**PROGRESS ON HIGH RESOLUTION MAPPING OF THE LUNAR SOUTH POLE-AITKEN BASIN INTERIOR.** B. A. Archinal[1], L. R. Gaddis[1], T. M. Hare[1], M. R. Rosiek[1], E. Howington-Kraus[1], E. Lee[1], L. A. Weller[1], R. L. Kirk[1], K. Edmundson[1], O. H. Thomas[1], T. L. Becker[1], B. L. Jolliff[2], T. N. Tran[3], M. S. Robinson[3], and the LROC Science Team. [1]U. S. Geological Survey (2255 N. Gemini Drive, Flagstaff, AZ 86001, USA, barchinal@usgs.gov); [2]Washington University, St. Louis, MO; [3]Arizona State University, Tempe, AZ 85287, USA.

**Overview:** As new data are acquired, we are making geodetically controlled high-resolution digital terrain models (DTMs) and image orthomosaics of the Constellation (Cx) Program region of interest (ROI) [1] in the lunar South Pole-Aitken basin interior ("SAB") (centered at 200.06° E, 60.00° S) [2]. This work is part of the Lunar Mapping and Modeling Program (LMMP), a NASA-funded effort to create useful cartographic products from past and current lunar datasets and to serve them on a web portal [3]. The SAB is one of 50 ROIs chosen by Cx as potential sites for future robotic or human landings or analogs thereof. Source data for our products include publically released ~50 cm/pixel Lunar Reconnaissance Orbiter Camera (LROC) Narrow Angle Camera images [4] and Lunar Orbiter Laser Altimeter (LOLA) [5] spot elevation measurements, and preliminary global DTM at 16 posts/degree.

**Mapping Products:** One goal of the Cx site characterization effort was to map in detail the 2- and 3-D aspects of the lunar surface within a high-priority central 10x10-km area in the context of regional terrain maps and mosaics at 20x20- and 40x40-km regions centered on the ROI. Analyses of the detailed data help to identify sites most suitable for safely landing spacecraft. LOLA topography and slope information of the entire SAB region highlight extensive areas that are relatively flat with low slopes (<2.5 degrees), within which it is possible to identify safe landing sites.

Preliminary maps and derived data products developed so far include 1) a geodetically controlled LROC mosaic (Figure 1) of ~90% of the 40x40-km ROI, with a sample spacing of 2 m/pixel, orthorectified with LOLA data or, where possible, the stereo DTM; 2) a stereo DTM covering ~25% of the center 20x20-km area of the ROI, with post spacing (resolution) of 1.5 m and ~86x$10^6$ posts; 3) slope and roughness maps derived from the stereo DTM; 4) comparison of DTM slope at 1.5 m to optical maturity [6] at 100 m/pixel; and 5) test DTMs generated via the use of photoclinometry ("shape from shading"), covering small areas with post spacing of 50 cm. *The LROC mosaic is one of the largest non-global controlled mosaics (in pixel space) ever made of the lunar surface. The photoclinometry DTMs are the highest resolution DTMs ever made of the lunar surface from orbital data.* Examination of the resolution of these products shows that the stereo DTM reveals features on the order of 10 m in size, while the photoclinometry DTM shows features on the order of 1 to 3 m in size.

**Coordinate System:** All of these products are in the lunar mean Earth/polar axis coordinate system [7] and the preliminary global reference frame of the current LOLA DTM [5]. The absolute accuracy of these products is limited by the horizontal and vertical accuracy of the LOLA DTM, to which they are tied (DTMs and mosaics) or on which they are projected (mosaics). The expected vertical precision of the stereo DTM is ~20 cm. The products will soon be publically available via the LMMP Portal (http://lmmp.nasa.gov) and also via the planetary GIS site (http://webgis.wr.usgs.gov/) at the USGS. Final versions tied to the LOLA nominal mission global DTM (to be released in 2011 March to the PDS) will be available in 2011 October.

**Landing Site Characterization:** Preliminary analyses of the detailed products in the context of regional views provided by the preliminary global LOLA DTM show that the SAB site has widespread intercrater plains with regional slopes generally less than a few degrees. The preliminary LROC DEM shows local slopes (over 3 m) of ~9° root mean square. Comparison to soil maturity maps derived from Clementine data reveals the distribution of fresh craters on the crater-saturated surface and provides context for more detailed boulder studies using the LROC images. The very high spatial resolution of the DTM, image mosaic and photoclinometry products provide detailed information on the roughness of the surface, crater size and distributions, and boulder populations. Together these data suggest that the SAB site will be highly suitable as a lunar landing site and thus serves as an excellent test-case for future landing site planning and development of lunar surface operational maps.

**Acknowledgements**: This work was partially funded by the NASA Lunar Mapping and Modeling Project and Lunar Reconnaissance Orbiter Participating Scientist Program.

**References**: [1] Gruener, J.E. and B.K. Joosten (2009) *LRO Science Targeting Meeting*, Abst #6036. [2] Archinal, B., et al. (2009) AGU 2010 Fall Meeting, Abst P53D-1549. [3] Noble, S.K. et al. (2009) *Ann Mtg LEAG*, Abst #2014. [4] Robinson, M.S., et al. (2010) *Space Sci. Rev., 150*, 81. [5] Smith, D.E., et al. (2010) *Space Sci. Rev., 150*, 209. [6] Lucey, P.G., et al. (2000) *JGR, 105*, 20377. [7] LRO Project and LGCWG (2009) White Paper, v. 5, Oct. 1 (http://lunar.gsfc.nasa.gov/library/LunCoordWhitePaper-10-08.pdf). Archinal, B., et al. (2011), *CMDA*, in press, doi: 10.1007/s10569-010-9320-4. [8] Becker, T., et al. (2008) LPS XXXIX, Abst #2358.

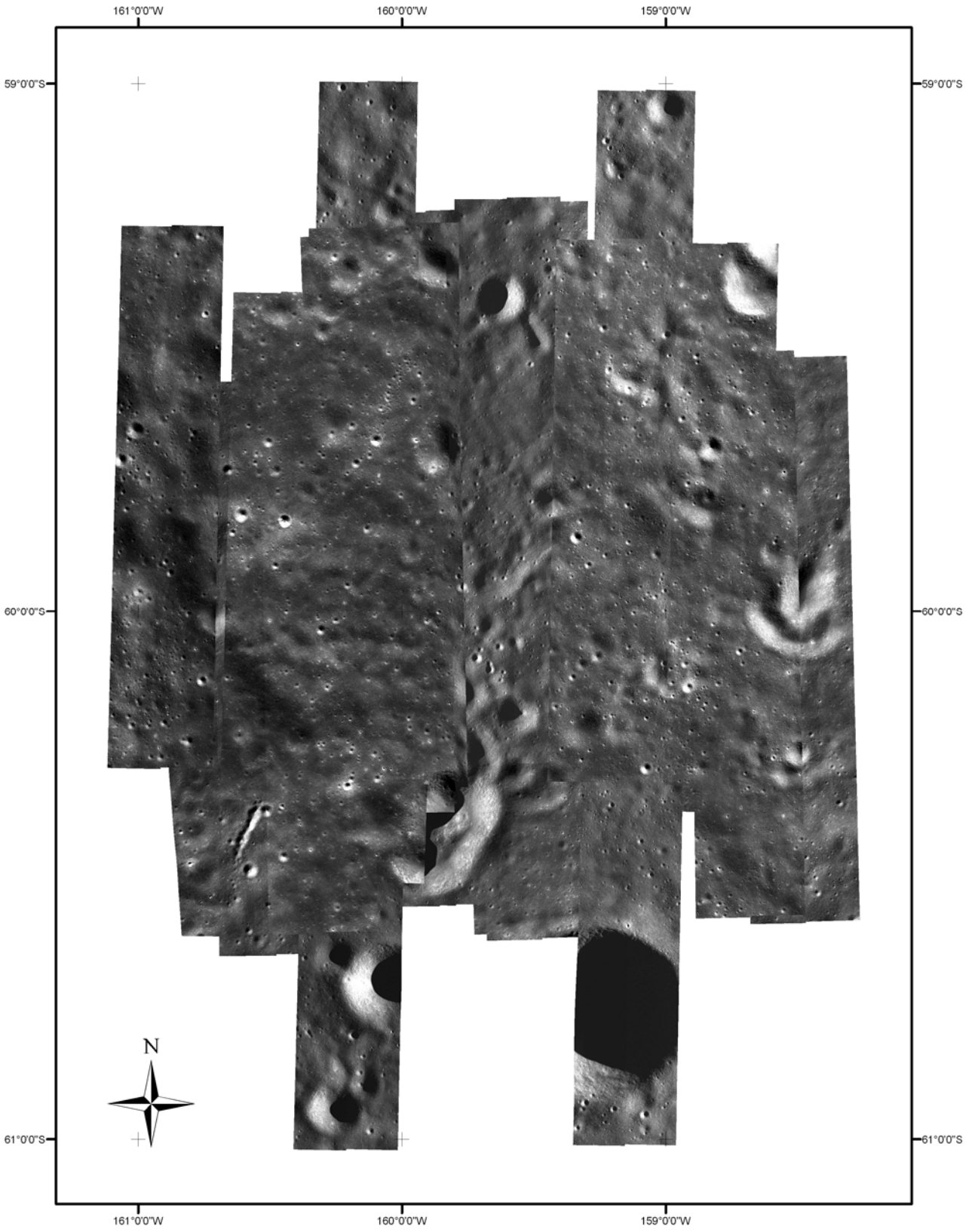


Figure 1: Preliminary geodetically controlled orthomosaic of ~90% of the 40 x 40 km SAB ROI, orthorectified with LOLA data or, where possible, the stereo DTM and controlled to the current LOLA reference frame. Cylindrical projection, with north up and east to the right. The original mosaic file has a sample spacing of 1 meter. In sheer number of pixels, this is one of the largest non-global controlled mosaics ever made of the lunar surface, at about 1.6 gigapixels in size (comparable in size to the global Lunar Orbiter mosaic [8]). If printed at full resolution (150 pixels/inch) this mosaic would be over 6x6 meters in size. The final product will have a sample spacing of 50 cm and will therefore be four times larger.