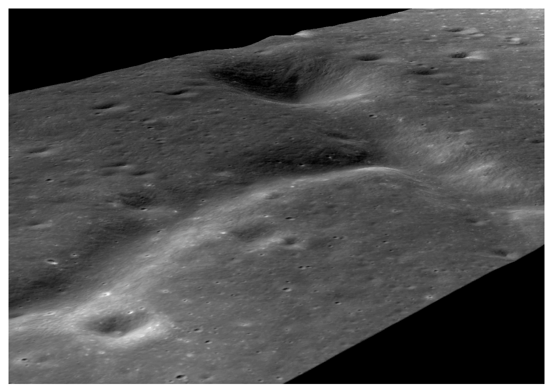

Figure 1. Orthoimage from NAC frame M104527070L draped over a DTM of a portion of Alphonsus crater (4 m/pixel, no vertical exaggeration). Image width ~4.8 km.

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