The Lunar Reconnaissance Orbiter: Plans for the Science Phase

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Introduction: The Lunar Reconnaissance Orbiter spacecraft (LRO), launched on June 18, 2009, began with the goal of seeking safe landing sites for future robotic missions or the return of humans to the Moon as part of NASA's Exploration Systems Mission Directorate (ESMD). In addition, LRO's objectives included the search for surface resources and to investigate the Lunar radiation environment. After spacecraft commissioning, the ESMD phase of the mission began on September 15, 2009 and completed on September 15, 2010 when operational responsibility for LRO was transferred to NASA's Science Mission Directorate (SMD). The SMD mission is scheduled for 2 years and will be completed in 2012 with an opportunity for an extended mission. Under SMD, the mission focuses on a new set of goals related to understanding the geologic history of the Moon, its current state, and what it can tell us about the evolution of the Solar System.

Having marked the two-year anniversary, we will review here the major results from the LRO mission for both exploration and science and discuss plans and objectives going forward. Results from the LRO mission include but are not limited to the developent of comprehensive high resolution maps and digital terrain models of the lunar surface; discoveries on the nature of hydrogen distribution, and by extension water, at the lunar poles; measurement of the day and night time temperature of the lunar surface including temperature down below 30 K in permanently shadowed regions (PSRs); direct measurement of Hg, H_2, and CO deposits in the PSRs, evidence for recent tectonic activity on the Moon, and high resolution maps of the illumination conditions as the poles.

The objectives for the second phase of the mission under SMD include: 1) understanding the bombardment history of the Moon, 2) interpreting Lunar geologic processes, 3) mapping the global Lunar regolith, 4) identifying volatiles on the Moon, and 5) measuring the Lunar atmosphere and radiation environment.

The instruments, which were describe in detail previously[1], include ***Lunar Orbiter Laser Altimeter (LOLA)***, PI, David Smith, NASA Goddard Space Flight Center, Greenbelt, MD, ***Lunar Reconnaissance Orbiter Camera (LROC)***, PI, Mark Robinson, Arizona State University, Tempe, Arizona, ***Lunar Exploration Neutron Detector (LEND)***, PI, Igor Mitrofanov, Institute for Space Research, and Federal Space Agency, Moscow, ***Diviner Lunar Radiometer Experiment (DLRE),*** PI, David Paige, University of California, Los Angeles, ***Lyman-Alpha Mapping Project (LAMP)***, PI, Alan Stern, Southwest Research Institute, Boulder, Colorado, ***Cosmic Ray Telescope for the Effects of Radiation (CRaTER)***, PI, Harlan Spence, University of New Hampshire, New Hampshire, and ***Mini Radio-Frequency Technology Demonstration (Mini-RF)***, P.I. Ben Bussey, Applied Physics Laboratory, Maryland.

Figure 1 The fully assembled and thermal blanketed spacecraft.

Data Access: All of the LRO data are added to the Planetary Data System on three month intervals, with no data or data products older than 6 months. As of September 15 2011 more than 250 TBytes of data have been made available to the science community.

References: [1] Vondrak, R.R., Keller, J.W., and Russell, C.T., (Ed.s), 2010, Lunar Reconnaissance Orbiter Mission, New York, Springer.