CONTROLLED HIGH-RESOLUTION LROC NAC POLAR MOSAICS. B. Archinal[1], L. Weller[1], J. Richie[1], E. Lee[1,2], K. Bennett[1], E. Speyerer[3], and T. Tyburczy[3] [1]U. S. Geological Survey, Astrogeology Science Center (2255 N. Gemini Drive, Flagstaff, AZ 86004; barchinal@usgs.gov); [2]Retired; [3]School of Earth and Space Exploration, Arizona State University, Tempe, AZ 85287.

Introduction: We are completing our effort to create geodetically controlled 1 m/pixel LRO LROC [1,2] narrow angle camera (NAC) lunar polar cap mosaics, poleward from 85° latitude. The final products of this effort will include controlled mosaics of useful images from 2009 through 2014 and 9 m/pixel "illumination" controlled mosaics made every 10° of solar longitude. See previous publications [2–4] for additional information, which also cover some of the many benefits and possible uses of these products.

Control solutions have been performed with the USGS ISIS software package *jigsaw* application [4]. We have completed a final network and created the mosaics for the north pole, which will be released and archived in early 2023. We are working on a final network for the south pole.

Solution Statistics and Ground Control: Table 1 shows statistics of the two networks, including numbers of constrained points and images. For ground control we have used a NASA Ames application [5] to match illuminated LRO Lunar Orbiter Laser Altimeter (LOLA) track data to images in order to provide absolute constraints on position. Our solutions have been done using constraints appropriate to the accuracy of the LOLA track data. The north pole includes 16,306 constrained points over 226 images, and the south pole 12,535 constrained points over 228 images. A plot of the north pole images and points used is given in Figure 1.

Figure 2 shows a comparison between uncontrolled and controlled images. As examples of final products, Figure 3 shows an example illumination mosaic. Figure 4 shows the entire averaged north pole mosaic. We plan to release the north pole (RDR) products with the March 15 PDS release and the south pole products later this year.

Benefits: Aside from benefits described in our previous publications, these mosaics provide characterization at high resolution of all lunar polar landing sites of interest, including polar CLPS sites and the 13 Artemis landing candidate regions (https://www.nasa.gov/press-release/nasa-identifies-candidate-regions-for-landing-next-americans-on-moon/).

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References: [1] Vondrak et al. (2010) *Space Sci. Rev.* 150, 7. [2] Robinson et al. (2010) *Space Sci. Rev.* 150, 81. [3] Archinal et al. (2015) *LPS XLVI*, #1571 (2015) *LEAG*, #2040; (2016) *LEAG*, #5044. [4] Edmundson et al. (2012) I*nt. Ann. Photog., Rem. Sens. & Spatial Inf. Sci.*, I-4, 203. [5] Nefian et al. (2014) *LPS XLVI*, #1679.

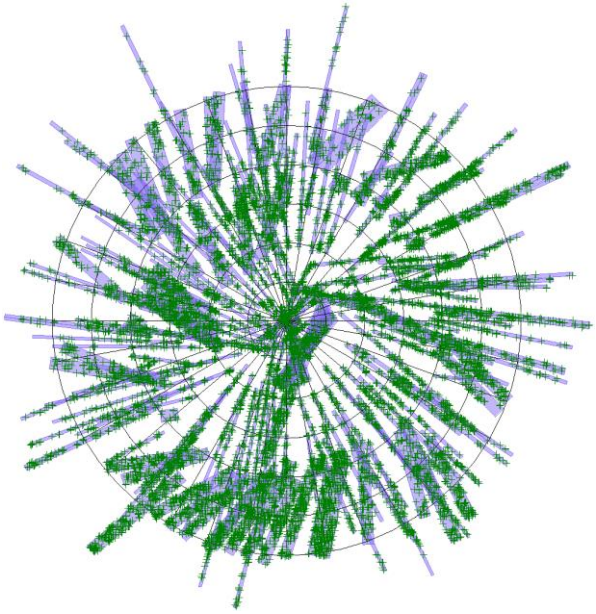

Figure 1: North pole area image showing LROC images (purple) and points (green) constrained to LOLA. Covers 84° latitude and poleward, 1° lat. x 10° long. grid spacing, and 0° longitude meridian (toward Earth) is at bottom.

Table 1: Solution & Residuals Stats

(south is preliminary)

	north	south
Images:	9,687	18,776
Points:	405,532	1,638,398
Measures:	3,128,764	17,267,675
Const. Pts.:	16,306	12,535
Const. Img.:	226	228
Sol. Variance	0.40	1.2
	(pixels:)	(pixels:)
Mean:	0.52	1.76
Std. Dev.:	0.48	1.66
Maximum:	13.0	104.50

Note: 1 pixel ~= 1 meter

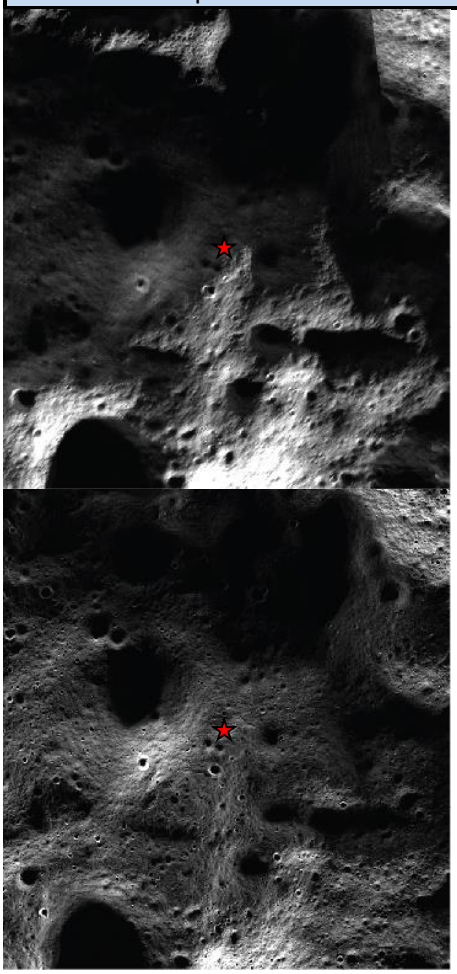

Figure 2: North pole area, before (top) and after (bottom) control of images. Mosaicked at 10 m/pixel; 3.6 x 3.9 km shown; red star is north pole.

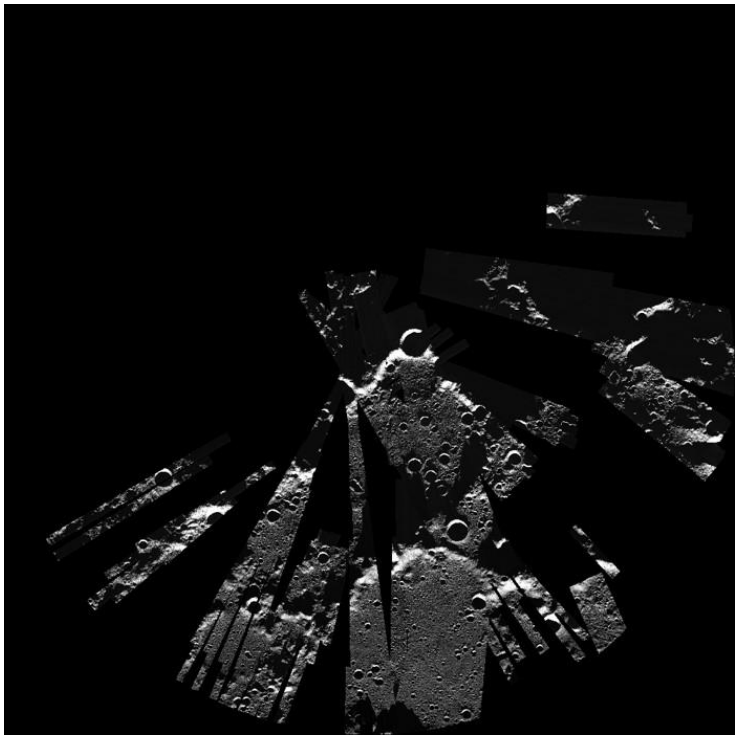

Figure 3: Example illumination mosaic of the north pole, showing all images within one 10° bin of solar longitude. Same coverage and orientation as in Figure 1.

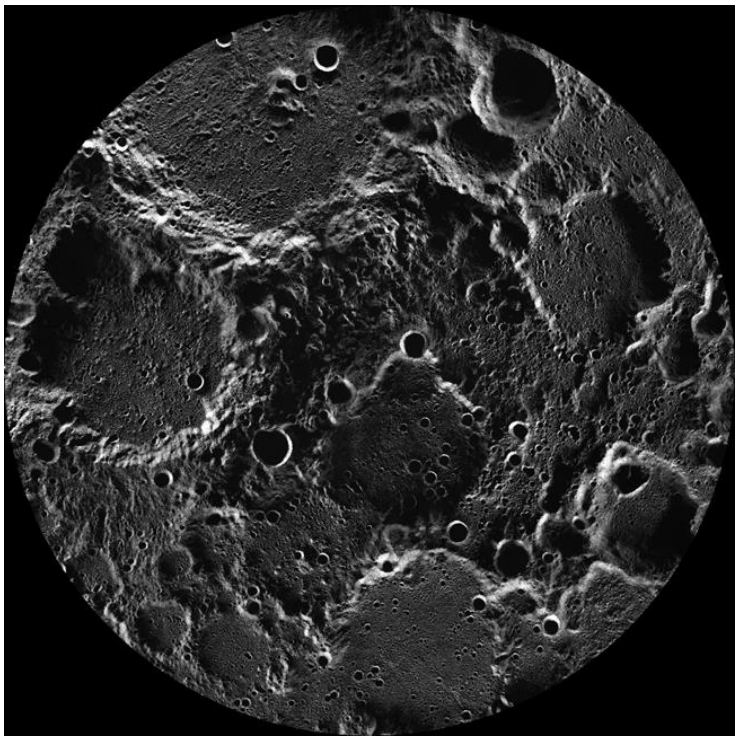

Figure 4: The north pole mosaic, including all images, shown at a much reduced resolution from the full 1 m/pixel mosaic. Same coverage and orientation as in Figure 1.