National Aeronautics and Space Administration

NASA facts

Lunar Precursor Robotic Program

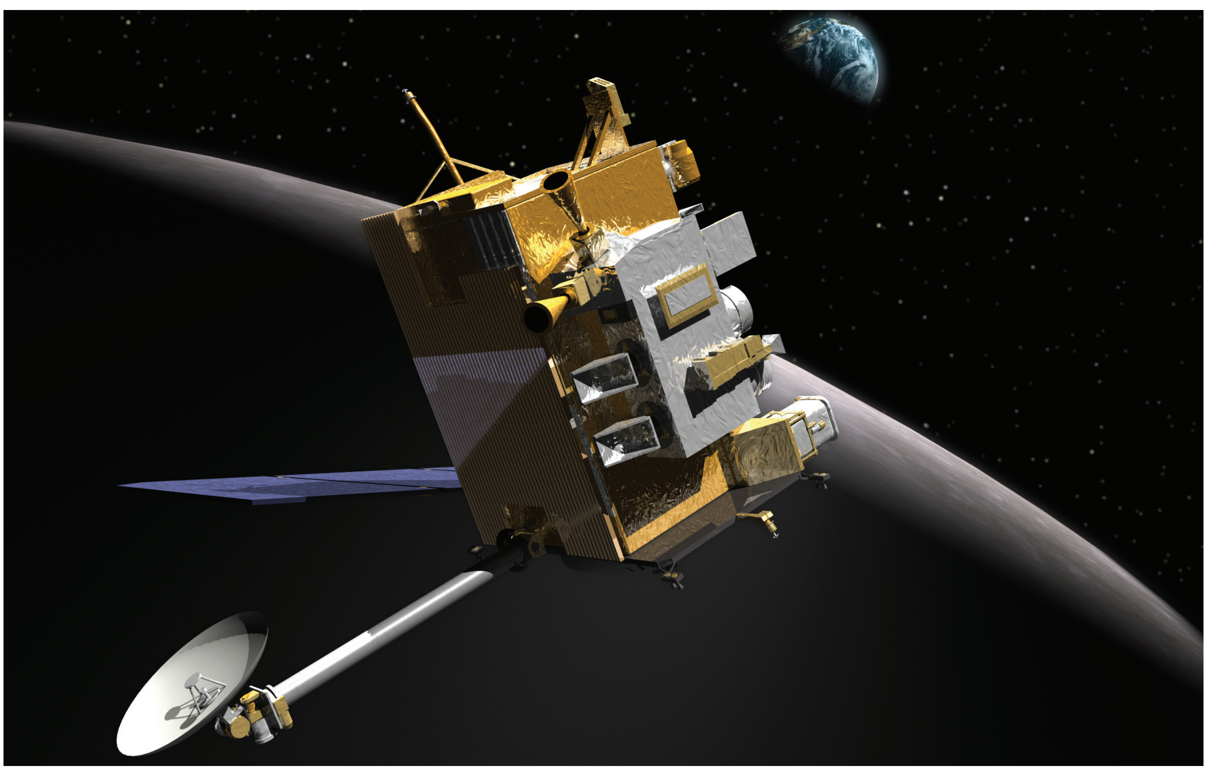
Leading the Way Back to the Moon

Returning to the Moon

The United States and a host of international agencies have begun a program to extend human presence in the solar system, beginning with a return to the moon. The return to the moon to establish a sustained human presence on another planetary surface will enable the pursuit of scientific activities that address fundamental questions about the history of Earth, the solar system and the universe—and about our place in them. It will allow us to test technologies, systems, flight operations and exploration techniques to reduce the risk and increase the productivity of future missions to Mars and beyond. It will also expand Earth's economic sphere and enable commercial activities with benefits to life on our home planet.

Lunar Precursor Robotic Program Office

NASA's Lunar Precursor Robotic Program (LPRP) Office located at Marshall Space Flight Center in Huntsville, Ala., manages two pathfinding robotic missions to the moon for the Exploration Systems Mission Directorate at NASA's Headquarters in Washington, D.C., the Lunar Reconnaissance Orbiter and the Lunar Crater Observation and Sensing Satellite. These precursor missions will provide data with unprecedented accuracy that describes the lunar environment for mapping and modeling, enabling establishment of a lunar outpost in preparation for sustained human exploration. In addition to the two missions and the mapping responsibility, the Lunar Precursor Robotic Program is responsible for management of public outreach. While



The Lunar Reconnaissance Orbiter will spend at least one year in low, polar orbit, with all six instruments working simultaneously to collect detailed information about the lunar environment.

the Lunar Precursor Robotic Program currently is part of NASA's Exploration Systems Mission Directorate, it will transition to the Science Mission Directorate in 2010 as a part of the agency's Lunar Science Program.

Currently, the Lunar Precursor Robotic Program oversees development of the next two NASA flight missions to the moon: the Lunar Reconnaissance Orbiter (LRO) and the Lunar Crater Observation and Sensing Satellite (LCROSS). The Lunar Reconnaissance Orbiter and the Lunar Crater Observation and Sensing Satellite are co-manifested and scheduled for launch in early 2009. Together they will extend our understanding of the lunar environment, preparing us for sustainable human missions to the moon.

Lunar Reconnaissance Orbiter

The Lunar Reconnaissance Orbiter is the first step in NASA's endeavor to create a comprehensive atlas of the moon's features and resources. This robotic mission will provide data necessary to design a lunar outpost. It follows in the footsteps of the predecessors to the Apollo missions —Ranger, Lunar Orbiter and Surveyor—missions designed in part to search for the best possible lunar landing sites for the first Apollo astronauts. It also builds on a rich recent history of later lunar missions such as Clementine, Lunar Prospector, the Indian Space Research Organization's Chandrayaan-1, the Japan Aerospace Exploration Agency's Kaguya, and the European Space Agency's SMART-1, which provided more detailed images of the lunar surface and initial assessments of resources. Because future missions will involve humans living for extended periods on the moon's surface at lunar outposts, the goals of the project go beyond the requirements of these previous missions. Data from the mission will fill gaps and significantly improve accuracy to prepare for this extended stay.

The Lunar Reconnaissance Orbiter is scheduled for launch in 2009 on an Atlas V rocket. Transfer to the moon will take approximately four days. It will then enter an elliptical orbit —called the commissioning orbit, where the final checkout of the spacecraft and its instruments will be done—from which it will move into its final orbit. The final orbit will be a circular polar orbit approximately 50 km, a little more than 30 miles, above the moon's surface—closer than any other lunar mission. The orbiter will spend at least one year in low polar orbit around the moon, collecting detailed information about the lunar environment. Its payload of six instruments will provide improved accuracy maps and higher resolution images of future lunar landing sites, assess potential lunar resources and characterize the radiation environment.

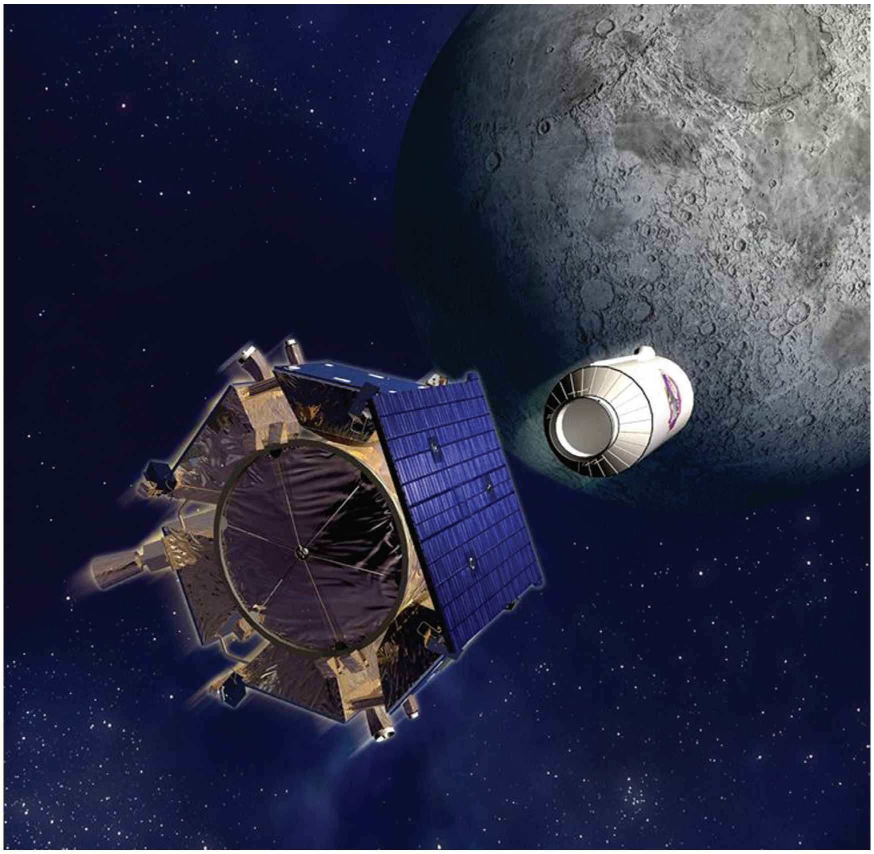
The mission will return the most detailed global lunar data gathered to date, including day-night temperature maps, topographical information, high resolution multi-band imaging, and measurements of the moon's ultraviolet albedo, or the reflectivity of the moon's surface. Although the orbiter's primary objective is exploration, the payload's scientific instruments will enable transition, after one year, to science exploration under NASA's Science Mission Directorate.

NASA's Goddard Space Flight Center in Greenbelt, Md., manages the Lunar Reconnaissance Orbiter project. Goddard will build the spacecraft, integrate instruments and provide payload accommodations, mission operations, systems engineering, assurance and management.

Lunar Crater Observation and Sensing Satellite

The Lunar Crater Observation and Sensing Satellite (LCROSS) mission, the second flight mission managed by the Lunar Precursor Robotic Program, will begin its trip to the moon on the same rocket as the Lunar Reconnaissance Orbiter. The primary objective of the observation and sensing satellite mission is, in a low-cost, low-technology manner, to try to confirm the presence of water ice at a location within a permanently shadowed crater near one of the moon's polar regions. Previous lunar missions have detected enhanced hydrogen levels at craters near the lunar poles. Scientists believe this hydrogen may be present in the form of water ice embedded in permanently shadowed craters. Water ice could have many uses in lunar exploration ranging from drinking water to breathable oxygen. Hydrogen harvested from water ice could be used for rocket fuel, and water could even act as a barrier against radiation to help protect astronauts and their lunar habitats.

After the Lunar Reconnaissance Orbiter separates from the Atlas V launch vehicle for its own mission, the Lunar Crater Observation and Sensing Satellite will use the spent Centaur upper stage rocket as a 2,200-kilogram (4,850-pound) lunar impactor, targeting a permanently shadowed crater near one of the lunar poles. This experiment will analyze the moment of impact, when a greater than 250 metric ton plume of lunar ejecta (material "ejected" from the moon upon impact) rises above the moon's surface. The spacecraft will observe the plume of material with a suite of nine science instruments to look for water ice and examine lunar soil. Approximately four minutes after the first impact, the satellite will fly through the plume and then impact the moon's surface. These impacts may be observable from a number of lunar-orbiting satellites as well as Earth-based telescopes.



The two main components of the Lunar Crater Observation and Sensing Satellite mission are the Shepherding Spacecraft and the Centaur upper stage rocket. The Shepherding Spacecraft guides the rocket to a site selected on the moon and then, after separating from it, analyzes the dust cloud created by the Centaur impact.

NASA's Ames Research Center in Moffett Field, Calif., oversees the development of the Lunar Crater Observation and Sensing Satellite mission with its spacecraft and integration partner Northrop Grumman. Ames is managing the mission, performing mission operations, and developing the payload instruments, while Northrop Grumman is designing and building the spacecraft for this innovative mission.

Mapping the Moon— Lunar Mapping and Modeling Project

The Lunar Precursor Robotic Program's Lunar Mapping and Modeling Project will integrate new data from these missions, and potentially from international missions, with existing information to develop highly detailed surface maps of topography and resource distribution. The project also will develop computer models of radiation and sunlight levels on the lunar surface. By using information from historical missions, the upcoming Lunar Reconnaissance Orbiter mission, and international lunar missions, NASA will develop tools to aid the Constellation Program in planning for habitat development and location, power systems development, resource utilization and other engineering activities on the moon.

Leading the Way Back to the Moon

The Lunar Precursor Robotic Program is preparing the way for humankind's successful and productive return to the moon by taking that crucial first step, providing strategic knowledge necessary to make informed, efficient and cost-effective decisions for sustainable human lunar return. The Lunar Precursor Robotic Program will create a foundation for future space exploration, thereby providing benefits to humankind and converting dreams into reality.

For more information on the Lunar Precursor Robotic Program, visit:
http://moon.msfc.nasa.gov

For information about NASA and agency programs on the Web, visit:
http://www.nasa.gov

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George C. Marshall Space Flight Center
Huntsville, AL 35812
www.nasa.gov/marshall

www.nasa.gov

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