



## **Results from the First 6 Months of Operation of the Multi-Beam Laser Altimeter on LRO**

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The LOLA instrument began operations on July 3, 2009 when the spacecraft entered a 2-month commissioning orbit. On Sept 15 LRO began its routine mapping phase in a 50 km near circular polar orbit and had acquired over 1 billion altimeter measurements by mid-January, 2010. LOLA has 5 beams and illuminates 5 spots on the lunar surface in the form of a cross with the arms 25 meters in length. The spot formation enables surface slopes to be derived in 2 orthogonal directions. Each laser spot on the surface is 5-meters in diameter and the nominal range accuracy is 10 cm over flat surfaces. The return energy is measured in each spot to provide the albedo of the surface at the wavelength of the laser (1064 nm), which emits 2.5 mJ pulses at 28 Hz and able to acquire 140 measurements/second. The average along-track resolution of the altimeter data since beginning operations is 20 meters, and the across-track resolution is an average of approximately 0.2 degrees.

LOLA also has a small optical receiver attached to the high gain antenna that is able to receive laser pulses from an Earth-based laser tracking system to provide 1-way range measurements to LRO. The Earth-based laser system transmits pulses at 28 Hz to the receiver on LRO which are carried to LOLA where their time of arrival is recorded. The difference between transmit time and receive time provide the range to LRO. Precision of individual one-way measurements is approximately 24 cm, providing a better than 5 cm normal point every 5 seconds. These data are helping improve the orbit determination of LRO and will eventually help improve the lunar gravity model.