THE LUNAR RECONNAISSANCE ORBITER EDUCATION AND PUBLIC OUTREACH PROGRAM.

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Introduction: The Lunar Reconnaissance Orbiter (LRO) spacecraft is the first of a series of robotic missions to the moon as part of NASA’s Vision for Space Exploration. The spacecraft is focused on finding safe landing sites for future human and robotic missions, exploring the permanently shadowed regions of the moon, determining the lunar radiation environment, and searching for lunar resources. LRO will determine the global topography of the lunar surface, obtain high resolution images, search for water in the permanently shadowed regions of the moon, and points of near continuous illumination that can be exploited for solar power.

Our education and outreach program has formal and informal components with the formal program focused on K-12 education as well as college. Informal education plans include products and professional development opportunities for museums, libraries, after school programs and youth groups.

Because the recent emphasis by many of the world’s space programs, including the United States through the Vision for Space Exploration, there will be a broad array of outreach efforts devoted to the moon. The LRO EPO plan strives to be international in scope through coordination and cooperation with the international lunar community. Many of the EPO activities cut across the interests of all lunar science, but the LRO EPO program will naturally highlight the LRO mission where we are best able to leverage our access to the science and engineering teams.

LRO is comprised of six research instruments and a technology demonstration that will search for water ice, map the surface of the moon, and assess the chemical composition for identification of potential resources. Each instrument is managed by a different institution and has its own education and public outreach (EPO) effort. Coordination of LRO EPO is managed through the LRO Project Science Office.

LRO Instrument EPO Plans

Lyman-Alpha Altimeter Mapping Project (LAMP). The LAMP instrument will use UV radiation from starlight to find frozen water in the permanently shadowed regions on the moon. LAMP is lead by PI Alan Stern and is managed by the Southwest Research Institute. The Denver Museum of Nature & Science will lead the development of education programs and a small museum exhibit. Rocky Mountain Public Broadcasting Service (PBS) will assist with a public broadcast of LAMP mission goals and scientist discussions. A DVD that focuses on the mission’s search for water and on the scientists that are involved will be distributed. Other products include a series of lectures for adult audiences, a teacher program, and a public event on the day of the launch.

Diviner Lunar Radiometry Experiment (DLRE). Diviner is a University of California, Los Angeles (UCLA) activity lead by PI David Paige that will measure lunar surface temperatures. The temperature of the lunar surface and subsurface is a key environmental characteristic for the planning of future robotic and human exploration. The education and outreach plan will be implemented by a series of partners including UCLA, the Bishop Museum in Honolulu, Hawaii, the Science and Natural History Filmmaking School of MSU, NASA’s Solar System Ambassadors, and the Mars Museum Alliance. A unique element of the public outreach plan is to engage the people in selecting landing sites. Other activities include offering professional development workshops to educators, museum exhibits, a public lecture series, and a documentary about LRO and the Diviner instrument.

Lunar Reconnaissance Orbiter Camera (LROC). LROC, includes narrow angle and wide angle cameras and is led by PI Mark Robinson, Arizona State University.

LROC will acquire images to assess meter and smaller scale features to facilitate safety analysis for potential lunar landing sites near polar resources and elsewhere on the Moon. Partners for education and public outreach include the Adler Planetarium and Science Center, DePaul Space Science Center, Great Lakes Planetarium Association, and the Chicago Astronomical Society. An innovative strategy will be employed to engage educators in the mission. An education image processing tool kit adapted from the Mars Student Imaging Project, will allow students and teachers to analyze images from LROC’s cameras. Amateur astronomers and planetarium educators will be trained to present workshops to teachers. Animations and other visuals will also be incorporated into small kiosk displays for small planetaria, and the Adler Planetarium will install an Interactive Moon Wall with high-resolution LROC images.

Lunar Orbiter Laser Altimeter (LOLA). LOLA is led by co-PIs David Smith of NASA Goddard Space Flight Center (GSFC) and Maria Zuber of MIT. LOLA, managed by GSFC, will utilize a laser to produce a high-resolution global topographic model of the moon. This enables precise targeting, safe landing and surface mobility to carry out lunar exploration. LOLA will also characterize the polar illumination environment, and image permanently shadowed Polar Regions of the Moon to identify possible locations of surface ice crystals in shadowed polar craters. The education plan capitalizes on several of NASA’s K-12 education
programs, including the NASA Explorer Schools and Aerospace Education Specialists. In conjunction with other partners at GSFC, JSC and the Smithsonian Institution National Air and Space Museum, the LOLA education team will revise and update older NASA lunar-themed education materials, create 3-D models of Moon topography, and implement in-depth training to Explorer School educators. The LOLA team will also present a series of webcasts during instrument development and testing and LOLA’s integration into the LRO spacecraft.

Cosmic Ray Telescope for the effects of Radiation (CRaTER). Harlan Spence, Boston University, leads CRaTER. The primary goal of CRaTER is to characterize the global lunar radiation environment and its biological impacts. This objective is critical if we are to implement a sustained, safe, and affordable human and robotic program. The Center for Integrated Space Weather Modeling at Boston University will provide LRO education materials through their summer school program in Space Weather. The Boston University College of Engineering will also offer small research grants to undergraduate and graduate students to perform related studies.

Lunar Exploration Neutron Detector (LEND) The LEND experiment was proposed by Igor Mitrofanov Principle Investigator from Russian Institute for Space Research. Partners include the University of Maryland and GSFC. LEND will provide the measurements which include the creation of high resolution Hydrogen distribution maps and the characterization of surface distribution and column density of possible near-surface water ice deposits in the Moon’s polar cold traps. Education and public outreach will be managed through partnerships with the American Institute of Physics and Society of Physics Students. Undergraduate students and faculty teams from NASA Minority University Space Interdisciplinary Network (MU-SPIN) schools will be responsible for processing LEND data. The teams will spend several summers at GSFC to help develop data processing code and will then set up processing centers at their home institutions.

Current LRO EPO Partnerships

Lunar and Planetary Institute. "To the Moon and Beyond: Engaging Children in NASA Lunar Exploration in Libraries" is a partnership between NASA and the informal library community. LPI and the LRO EPO team developed a module for children ages 8 to 13 that leverages the LRO mission to excite them about our Nation’s future exploration of the Moon; the module is available on the LPI website. 70 public and school librarians from MD, DE and PA attended one of two two-day workshops at GSFC to learn about LRO and the activities in the module. These librarians receive long term support to conduct lunar education programs in their communities through continued interaction with LPO EPO and project members. The “Explore the Moon” module is also available to other librarians who take part in LPI’s “Exploration Systems Mission Outreach” project.

Moon Mineralogy Mapper. The Lunar Outpost 2018 project focused on the science and education initiatives being developed the Moon Mineralogy Mapper a spectrometer that will fly onboard Chandrayaan-1 in 2007, and LRO. Workshop participants from museums and science centers participated in three Institute activities designed to help each museum develop lunar outpost exhibit and/or education program. The launch of Lunar Outpost web sites and initial designs will be linked via each museum/science center’s web site.

Girl Scouts USA, JPL and JSC. The JPL/JSC team implementing the ESMD funded workshop development and implementation project, “Girl Scouts Exploring in the 21st Century: Promise Them the Moon and Mars”, will actively incorporate personnel, resources, and activities from the LRO education program in the education of a team of adult Girl Scouts equipped to share NASA exploration with girls and families all over the nation. The LRO E/PO program, will work with the JPL/JSC team to incorporate active hands-on activities and mission speakers in the workshop for the adult Girl Scout NASA Core Trainers in the summer of 2007.

ESMD Related Projects: Field Trip to the Moon, (MSFC) a cooperative effort between NASA and the American Museum of Natural History (AMNH) to create and disseminate a new and multi-sensory program for school groups visiting museums and science centers; Lunar Nautics,(MSFC) a compilation of hands-on activities hosted by Discovery Place museum where participants will design, test, analyze and budget a space mission to the moon from inception to conclusion.; Radiation and Human Space Flight (MSFC) a video and curriculum module and professional development that introduces students to radiation through NASA studies for astronaut safety.