LOLA

LUNAR ORBITER LASER ALTIMETER

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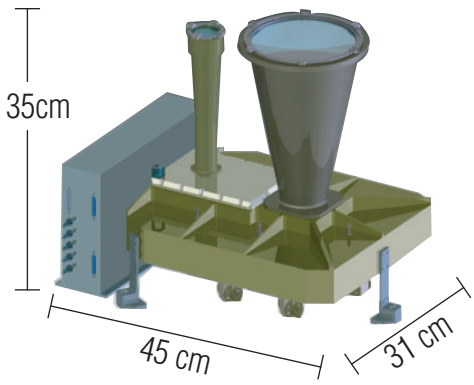
LOLA WILL DELIVER THE MEASUREMENTS NEEDED TO RETURN ROVERS AND HUMANS SAFELY TO THE MOON.



LOLA fully achieves three LRO measurement objectives and addresses two other. LOLA will provide all the data necessary to select intriguing, safe landing sites, while providing the reference system needed to navigate to those sites.

LOLA builds on extensive spaceflight heritage, including the Mercury Laser Altimeter (MLA) and the Mars Orbiter Laser Altimeter (MOLA). The LOLA measurement team has 15 years of altimetry experience that includes providing MOLA data to the Mars Exploration Rover site-selection teams.

LOLA will do at the moon what MOLA did at Mars, but with 3-5 times greater vertical accuracy and 32 times more frequent measurements along track.

Key Instrument Parameters	
Mass	9.6 kg
Volume	0.45 m length
	0.31 m width
	0.35 m height
Power	26.2 W (29.9 W turn-on peak)
Data Rate	10 kbps
Link Margin	5.4dB at 50 km orbit

MEASUREMENT OBJECTIVES

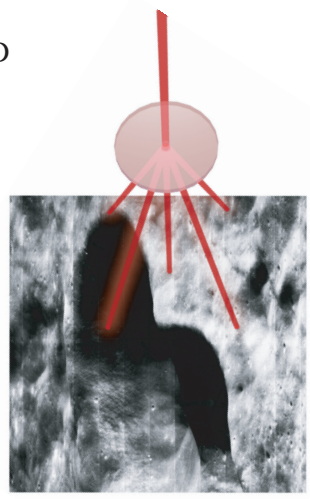
LRO Objectives	LOLA Measurement
• **Global Geodetic Lunar Topography**	**Range**
• **Characterize Polar Region Illumination**	**Range**
• **Image Permanently Shadowed Regions**	**Range**
• Assess meter-scale features to facilitate landing-site selection	Range, Roughness
• Identify near-surface water ice	Reflectance

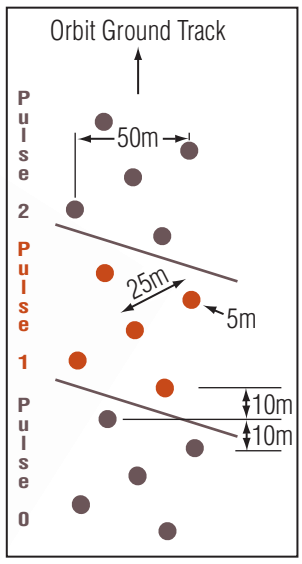
LOLA fully achieves bold objectives

LOLA Products
Global, regional, and local (meter-scale) models of: • Geodetic Topography • Surface slopes • Surface roughness • Surface brightness Improved lunar gravity model

OPERATIONS OVERVIEW

The LOLA instrument pulses a single laser through a Diffractive Optical Element (DOE) to produce five beams that illuminate the lunar surface. For each beam, LOLA measures time of flight (range), pulse spreading (surface roughness), and transmit/return energy (surface reflectance). With its 2-D spot pattern, LOLA unambiguously determines slopes along-track and across-track.



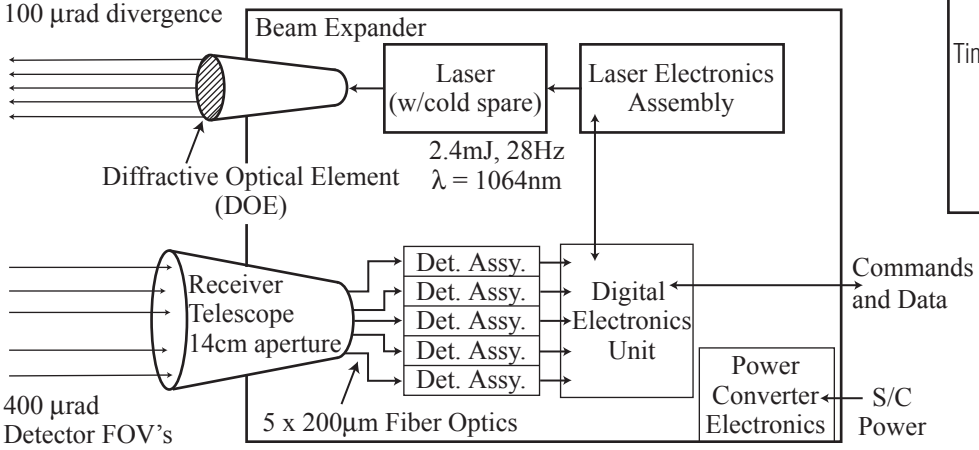


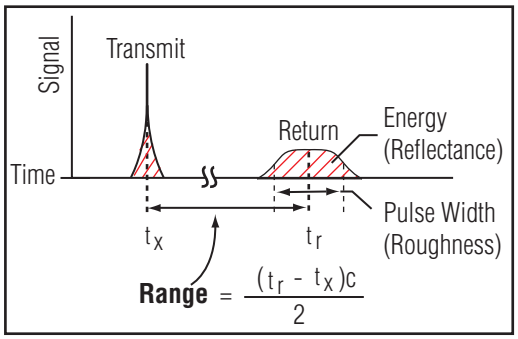
In a 50km polar orbit, pulsing the laser at 28 Hz creates an ~50m-wide swatch of five topographic profiles. Swaths will have 1.25km separation at the equator, with **[complete polar coverage beyond +/-86 degrees latitude.]** Raw measurements are transmitted to Earth for analysis.

LOLA's robust link margin provides ample reserve to accommodate uncertainties in lunar surface roughness and albedo, while providing operational flexibility to the LRO mission

Schematic

5 Laser beams w/500 µrad separation and 100 µrad divergence

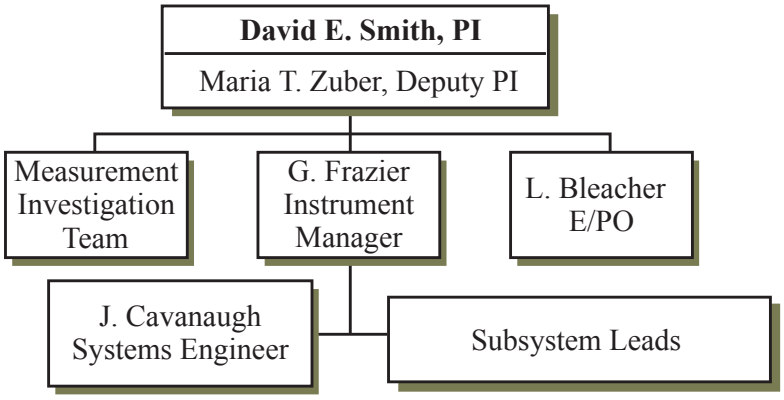




Instrument Performance	
Altimeter Measurement	+/- 10 cm
Pulse Spreading Measurement	30 cm rms
Return Laser Energy Measurement	~5%

Management Overview

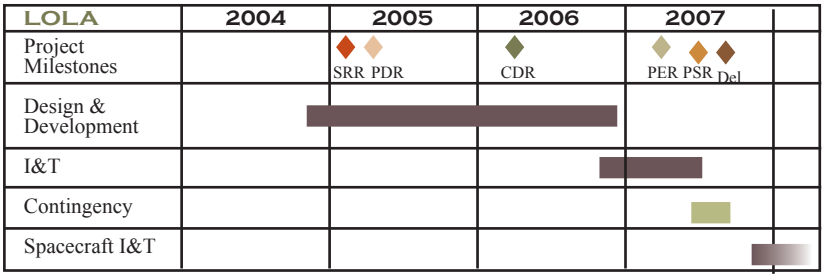
- Instrument managed, developed and tested at Goddard Space Flight Center in Greenbelt, Maryland
- Experience and personnel carry over from Mercury Laser Altimeter (MLA)
- Management organization is simple with clear lines of authority.



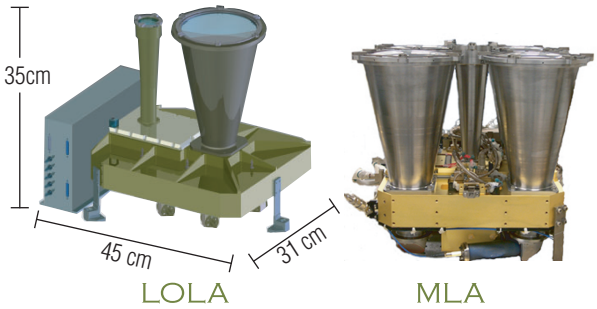
E/PO Objectives

- Partner with existing dissemination networks, including those of the MESSENGER mission, to reach a broad and diverse audience
- Inspire the next generation through the infusion of lunar and planetary data into the classroom (K-12 and undergraduate)
- Include lunar 3-D topographic models in education kits targeting a variety of audiences, including special-needs students, in a variety of venues

Schedule & Cost



Cost:_____ Contingency:_____ TOTAL:_____



The LOLA instrument is TRL 7 based on MLA heritage

Summary

High Evaluation Merit
- Fully addresses 3 LRO Measurement Objectives
- Contributes 5 of the 7 LRO measurement datasets

Technically Feasible
- Strong heritage
- No New technology

Low Implementation Risk
- Experienced measurement and implementation teams
- Backed by GSFC's exceptional personnel and facilities