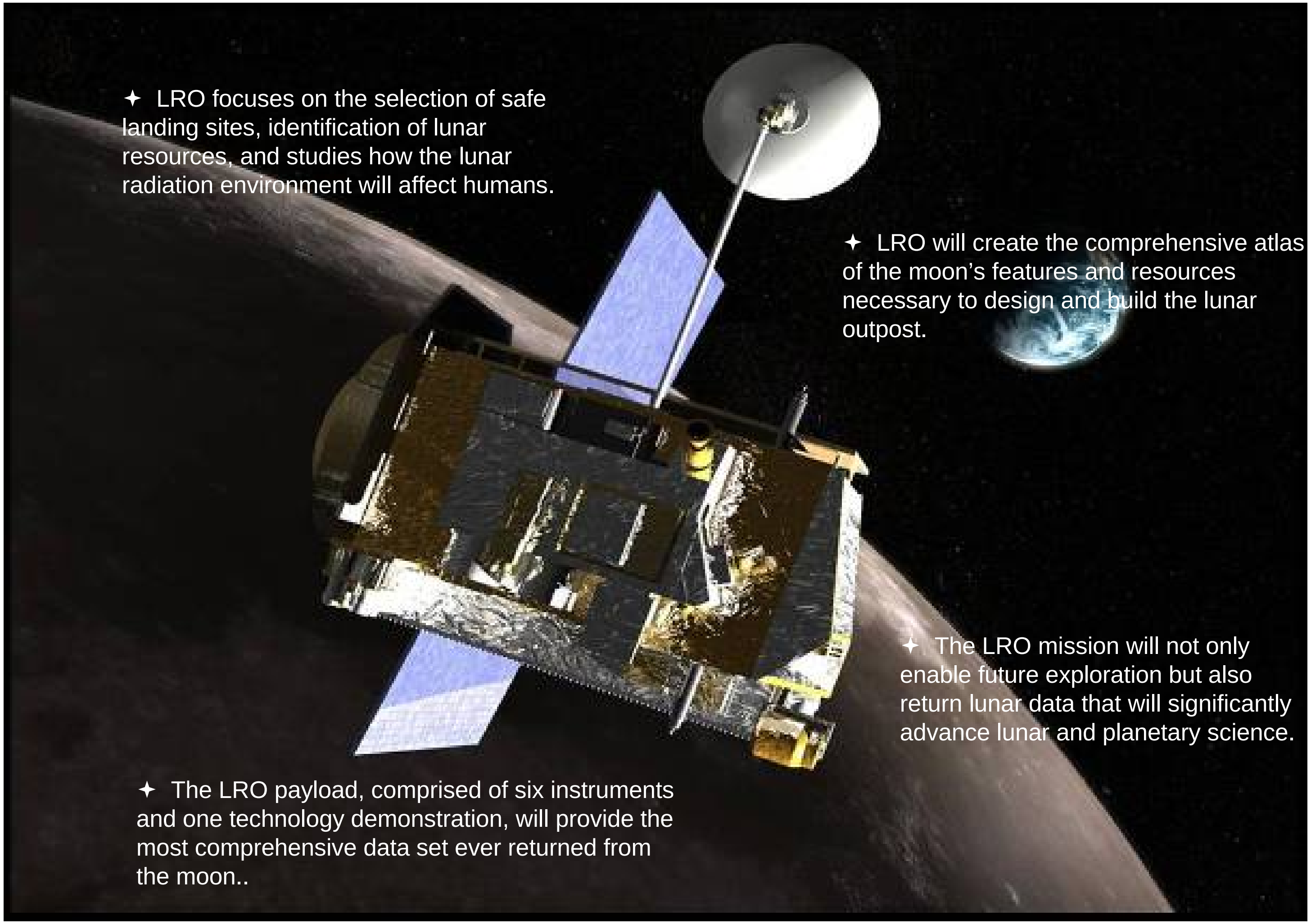
Lunar Reconnaissance Orbiter Overview

The Lunar Reconnaissance Orbiter (LRO) is NASA's first step in returning humans to the moon.



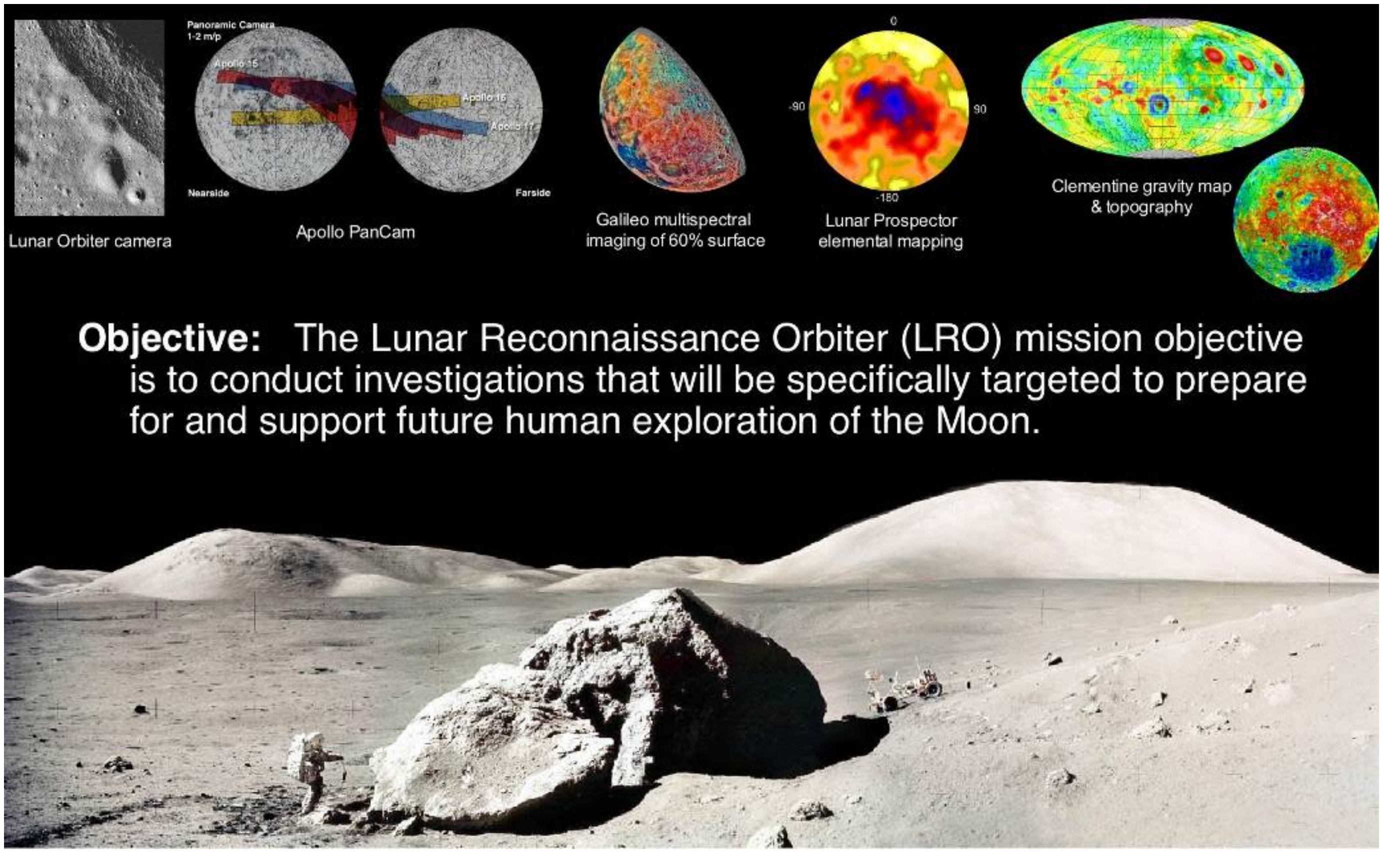
✦ LRO focuses on the selection of safe landing sites, identification of lunar resources, and studies how the lunar radiation environment will affect humans.

✦ LRO will create the comprehensive atlas of the moon's features and resources necessary to design and build the lunar outpost.

✦ The LRO mission will not only enable future exploration but also return lunar data that will significantly advance lunar and planetary science.

✦ The LRO payload, comprised of six instruments and one technology demonstration, will provide the most comprehensive data set ever returned from the moon..

Lunar Reconnaissance Orbiter
Mission Objectives



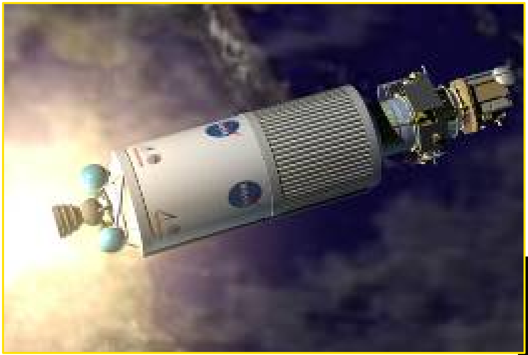
Safe Landing Sites
High resolution imagery
Global geodetic grid
Topography
Rock abundances

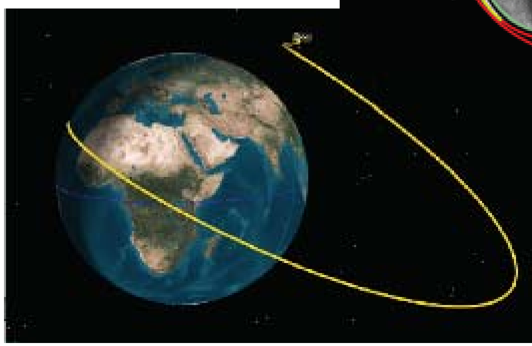
Locate Potential Resources
Hydrogen/water at the lunar poles
Continuous solar energy
Mineralogy

Space Environment
Energetic particles
Neutrons

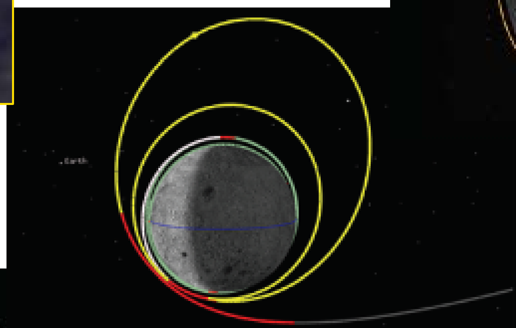
LRO Mission Overview

Launch: October 28, 2008



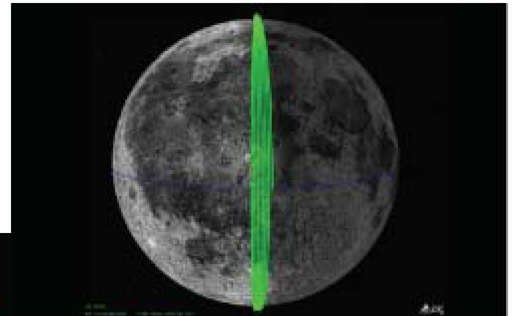


Minimum Energy
Lunar Transfer ~ 4 Days



Lunar Orbit Insertion
Sequence, 4-6 Days

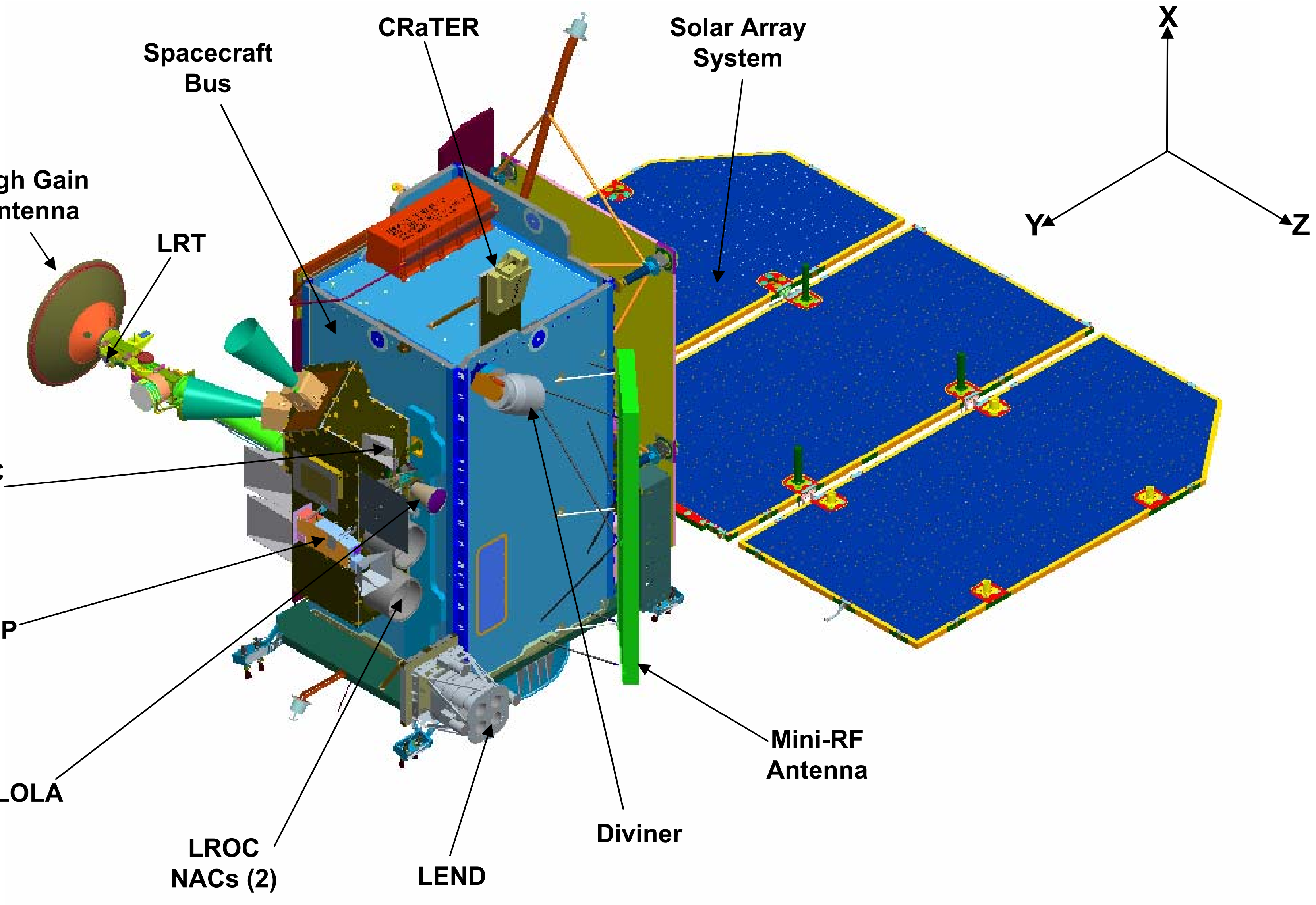
Commissioning Phase,
30 x 216 km Altitude
Quasi-Frozen Orbit,
Up to 60 Days



Polar Mapping Phase,
50 km Altitude Circular Orbit,
At least 1 Year

Nominal End of Mission: February 2010

LRO Spacecraft



Orbiter Instrumentation

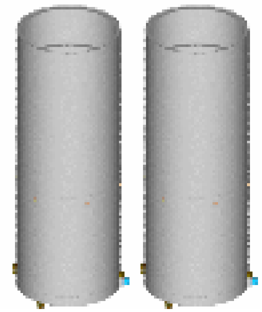
LROC/WAC: Wide-Angle Camera

- Global Imagery
- Lighting
- Resources

Day Side
Autonomous

LROC/NACs: Narrow-Angle Cameras

- Targeted Imagery
- Hazards
- Topography



Day Side
Timeline Driven

LOLA: Lunar Orbiter Laser Altimeter

- Topography
- Slopes
- Roughness

Full Orbit
Autonomous

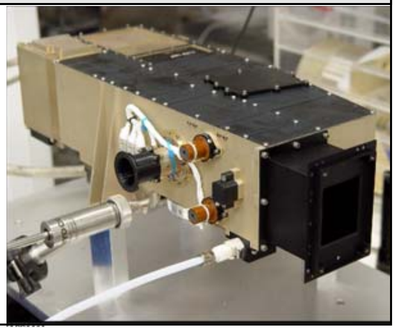
DLRE: Diviner Lunar Radiometer Exp.

- Temperature
- Hazards
- Resources

Full Orbit
Autonomous

LAMP: Lyman-Alpha Mapping Project

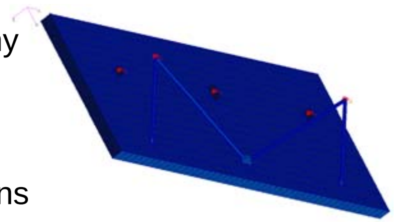
- Water-Frost
- PSR Maps



Night Side
Autonomous

Mini-RF: Synthetic Aperture Radar

- Tech Demonstration
- Resources
- Topography



Polar Regions
Timeline Driven

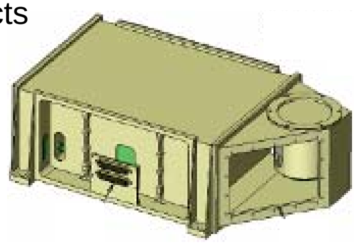
LEND: Lunar Explr. Neutron Detector

- Neutron Albedo
- Hydrogen Maps

Full Orbit
Autonomous

CRaTER: Cosmic Ray Telescope…

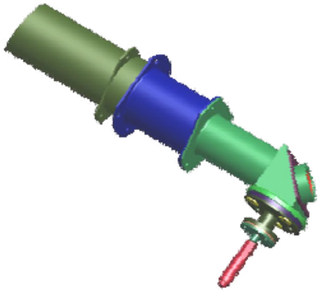
- Radiation Spectra
- Tissue Effects



Full Orbit
Autonomous

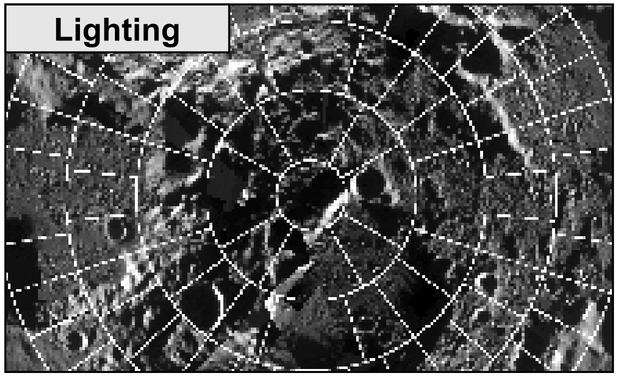
LRT: Laser Ranging Telescope

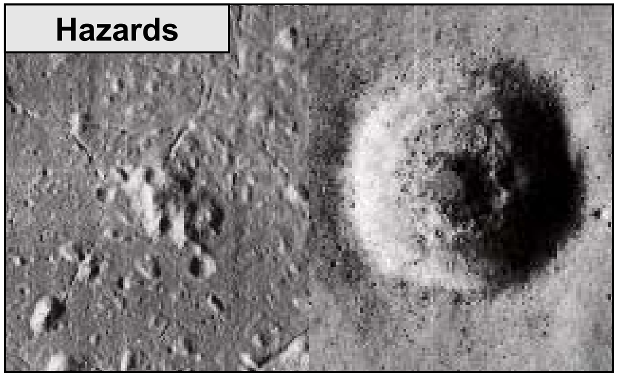
- Topography
- Gravity

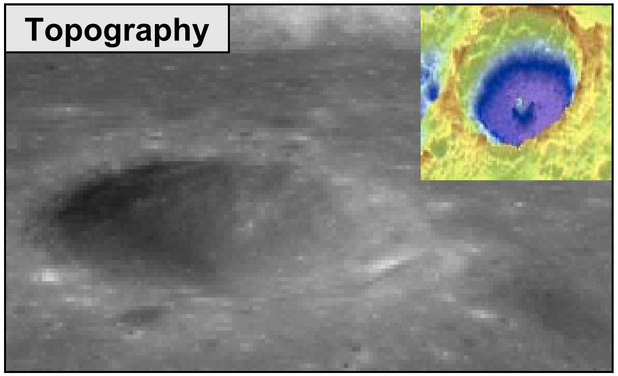


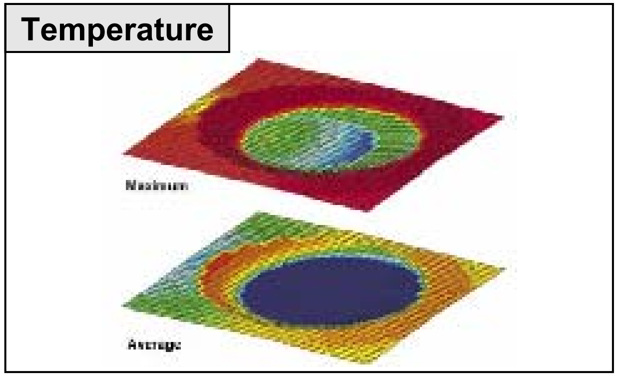
LRGS LOS
Autonomous

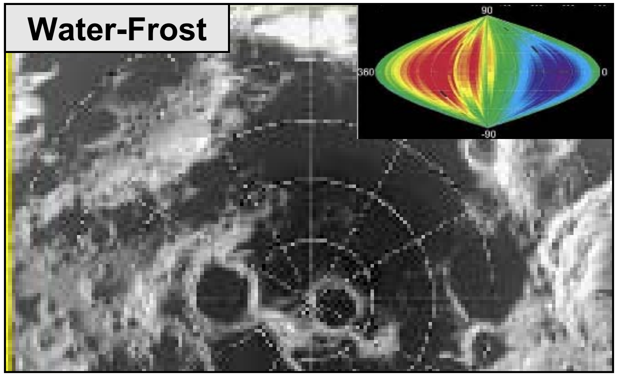
Orbiter Data Products

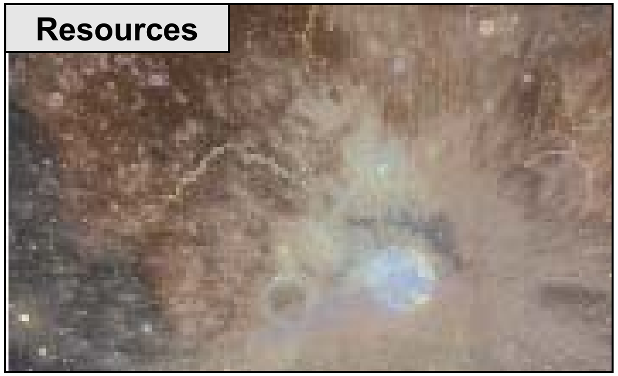


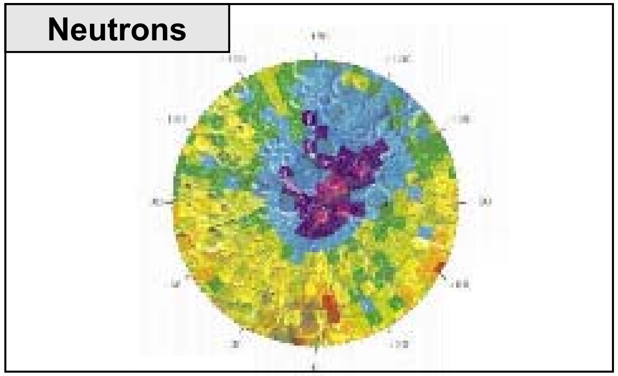


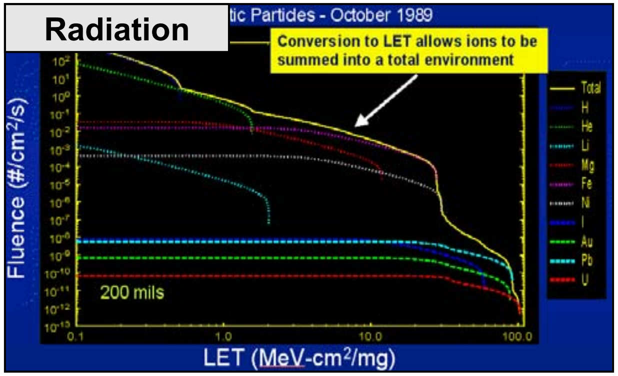


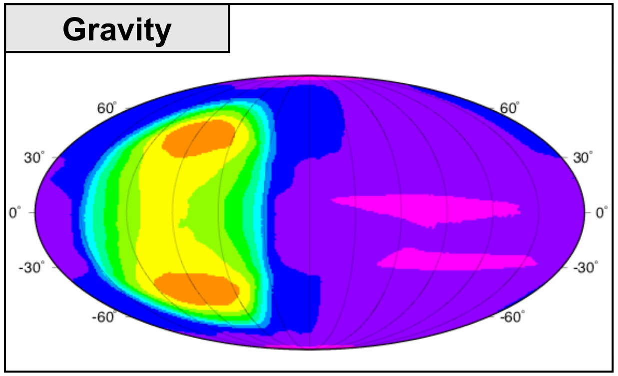












LOLA Measurement Objectives

1. Topography of the Moon to an accuracy ± 1 meter and 0.1 meter precision.
2. Surface slopes in 2 directions to better than 0.5 degrees on a 50 meter scale.
3. Surface roughness to 0.3 meters.
4. Surface reflectance of the Moon at 1064 nm to ~ 5%.
5. Establish a global lunar geodetic coordinate system.
6. Improve knowledge of the lunar gravity field

Along-track sampling in latitude 25 meters

Across-track sampling in longitude 0.04 degrees (~25 meters above lats 85 and ~1.2 km at the equator), after 1 year of operation.

LRO Spacecraft Positioning

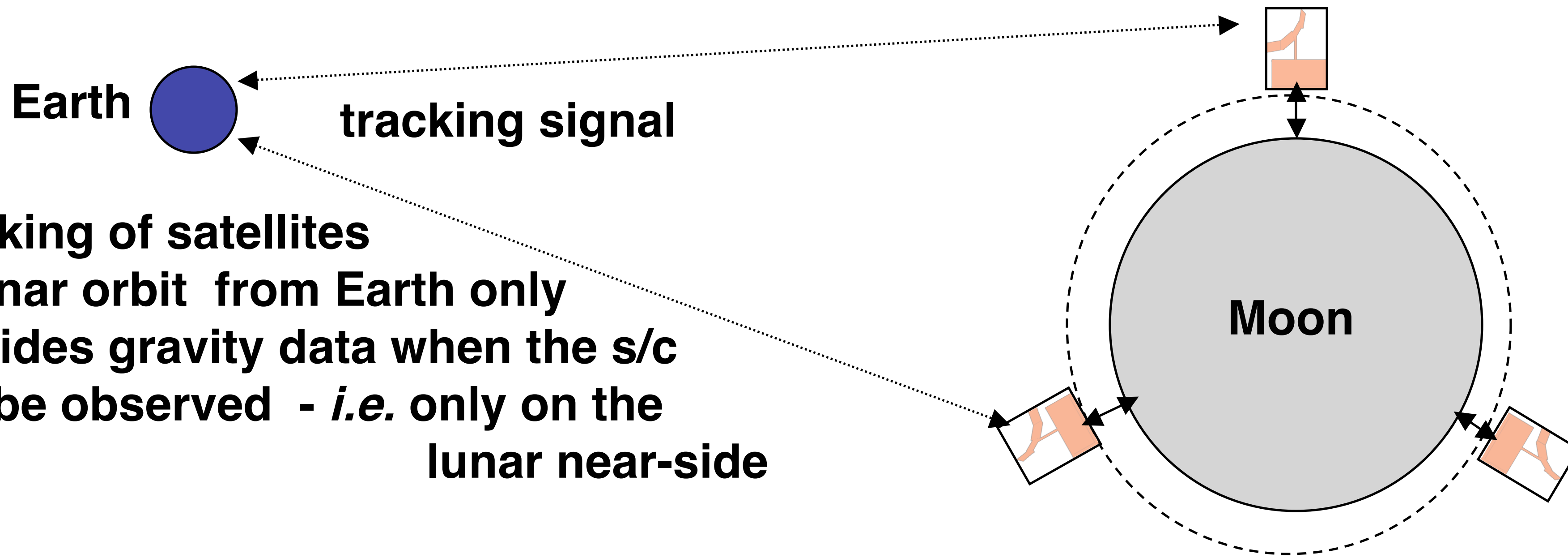
- Simulations of the first 3 months of the LRO mission, and experience at Mars, suggest the addition of a precision range to the S-band tracking and inclusion of LOLA altimeter data can provide an improved model of the gravity field adequate for LRO orbit reconstruction.
- To improve the orbital position of LRO, and meet the LRO Level 1 Requirements for data products, improvement in the knowledge the lunar gravity field is needed.

Required Science Measurements by LR

LR measurements will:

- Provide relative range measurements to LRO spacecraft at <10-cm precision, at 1 Hz.
- Maintain range stability to ±1 m over 1 hour.
- in conjunction with the S-band data and the LOLA altimeter data, allow the orbit of the LRO spacecraft to be determined within 50 m along track, 50 m across track, and 1 m radial.
- improve the targeting of LROC by improving the prediction of the LRO orbit.
- allow every LROC pixel coordinate to be known to 50 meters and all LRO data co-registered at the 50-m horizontal level.
- improved knowledge of the lunar gravity model to enable visiting a particular location to within ~50 m.

Improving the Lunar Gravity Field

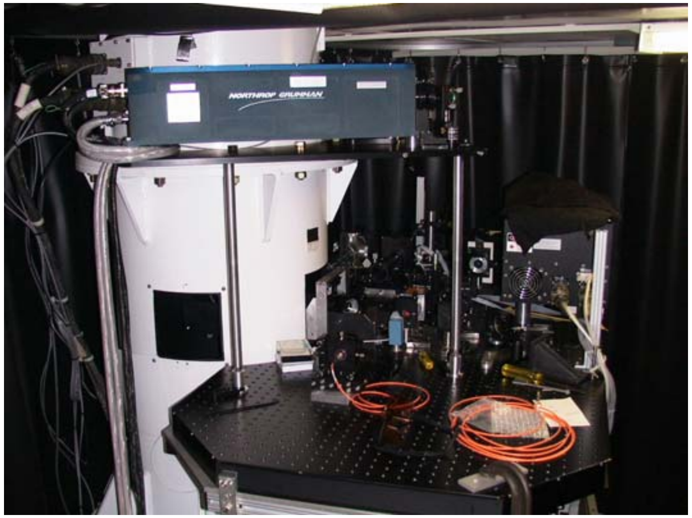


Tracking of satellites in lunar orbit from Earth only provides gravity data when the s/c can be observed - *i.e.* only on the lunar near-side

Altimetry and altimetric cross-overs on the far-side (and near-side) of the Moon will be included as a tracking data for gravity estimation

Cross-overs occur about every 1 to 2 km in longitude and 3 deg in latitude at equator

Laser Ranging



Acknowledgements

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LOLA and LR Instrument Design:

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