NASA/NSTA Web Seminar:
Mapping the Moon: Simulating LOLA in the Classroom

Landing Site Selection

Tuesday, April 22, 2008
Mapping the Moon
Mapping the Moon
Web Seminar I

Landing Site Selection
April 22, 2008

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Dr. Susan Hoban
University of Maryland, Baltimore County

Supported through NASA Exploration Systems Mission Directorate
Agenda: Landing Site Selection

- **Overview**
  - Web seminar I: Landing Site Selection (today)
  - Web seminar II: Search for Lunar Ice (5/13)
- **Best data to-date: Clementine**
  - Satellite-based topographic mapping
  - Interpretation of topographic maps
  - Why do we need more lunar maps?
- **Spatial resolution**
  - Lunar Land topography demo
  - “Needle in the Haystack” spatial resolution exercise
- **Lunar Orbiter LASER Altimeter (LOLA)**
- **Landing Site Selection**
  - Where should your robot land on the surface of Lunar Land?
Clementine Topographic Map of the Moon

Contour Interval - 500 m

Near Side

Far Side

340-m resolution

Kilometers
Clementine Discussion

What do the colors represent?

Clementine Topographic Map of the Moon
Contour Interval - 500 m

Near Side
Far Side
-8 -6 -4 -2 0 2 4 6 8
Kilometers
Clementine Discussion

What do the colors represent?
- Specific ranges of elevation.

*Clementine Topographic Map of the Moon*

Contour Interval - 500 m

Near Side

Far Side

Kilometers
Clementine Discussion

Where is the elevation highest?

Clementine Topographic Map of the Moon
Contour Interval - 500 m

Near Side
-8 -6 -4 -2 0 2 4 6 8
Far Side
Kilometers
Clementine Discussion

Where is the elevation highest?
- Red and white areas.

*Clementine Topographic Map of the Moon*
Contour Interval - 500 m

Near Side
-8 -6 -4 -2 0 2 4 6 8

Kilometers

Far Side
Clementine Discussion

Where is the elevation lowest?
Clementine Discussion

Where is the elevation lowest?
- Purple areas.

Clementine Topographic Map of the Moon
Contour Interval - 500 m
Can you judge?

Could a 10-m diameter lunar lander fit in the crater marked on the surface?

<table>
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<th>YES</th>
<th>NO</th>
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Can you judge?

Could a 10-m diameter lunar lander fit in the crater marked on the surface?

Yes, because the crater diameter is 2220 m.
Can you judge?

Can you tell if the floor of the crater is smooth enough for your spacecraft to land safely?

<table>
<thead>
<tr>
<th>YES</th>
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Can you judge?

Can you tell if the floor of the crater is smooth enough for your spacecraft to land safely

No, because the spatial resolution is 340 m.
Further Clementine Questions

Could you securely use this map to choose a landing site for the lander?

<table>
<thead>
<tr>
<th>YES</th>
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Further Clementine Questions

Could you securely use this map to choose a landing site for the lander?

No, because the spatial resolution is 340 m.
Further Clementine Questions

What would you need for more confidence in answering the preceding question?

Please respond to this question using the Chat Window.
Further Clementine Questions

What would you need for more confidence in answering the preceding question?

Better spatial resolution of the map.
Satellite Mapping
Why does the dashed line not look exactly like the solid line?
Measurement vs Reality

What could you do to improve the accuracy of the measurement?
Lunar Land
Lunar Land slice: 2 data points per second
Lunar Land slice: 4 data points per second
Lunar Land slice: 100 data points per second
Needle in the Haystack

If the numbers represent the height of features on the surface (blank = 0 represents “sea level”), where is the tallest feature?

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What does the landscape look like in the upper right corner?

Would you want to try to land a spacecraft on a tall, pointy feature?
Decrease resolution by a factor of 2

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8 x 8

4 x 4
Decrease resolution by a factor of 2
AGAIN

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4 x 4

a   b

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2 x 2
Can you go the other way??
Lunar Orbiter Laser Altimeter

To fly onboard the Lunar Reconnaissance Orbiter, launch Nov 2008
lunar.gsfc.nasa.gov
What will LOLA produce?

- High resolution 3-D map of the Moon
  - Geodetic global topography - nearside essential at < 3m (vertical) and 30m (horizontal)
  - Assessment of features for landing sites

- Polar region resources assessment: largest unknown in present knowledge of lunar resources
  - Identification of near-surface water ice in polar cold traps
  - Characterization of polar region
    - lighting environment, temperature mapping, imaging of surface in permanently shadowed regions
Landing Site Selection

Objective

Use the topographic map of Lunar Land to determine a landing site for the Lunar Land Explorer (LLEx). LLEx will be sent on a mission to search for “ice” in Lunar Land in the next Web Seminar.

• What features are you looking for in the map?
• What do you need to know about LLEx?
Landing Site Selection

What features are you looking for in the map?

1.

2.
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Acknowledgements

• NASA Exploration Systems Mission Directorate
  explore.nasa.gov
• NASA Goddard Space Flight Center Education
  education.gsfc.nasa.gov

For questions or further information

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