The Lunar Reconnaissance Orbiter (LRO)  
Mission Overview  

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Lunar Reconnaissance Orbiter (LRO)  
First Step in the Robotic Lunar Exploration Program

LRO Objectives

- Characterization of the lunar radiation environment, biological impacts, and potential mitigation. Key aspects of this objective include determining the global radiation environment, investigating the capabilities of potential shielding materials, and validating deep space radiation prototype hardware and software.

- Develop a high resolution global, three dimensional geodetic grid of the Moon and provide the topography necessary for selecting future landing sites.

- Assess in detail the resources and environments of the Moon’s polar regions.

- High spatial resolution assessment of the Moon’s surface addressing elemental composition, mineralogy, and Regolith characteristics.

Objective: The Lunar Reconnaissance Orbiter (LRO) mission objective is to conduct investigations that will be specifically targeted to prepare for and support future human exploration of the Moon.
LRO Mission Overview

- Launched June 18, 2009 on a Atlas-V into a direct insertion trajectory to the moon.
- On-board propulsion system used to capture at the moon, insert into and maintain 50 km altitude circular polar reconnaissance orbit.
- 1 year prime mission, 2+ year extended mission

- 810 kilogram dry mass
- 894 kilograms fuel
- 823 watts orbit average power
- 4kbps S-band uplink
- 100Mbps Ka-Band downlink
- GSFC In-house spacecraft bus
- One RAD750 S/C processor
- 1553 and Spacewire data bus
- 7 science instruments
Trajectory/Orbit Overview

Minimum Energy Lunar Transfer: ~ 4 days

Lunar Orbit Insertion Sequence (4): 2-4 days

30 x 216 km Orbit: up to 60 days

50 km Polar Mapping Orbit: at least 1 year
Spacecraft - Artist’s Conception
Spacecraft - Photo
## LRO Payload Overview

<table>
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<tr>
<th>INSTRUMENT</th>
<th>Measurement</th>
<th>Exploration Benefit</th>
<th>Science Benefit</th>
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<tr>
<td>CRaTER</td>
<td>Tissue equivalent response to radiation</td>
<td>Safe, high performance, lighter weight space vehicles</td>
<td>Radiation boundary conditions for biological response</td>
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<tr>
<td>DLRE</td>
<td>Better than 500m scale maps of Temperature, surface ice, mineralogy</td>
<td>Determines conditions for systems operability, resource including water-ice location</td>
<td></td>
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<tr>
<td>LAMP</td>
<td>Maps of frosts in permanently shadowed areas, etc.</td>
<td>Locate potential water-ice on the surface, image shadowed areas</td>
<td>Source, history, migration and deposition of polar volatiles</td>
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<tr>
<td>LEND</td>
<td>Maps of hydrogen in upper 1 m of Moon at 10km scales</td>
<td>Locate potential water-ice in lunar soil</td>
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<tr>
<td>LOLA</td>
<td>~50 m scale polar topography at &lt;10 cm vertical, roughness</td>
<td>Safe landing sites and surface navigation</td>
<td>Geodetic topography for geological evolution</td>
</tr>
<tr>
<td>LROC</td>
<td>1000's of 50cm/pixel images (125km2), and entire Moon at 100m in UV, Visible</td>
<td>Surface Landing hazards and some resource identification</td>
<td>Tectonic, impact and volcanic processes, resource evaluation, and crustal evolution</td>
</tr>
<tr>
<td>Mini-RF</td>
<td>X&amp;S-band Radar imaging and radiometry</td>
<td>Demonstrate new lightweight SAR and communication technologies, locate potential water-ice</td>
<td>Source, history, deposition of polar volatiles</td>
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- **CRaTER**: Cosmic Ray Telescope for the Effects of Radiation
- **DLRE**: Diviner Lunar Radiometer Experiment
- **LAMP**: Lyman Alpha Mapping Project
- **LEND**: Lunar Exploration Neutron Detector
- **LOLA**: Lunar Orbiter Laser Altimeter
- **LROC**: Lunar Reconnaissance Orbiter Camera
- **Mini-RF**: Technology Demonstration

**Exploration Benefits**
- Safe, high performance, lighter weight space vehicles
- Determines conditions for systems operability, resource including water-ice location
- Locate potential water-ice on the surface, image shadowed areas
- Locate potential water-ice in lunar soil
- Safe landing sites and surface navigation
- Surface Landing hazards and some resource identification
- Demonstrate new lightweight SAR and communication technologies, locate potential water-ice

**Science Benefits**
- Radiation boundary conditions for biological response
- Source, history, migration and deposition of polar volatiles
- Geodetic topography for geological evolution
- Tectonic, impact and volcanic processes, resource evaluation, and crustal evolution
- Source, history, deposition of polar volatiles
Apollo 12 Landing Site - LROC
Additional Resources

- **NASA LRO Mission Website:**

- **LRO Project Website:** lro.gsfc.nasa.gov

- **LRO on Twitter:** twitter.com/LRO_NASA

- **LRO Blog:** lroupdate.blogspot.com