Lunar Reconnaissance Orbiter

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The **Lunar Reconnaissance Orbiter** (**LRO**) is a robotic spacecraft which the United States plans to place in orbit around the Moon.[1] Launch aboard an Atlas V is scheduled for February 27, 2009.[3][2] LRO will be the first mission with a primary objective to implement the United States Vision for Space Exploration. To successfully attain the goals of "The Vision", that include human exploration of the Moon, LRO will survey lunar resources and identify possible landing sites.

The LRO launch vehicle will also carry the Lunar CRater Observation and Sensing Satellite (**LCROSS**), which is designed to detect water liberated as the launch vehicle's spent upper stage strikes a lunar crater. Together, LCROSS and LRO form the vanguard of the NASA Lunar Precursor Robotic Program's return to the Moon.[4]

Lunar Reconnaissance Orbiter

LRO Spacecraft, Artist Rendering

Organization	NASA
Mission type	Orbiter
Satellite of	The Moon
Orbits	30 - 70 km polar orbit
Launch date	No earlier than February 2009 [1]
Launch vehicle	Atlas V 401 [1][2]
Mission duration	1 year
NSSDC ID	LUNARRO (http://nssdc.gsfc.nasa.gov/nmc/masterCatalog.do?sc=LUNARRO)
Webpage	Lunar Reconnaissance Orbiter (http://lunar.gsfc.nasa.gov/)

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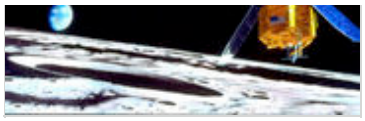
Mission

Under development by NASA's Goddard Space Flight Center, LRO is planned to be a large and sophisticated spacecraft in a polar orbit for a nominal mission of one Earth year. An optional extended phase of the mission (up to 5 years) could provide a communications relay for other future ground lunar

missions, such as a moon lander or rover.



Lunar Reconnaissance Orbiter (Concept study, ca. 2003, now obsolete).

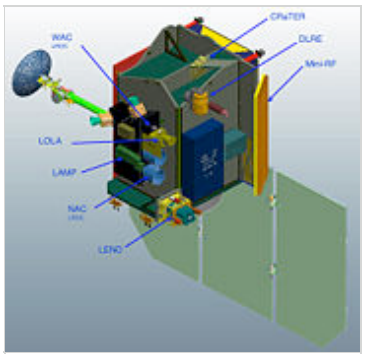
A preliminary design review was completed in February 2006 and the critical design review was completed in November of 2006.[5]

Areas of investigation will include:[6]

- Selenodetic global topography
- Characterization of deep space radiation in Lunar orbit
- The lunar polar regions, including possible water ice deposits and the lighting environment
- High-resolution mapping (max 0.5 m) to assist in the selection and characterization of future landing sites

Onboard instruments

The orbiter will carry a complement of six instruments and one technology demonstration:



Onboard instruments.

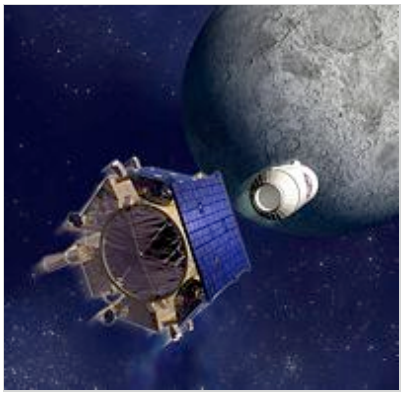
- CRaTER — The primary goal of CRaTER is to characterize the global lunar radiation environment and its biological impacts.[7]
- DLRE — The Diviner Lunar Radiometer Experiment will measure lunar surface thermal emission to provide essential information for future surface operations and exploration.[8]
- LAMP — The Lyman-Alpha Mapping Project will peer into permanently shadowed craters in search of water ice, seeing by the ultraviolet light from stars and the interplanetary medium.[9]
- LEND — The Lunar Exploration Neutron Detector will provide measurements, create maps, and detect possible near-surface water ice deposits..[10]
- LOLA — The Lunar Orbiter Laser Altimeter (LOLA) investigation will provide a precise global lunar topographic model and geodetic grid
- LROC — The Lunar Reconnaissance Orbiter Camera (LROC) has been designed to address the measurement requirements of landing site certification and polar illumination.[11] LROC comprises a pair of narrow-angle cameras (NAC) and a single wide-angle camera (WAC). LROC will fly several times over the historic Apollo lunar landing sites, with the camera's high resolution, the lunar rovers and Lunar Module descent stages and their respective shadows will be clearly visible. It is expected that this photography will boost public acknowledgement of the validity of the landings, and discredit the Apollo conspiracy theories.[12]
- Mini-RF — This will demonstrate new lightweight SAR and communications technologies and locate potential water-ice.

LRO's high-resolution mapping will show some of the larger pieces of equipment previously left on the Moon, and will return approximately 70–100 TB of image data.

Name to the Moon

Prior to the LRO's launch, NASA is giving members of the public the opportunity to have their names placed in a microchip on the LRO.[13]

LCROSS


LCROSS.

Piggy-backing on the launch of LRO will be the Lunar CRater Observation and Sensing Satellite (LCROSS), which is designed to watch as the launch vehicle's Centaur upper stage strikes a permanently shadowed region near the south pole of the Moon.[14] NASA expects the impact velocity will be about 9,000 km/hr.[15] It is hoped that spectral analysis of the resulting impact plume will help to confirm preliminary findings by the Clementine and Lunar Prospector missions which hinted that there may be water ice in the permanently shadowed regions. LCROSS will fly through the debris plume, then approximately 4 minutes after the Centaur impact will itself crash into a different part of the crater.

The LCROSS instrument payload, provided by NASA Ames Research Center, includes cameras working at visible, near infrared, and mid infrared wavelengths, as well as visible light and near infrared spectrometers, a photometer, and a data handling unit.[16] Mission scientists estimate that the Centaur impact plume may be visible through amateur-class telescopes with apertures as small as 10 to 12 inches.[17] Both impacts will also be monitored by Earth-based observatories and possibly by other orbital assets.

The addition of the LCROSS payload came about after NASA changed LRO to a larger rocket from the Delta II. It was chosen from 19 other proposals.[18] LCROSS is being managed by NASA's Ames Research Center and built by Northrop Grumman. The LCROSS preliminary design review was completed on 2006-09-08. The LCROSS mission passed its Mission Confirmation Review on 2007-02-02[19] and its Critical Design Review on 2007-02-22.[20] After assembly and testing at Ames, the instrument payload, provided by Ecliptic Enterprises Corporation,[21] was shipped to Northrop Grumman on 2008-01-14 for integration with the spacecraft.[22]

Launch, cis-lunar transfer and lunar orbit insertion

A nominal mission profile includes a launch providing a characteristic energy (C_3) of -1.85 km^2s^{-2}, leading to a cis-lunar transfer time of approximately 4 days, followed by lunar orbit insertion through a series of five implusive maneuvers requiring delta-vs of 11 to 385 meters per second.[23]

See also

- Exploration of the Moon
- List of current and future lunar missions
- Lunar ice
- Mars Reconnaissance Orbiter

References

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External links

- Lunar Reconnaissance Orbiter Acquisition Program (http://lro.larc.nasa.gov/)
- Lunar Reconnaissance Orbiter at GSFC (http://lunar.gsfc.nasa.gov)
- Lunar Reconnaissance Orbiter Mission Profile (http://solarsystem.nasa.gov/missions/profile.cfm?MCode=LRO) by NASA's Solar System Exploration (http://solarsystem.nasa.gov)
- CRaTER Instrument Home Page (http://crater.bu.edu/)
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