Mission Constraints for Extreme Terrain Exploration of the Lunar Surface

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1. Launch as secondary payload on EELV

2. Multiple landers with carrier stage cruise to moon

3. Carrier stage performs braking burn

4. Landers separate at termination of burn (~4 km alt.), perform final descent and landing

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Lunette Mission Overview

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Predecisional – For Planning and Discussion Purposes Only
Landing Considerations

- Nature of landing site demands special consideration
  - Narrow strip (~ 5 km x 1 km) for landing in “permanently lit” area
  - Hazardous drop-off if landing approaches crater rim
  - Landing site on crater rim likely to have abundance of rocks and other hazards

- Surface hazards also affect operational risks
  - Earth and Sun are at horizon
    - Relatively small surface features/boulders can shadow solar arrays or block view of Earth for communications
Landing Site

Potential Landing Approaches

EARTH

Observation Zone
South Pole
Resource Zone (100 Football Fields Shown)
Power Production Zone
Habitation Zone (ISS Modules Shown)
To Earth

Slope Magnitude (deg)

Monthly Illumination (Southern Winter)

60-90%
>70%
Flash Lidar Images For Hazard Detection

ALHAT HDA requirement is to detect 0.3m high rocks

63° Off Nadir

7° Off Nadir

ALHAT
Purpose of TRN enables pin-point landing

There are multiple TRN approaches

ALHAT TRN requirement is 30m $1\sigma$ under any lighting conditions

1-10m precisions are possible with passive optical approaches

Lunar Landing Error Ellipse without TRN
$\sim 1\text{km} \times 0.250\text{km}$ $3\sigma$

Lunar Landing Error Ellipse With TRN
$90\times90\text{m}$ $3\sigma$

Passive Optical TRN: APLNav Images

Passive Optical TRN: MAIA Landmark Matches

Lidar TRN: Area Correlation

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