LUNAR ORBITER LASER ALTIMETER ON LUNAR RECONNAISSANCE ORBITER. G. A. Neumann[1], D. E. Smith[1], and M. T. Zuber[2], [1]NASA Goddard Space Flight Center, Code 690, Greenbelt, MD 20771 (neumann@tharsis.gsfc.nasa.gov), [2]Massachusetts Institute of Technology, Dept. of Earth, Atmospheric, and Planetary Sciences, 77 Massachusetts Avenue, Cambridge, MA 02139.

Introduction: The Lunar Orbiter Laser Altimeter selected for the Lunar Reconnaissance Orbiter, to be launched Oct. 28, 2008, will map the Moon in a polar orbit over the course of a one-year nominal mission. Within the first 10 minutes, LOLA will collect more altimetric data from the Moon than all previous NASA missions. The novel design of LOLA will provide a precise selenodetic coordinate system for lunar mapping. In addition to altimetry, LOLA will measure bidirectional slope, surface reflectivity, and roughness on 5-m-diameter spots. The monthly release of crossover-adjusted data will facilitate co-registration with high-resolution images and other datasets.

Altimeter Design: A closely-spaced 5-spot pattern in the shape of a cross, rotated 26° from the S/C velocity vector, is repeated at 28 Hz. Spots are nominally 25 m apart at 50 km altitude, leaving an along-track pattern whose maximum spacing is 30 m between spots. Owing to orbital geometry, the coverage is densest at the poles (Figure 1), with overlapping tracks covering the crater rims and floors at spacings approaching 10 m between spots.

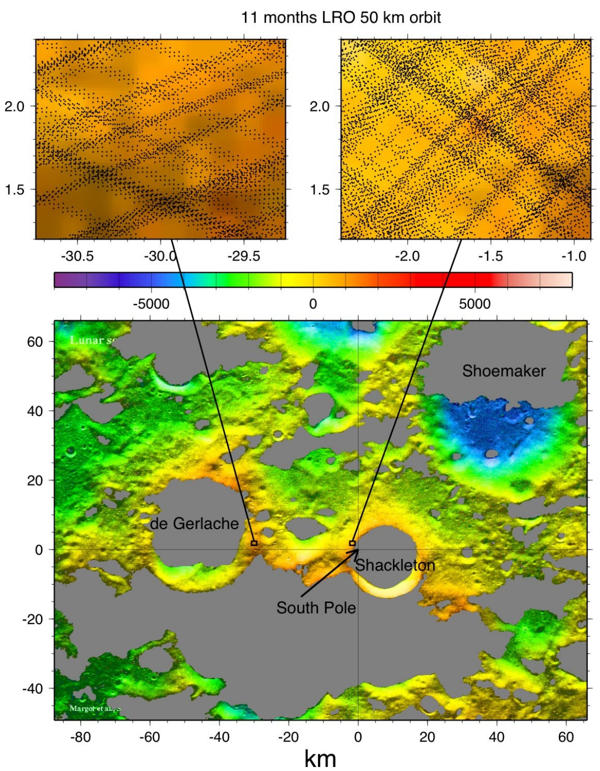

Figure 1: LOLA Coverage Density at S. Pole

Instrument Parameters. Design parameters as of June, 2006 are shown in Table 1. Current best estimates are within allocated design margins.

Table 1.

Instrument Parameter	Value
Mass	12.6 kg
Power	33 W
Dimensions	35 cm x 35 cm x 29 cm
Data Rate	28 kbit/s
1064-nm Laser	28 Hz
Pulse	2.4 ±0.4 mJ, 6 ns
Beam divergence	100 urad x 5 spots
Range	0-100 km (90%Pd)
Detectors, range resolution	5 Si-APD, 10 cm

Concept of Operation: LOLA will operate primarily in a nadir mode. Where targeting by LROC results in stereo coverage, one near-nadir look will provide absolute control. LOLA may also require offnadir pointing to achieve dense coverage of potential landing sites in permanently shadowed regions, but swings up to 2° off nadir will not degrade accuracy nor measurement of surface properties.

Current knowledge of horizontal position of lunar control points is thought to be a few km on the far side. Improved gravity models derived during the course of the mission, crossover solutions [1,2] and a one-way Laser Ranging capability will be implemented to achieve 50-m global horizontal accuracy for targeting [3].

Anticipated Coverage: During the Commissioning and Mapping mission phases, longitudinal coverage will be non-uniform owing to the influence of large gravity anomalies on the spacecraft orbit. Average spacing of tracks will be approximately 1.25 km apart. Further coverage by laser altimeters aboard international missions is anticipated, as well as opportunities for densification using stereo image matching.

References: [1] Rowlands, D.D. et. al. (1999), *Geophys. Res. Lett., 26*, 1191-1194, 1999. [2] Neumann et al. (2001) *J. Geophys. Res., 106,* 23,753-23,768, 2001. [3] D.E. Smith and M.T. Zuber (2006) *LCROSS Site Selection Workshop,* Moffett Field, CA, Abstract 9007.