LUNAR RECONNAISSANCE ORBITER OVERVIEW: THE INSTRUMENT SUITE AND MISSION. G. Chin[1,*], A. Bartels[1], S. Brylow[2], M. Foote[3], J. Garvin[1], J. Kaspar[4], J. Keller[1], I. Mitrofanov[5], K. Raney[6], M. Robinson[7], D. Smith[1], H. Spence[8], P. Spudis[9], S. A. Stern[10], M. Zuber[1], [1]Goddard Space Flight Center, Greenbelt, MD 20771, [2]Malin Space Science Systems, San Diego, CA 92121, [3]Jet Propulsion Laboratory, California Institute of Technology, Pasadena, CA 91109, [4]Massachusetts Institute of Technology, Cambridge, MA 02139, [5]Russian Federal Space Agency Institute for Space Research, Moscow, Russia 117997, [6]???, [7]Northwestern University, Evanston, IL 60208, [8]Boston University, Boston, MA 20201, [9] The Johns Hopkins University Applied Physics Laboratory, Laurel MD 20723, [10]Southwest Research Institute, Boulder, CO ZIP

Introduction: In January 2004, the President of the United States announced a new plan to advance the Nation's scientific, security, and economic interests through a robust space exploration program that integrates human and robotic exploration activities. NASA's Robotic Lunar Exploration Program (RLEP), formulated in response to the President's Vision for Space Exploration, will execute a series of robotic missions that will pave the way for eventual permanent human presence on the Moon. The Lunar Reconnaissance Orbiter (LRO) is first in this series of RLEP missions, and plans to launch in October of 2008 for at least one year of operation. LRO will employ six individual instruments to produce accurate maps and high-resolution images of future landing sites, to assess potential lunar resources, and to characterize the radiation environment. LRO will also test the feasibility of one advanced technology demonstration package. We give here an introduction to each of these instruments and an overview of their objectives.

LRO Measurement Objectives and the Instrument Suite: The Lunar Reconnaissance Orbiter (LRO) is the first mission to be implemented in NASA's Robotic Lunar Exploration Program (RLEP), one element of NASA's Exploration Systems Mission Directorate (ESMD) that aims to fulfill the President's Vision for Space Exploration. At the direction of NASA Headquarters (HQ), LRO management and in-house implementation will be situated at Goddard Space Flight Center (GSFC) to enable an October 2008 launch date. LRO will have a mission duration of one year with the possibility of extended operations. To help formulate LRO goals, NASA solicited the guidance of the science community through an Objectives, Requirements and Definition Team (ORDT) that provided a set of priority measurements. The ORDT objectives formed the basis of a NASA Announcement of Opportunity (AO) to competitively select instruments for LRO.

LRO AO solicited measurement investigations that will provide the following measurement sets:

- Characterization of the deep space radiation environment in lunar orbit, including neutron albedo (especially at energies in excess of 10 Mega electron Volts [MeV]), as well as:
    - Characterization of biological effects caused by exposure to the lunar orbital radiation environment
    - Characterization of changes in the properties of multifunctional radiation shielding materials caused by extended exposure to the lunar orbital environment
- Geodetic lunar global topography (at landing-site relevant scales)
- High spatial resolution hydrogen mapping of the Moon's surface
- Temperature mapping in the Moon's polar shadowed regions

Fig. 1 Artist rendering of the LRO Spacecraft design

- Landform-scale imaging of lunar surfaces in permanently shadowed regions
- Identification of putative deposits of appreciable near-surface water ice in the Moon's polar cold traps
- Assessment of meter and smaller-scale features to facilitate safety analysis for potential lunar landing sites
- Characterization of the illumination environment in the Moon's polar regions at relevant temporal scales (i.e., in terms of hours)

To fulfill the goals set by the ORDT and the LRO AO, NASA announced that the following six instruments had been selected for use on LRO in December 2004 and in addition to the six competitively selected instruments, LRO will also include a Mini Radio Frequency Technology Demonstration (Mini-RF).

***Lunar Orbiter Laser Altimeter (LOLA)*:** LOLA will determine the global topography of the lunar surface at high resolution, measure landing site slopes, surface roughness, and search for possible polar ice in shadowed regions. PI, David Smith, NASA Goddard Space Flight Center, Greenbelt, Maryland.

***Lunar Reconnaissance Orbiter Camera (LROC*)**: LROC will acquire targeted images of the lunar surface capable of resolving small-scale features that could be landing site hazards, as well as wide-angle images at multiple wavelengths of the lunar poles to document changing illumination conditions and potential resources. PI, Mark Robinson, Northwestern University, Evanston, Illinois.

***Lunar Exploration Neutron Detector (LEND)*:** LEND will map the flux of neutrons from the lunar surface to search for evidence of water ice, and will provide space radiation environment measurements that may be useful for future human exploration. PI, Igor Mitrofanov, Institute for Space Research, and Federal Space Agency, Moscow.

Diviner Lunar Radiometer Experiment (DLRE): DLRE will chart the temperature of the entire lunar surface at roughly 985 feet (300 meter) horizontal scales to identify cold-traps and potential ice deposits. PI, David Paige, University of California, Los Angeles.

***Lyman-Alpha Mapping Project (LAMP*)**: LAMP will observe the entire lunar surface in the far ultraviolet. LAMP will search for surface ice and frost in the polar regions and provide images of permanently shadowed regions illuminated only by starlight. PI, Alan Stern, Southwest Research Institute, Boulder, Colorado.

***Cosmic Ray Telescope for the Effects of Radiation (CRaTER*)**: CRaTER will investigate the effect of galactic cosmic rays on tissue-equivalent plastics as a constraint on models of biological response to background space radiation. PI, Harlan Spence, Boston University, Massachusetts.

Mini Radio-Frequency Technology Demonstration (Mini-RF) The Mini-RF system has been included in the LRO payload through multi-agency agreements and sponsorship. Its primary purpose is technical demonstration in the lunar environment of a unique miniaturized multi-mode radar observatory. Its synthetic aperture radar (SAR) imaging modes are most relevant to the scientific and exploratory roles of LRO. Keith Raney, Applied Physics Laboratory, Laurel Maryland.