Altimetric Mapping of the Moon

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The Lunar Reconnaissance Orbiter (LRO) mission will carry a laser altimeter for precision mapping of the lunar topography, establishment of a lunar geodetic reference system and for the identification of potential landing sites for future robotic and human missions. The mission, nominally one year, will also acquire sub-meter imaging, neutron flux data, surface temperature data, Lyman Alpha flux, and the cosmic ray environment. The LRO spacecraft will operate in a polar orbit at a nominal mean altitude of 50 km, although the actual altitude is expected to vary between 30 and 50 km. The laser altimeter is a multi-beam system that operates at 28Hz and will provide the topography (shape), full surface slope, surface roughness, and surface reflectance. The nominal accuracy of the altimeter is 10 cm, the surface slopes to a few tenths of a degree, and surface roughness to approximately 30 cm. The orbit of the spacecraft, although very nearly polar throughout the mission, will create orbital crossovers at all latitudes and longitudes that will be used in the orbit determination process. At the end of the 1-year mission there will be a crossover location every few km in latitude and longitude providing a very strong geometric grid from which the lunar shape will be derived and the position of the spacecraft. We anticipate the lunar shape will be known to better than 1 meter at all the crossover locations on both the near- and far-sides of the moon. The LRO spacecraft will be tracked at S-band frequencies and in conjunction with the altimeter used to develop a global lunar geodetic reference system. The laser altimeter will obtain reflections from the 3 laser reflectors placed on the moon by the Apollo missions and it is anticipated that these locations will be the basis of a new body-fixed lunar geodetic coordinate system. In addition, data acquired by the Clementine and subsequent international missions will be incorporated into the final models where possible.