LUNAR RECONNAISSANCE ORBITER STEREO IMAGING AND TOPOGRAPHIC MAPPING OPPORTUNITIES.

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LRO Stereo Imaging: Lunar Reconnaissance Orbiter (LRO) was launched on June 18, 2009 and arrived safely in Lunar orbit. The Lunar Reconnaissance Orbiter Camera (LROC) has two Narrow Angle Cameras (NACs), working jointly to provide a combined (in the cross-track direction) field of view, as well as a Wide Angle Camera (WAC). While LRO is equipped with the powerful Laser altimeter LOLA (Lunar Orbiting Laser Altimeter), stereo imaging will be carried out by both cameras to derive high-resolution terrain models that will complement the coverage of LOLA.

From its polar circular 50-km orbit of the nominal mapping mission, LROC will obtain two types of stereo coverage. The NAC camera will obtain coverage of targets selected by the LROC team that will be realized with one nadir and one off-pointed image (20° roll). Alternatively, pairs can be obtained with two spacecraft rolls (one to the left and one to the right) providing a stereo convergence angle up to 40°. Likewise, because of the wide field of view, overlapping WAC images from adjacent approx. 2-hour orbits can be used to generate topography of near-global coverage at few hundred meter effective spatial resolution. As the WAC will provide repeated surface coverage, images can be selected with illumination conditions that are favorable for stereo processing. With varying solar incidence angles (and availability of good radiometric calibration data), also the opportunity opens up for topographic mapping involving photometric modeling („shape from shading“).

Commissioning Results and Discussion: The analysis of the stereo image data is being carried out by several groups within the LRO team in a coordinated effort, with preliminary results being presented separately at this meeting [1]. The assessment of the WAC images using early calibration and ancillary data suggests that is feasible to derive a global lunar terrain model, if the nominal mission and scheduled mapping proceeds as planned. While the polar areas will be covered by the densely spaced merging LOLA tracks, the WAC stereo terrain model will exceed the spatial resolution of the LOLA data in the low-latitude areas and fill gaps between LOLA tracks nicely. Note that the spacing of LOLA tracks at the equator will be approx. 30 km after one month, i.e., one global pass. LOLA data will be used to calibrate the stereo topographic models for absolute lateral and vertical positioning and for possible long-wavelength trends in elevation. The multiple overlap and the comparably large stereo angles will allow us to construct a stable image block. Using image data from the Apollo landing sites, with the known coordinates of the landed spacecraft, radio transmitters, and Laser retroreflectors, the DTM can be firmly tied to the Lunar-fixed coordinate system.

The high quality of the NAC images suggests that large-size terrain models of unsurpassed high resolution, with DTM accuracies approaching the image resolution (1 m or better), can be obtained.

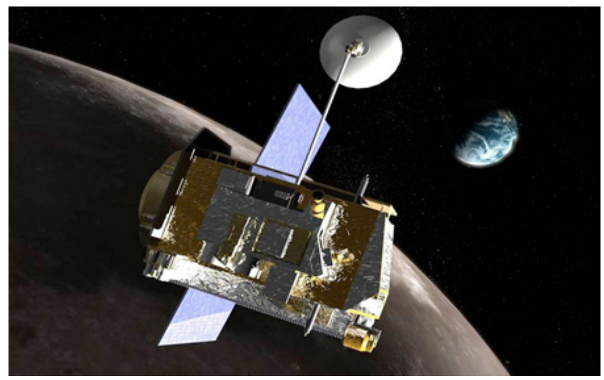

Fig. 1: Lunar Reconnaissance Orbiter (LRO) artists' view (image credit: NASA)

References: [1] F. Scholten, J. Oberst, M. Wählisch, K.-D. Matz, T. Roatsch, I. Haase, M. Robinson, Preliminary Results from DLR Stereo Mapping Tests of the LRO Commissioning Phase, this meeting.