U.S. Department of the Interior
U.S. Geological Survey

Prepared for the
National Aeronautics and Space Administration

Scientific Investigations Map 3316
Sheet 1 of 2

SCALE 1:6 078 683 (1 mm = 6.078683 km) AT 90° LATITUDE
POLAR STEREOGRAPHIC PROJECTION

NORTH POLAR REGION

MAP DESCRIPTION

This image mosaic is based on data from the Lunar Reconnaissance Orbiter Wide Angle Camera (WAC; Robinson and others, 2010), an instrument on the National Aeronautics and Space Administration (NASA) Lunar Reconnaissance Orbiter (LRO) spacecraft (Tooley and others, 2010). The WAC is a seven band (321 nanometers [nm], 360 nm, 415 nm, 566 nm, 604 nm, 643 nm, and 689 nm) push frame imager with a 90° field of view in monochrome mode, and 60° field of view in color mode. From the nominal 50-kilometer (km) polar orbit, the WAC acquires images with a 57-km swath-width and a typical length of 105 km. At nadir, the pixel scale for the visible filters (415–689 nm) is 75 meters (Speyerer and others, 2011). Each month, the WAC provided almost complete coverage of the Moon.

PROJECTION

The Mercator projection is used between latitudes ±57°, with a central meridian at 0° longitude and latitude equal to the nominal scale at 0°. The Polar Stereographic projection is used for the regions north of the +55° parallel and south of the –55° parallel, with a central meridian set for both at 0° and a latitude of true scale at +90° and -90°, respectively. The adopted spherical radius used to define the maps scale is 1737.4 km (Lunar Reconnaissance Orbiter Project Lunar Geodesy and Cartography Working Group, 2008; Archinal and others, 2011). In projection, the pixels are 100 meters at the equator.

COORDINATE SYSTEM

The Wide Angle Camera images were referenced to an internally consistent inertial coordinate system, derived from tracking of the LRO spacecraft and crossover-adjusted Lunar Orbiter Laser Altimeter (LOLA) data that were used together to determine the orbit of LRO in inertial space (Smith and others, 2011). By adopting appropriate values for the orientation of the Moon, as defined by the International Astronomical Union (IAU; Archinal and others, 2011), the images were orthorectified into the planet-fixed coordinates (longitude and latitude) used on this map. The coordinate system defined for this product is the mean Earth/polar axis (ME) system, sometimes called the mean Earth/rotation axis system. The ME system is the method most often used for cartographic products of the past (Davies and Colvin, 2000). Values for the orientation of the Moon were derived from the Jet Propulsion Laboratory Developmental Ephemeris (DE) 421 planetary ephemeris (Williams and others, 2008; Folkner and others, 2008; 2009) and rotated into the ME system. The LOLA-derived crossover-corrected ephemeris (Mazarico and others, 2012) and an updated camera pointing provide an average accuracy of ~1 km in the horizontal position (Scholten and others, 2012).

Longitude increases to the east and latitude is planetocentric, as allowed in accordance with current NASA and U.S. Geological Survey standards (Archinal and others, 2011). The intersection of the lunar equator and prime meridian occurs at what can be called the Moon's "mean sub-Earth point." The concept of a lunar "sub-Earth point" derives from the fact that the Moon's rotation is tidally locked to the Earth. The actual sub-Earth point on the Moon varies slightly due to orbital eccentricity, inclination, and other factors. So a "mean sub-Earth point" is used to define the point on the lunar surface where longitude equals 0°. This point does not coincide with any prominent crater or other lunar surface feature (Lunar Reconnaissance Orbiter Project Lunar Geodesy and Cartography Working Group, 2008; Archinal and others, 2011).

MAPPING TECHNIQUES

The WAC global mosaic shown here is a monochrome product with a normalized reflectance at 643 nm wavelength, and consists of more than 15,000 images acquired between November 2009 and February 2011 (Sato and others, 2014) using revised camera pointing (Wagner and others, 2015). The solar incidence angle at the Equator changes ~28° from the beginning to the end of each month. To reduce these incidence angle variations, data for the equatorial mosaic were collected over three periods (January 20, 2010 to January 28, 2010, May 30, 2010 to June 6, 2010, and July 24, 2010 to July 31, 2010). The South Pole mosaic images were acquired from August 10, 2010 to September 19, 2010, and the North Pole images were acquired from April 22, 2010 to May 19, 2010. Remaining gaps were filled with images acquired at other times with similar lighting conditions (Robinson and others, 2012). There is a brightness difference where the polar mosaics meet the equatorial mosaics because the polar images were acquired in a different season than the equatorial images, and the lunar photometric function is not perfectly known (Sato and others, 2014).

The equatorial WAC images were orthorectified onto the Global Lunar Digital Terrain Mosaic (GLD100, WAC-derived 100 m/pixel digital elevation model; Scholten and others, 2012) while the polar images were orthorectified onto the lunar LOLA polar digital elevation models (Neumann and others, 2010).

To create the final base image, the original WAC mosaic that was produced by the Lunar Reconnaissance Orbiter Camera team in a Simple Cylindrical projection with a resolution of 100m/pixel was projected into the Mercator and Polar Stereographic pieces. The images were then scaled to 1: 10,000,000 for the Mercator part and 1:6,078,683 for the two Polar Stereographic parts with a resolution of 300 pixels per inch. The two projections have a common scale at ±56° latitude.

NOMENCLATURE

Feature names on this sheet are approved by the IAU. All features greater than 85 km in diameter or length were included unless they were not visible on the map due to the small scale used for printing. However, some selected well-known features less that 85 km in diameter or length were included. For a complete list of the IAU-approved nomenclature for the Moon, see the Gazetteer of Planetary Nomenclature at http://planetarynames.wr.usgs.gov. For lunar mission names, only successful landers are shown, not impactors or expended orbiters.

ACKNOWLEDGMENTS

This map was made possible with thanks to NASA, the LRO mission, and the Lunar Reconnaissance Orbiter Camera team. The map was funded by NASA's Planetary Geology and Geophysics Cartography Program.

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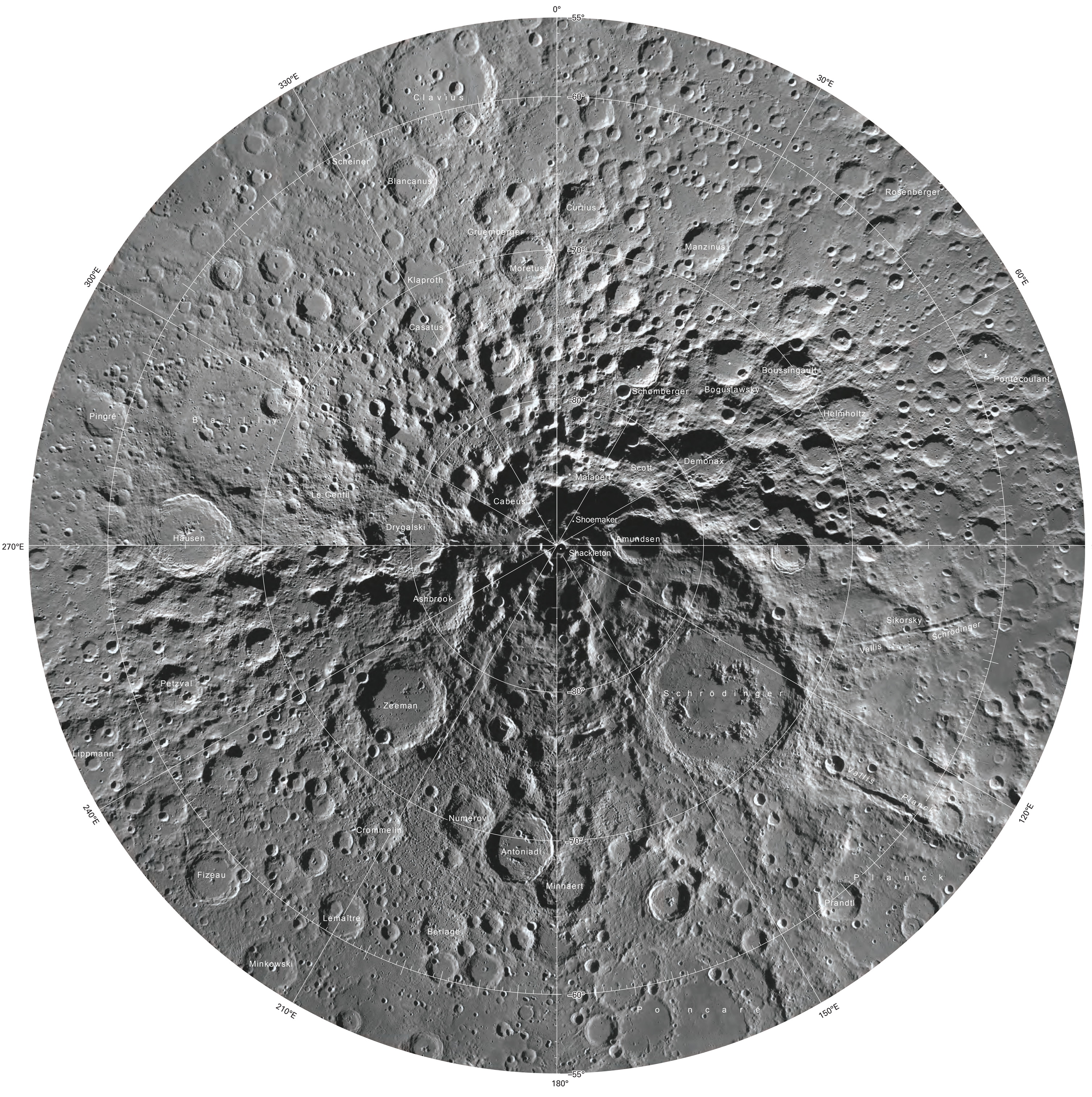
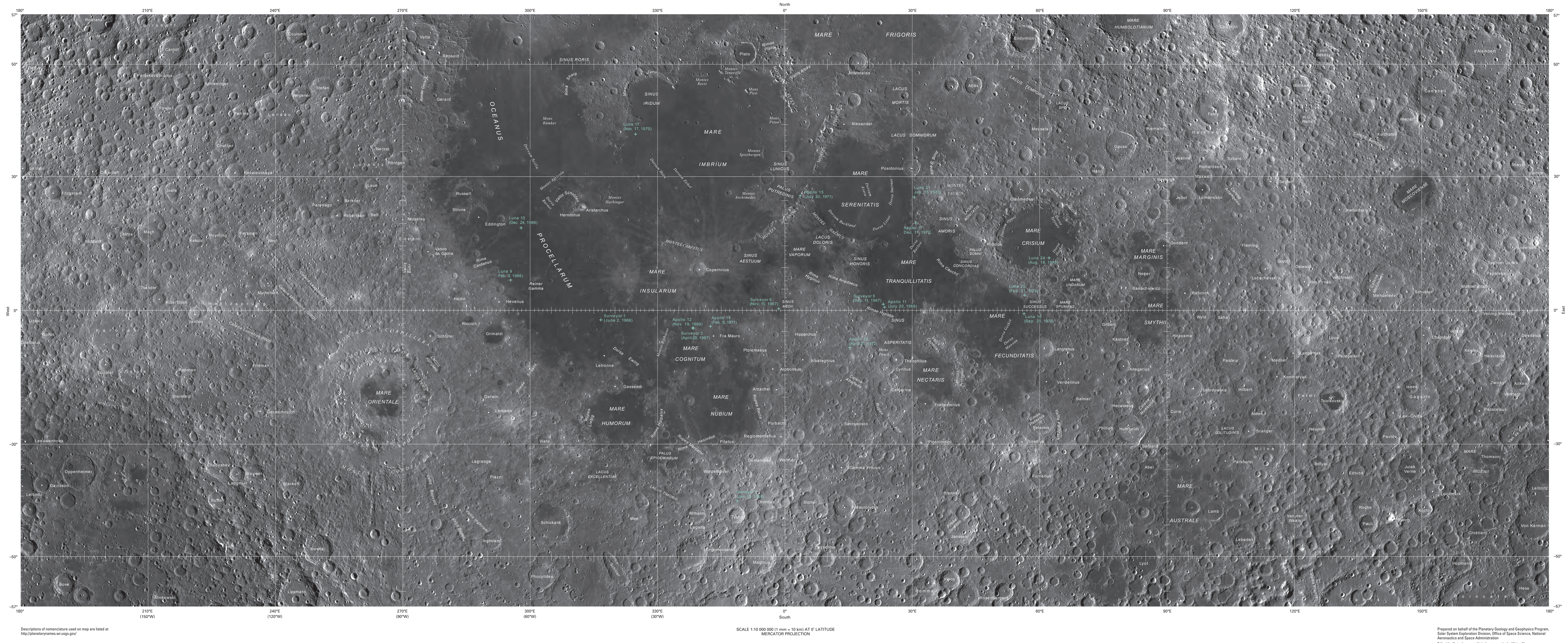


SCALE 1:6 078 683 (1 mm = 6.078683 km) AT -90° LATITUDE
POLAR STEREOGRAPHIC PROJECTION

SOUTH POLAR REGION



Descriptions of nomenclature used on map are listed at http://planetarynames.wr.usgs.gov/

SCALE 1:10 000 000 (1 mm = 10 km) AT 0° LATITUDE
MERCATOR PROJECTION

Prepared on behalf of the Planetary Geology and Geophysics Program, Solar System Exploration Division, Office of Space Science, National Aeronautics and Space Administration

Edited by Kate Jacques; digital cartography by Vivian Nguyen

Manuscript approved for publication October 28, 2014

Image Map of the Moon

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2015

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ISSN 2329-1311 (print)
ISSN 2329-132X (online)
http://dx.doi.org/10.3133/sim3316

Printed on recycled paper

ISBN 978-1-4113-3874-6

For sale by U.S. Geological Survey, Information Services, Box 25286, Federal Center, Denver, CO 80225, 1–888–ASK–USGS

Digital files available at http://pubs.usgs.gov/sim/3316/

Suggested citation: Hare, T.M., Hayward, R.K., Blue, J.S., Archinal, B.A., Robinson, M.S., Speyerer, E.J., Wagner, R.V., Smith, D.E., Zuber, M.T., Neumann, G.A., and Mazarico, E., 2015, Image mosaic and topographic map of the moon: U.S. Geological Survey Scientific Investigations Map 3316, 2 sheets, *http://dx.doi.org/10.3133/sim3316*.