Geophysical Research Abstracts,
Vol. 11, EGU2009-11345-1, 2009
EGU General Assembly 2009

The Laser Altimeter and Laser Tracking Investigations on LRO

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The Lunar Reconnaissance Orbiter (LRO) Mission is planned for launch at the end of April 2009. One of the instruments on the spacecraft is the Lunar Orbiter Laser Altimeter (LOLA), a multi-spot laser altimeter whose primary function is to provide a geodetic framework to which all LRO instrument data can be referenced. The accuracy of the altimeter measurement is at the 10-cm level and the accuracy of the global framework will be limited by the knowledge of the orbit of LRO, which is eventually expected to reach the 50-cm level. Of particular importance is the multi-spot feature of LOLA that provides instantaneous slopes, roughness from the pulse spreading, and albedo from the energy measurement, and enables the orbital cross-over approach to be applied to several measurement types. The quality of the LRO orbit determination is a critical factor in the geodetic performance of the instrument and in order to improve the orbit knowledge LRO has included and a one-way laser ranging (LR) system on the spacecraft. The LR system has the capacity to make approximately 10-cm precision distance measurements at 28 Hz from an international set of Earth-based laser tracking stations. The laser pulses from the tracking station are detected by a receiver on the high gain antenna, and are transmitted via fiber–optic cable to LOLA where the LOLA electronics time stamps their arrival and sends the data back in the LOLA telemetry stream. These very precise ranges in conjunction with the routine S-band Doppler tracking and the LOLA altimeter data will be used in the final orbit determination that is expected to include an improvement in the lunar gravity field model.