Lunar Exploration Initiative

Briefing Topic:

Lunar Surface Conditions

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Surface Temperatures

• Surface temperatures were measured with thermocouples at the Apollo 5 and 17 sites, where heat flow measurements were also made.

• Surface temperatures were measured using Earth-based techniques.

• These results were used to estimate temperatures at several locations on the Moon by the Lunar Colony Study Group:

<table>
<thead>
<tr>
<th>Shadowed Polar Craters</th>
<th>Other Polar Areas</th>
<th>Nearside Equatorial</th>
<th>Farside Equatorial</th>
<th>Limb Equatorial</th>
<th>Typical Mid-Latitudes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average T</td>
<td></td>
<td>220 K</td>
<td>254 K</td>
<td>256 K*</td>
<td>255 K</td>
</tr>
<tr>
<td>Monthly Range</td>
<td></td>
<td>± 10 K**</td>
<td>± 140 K</td>
<td>± 140 K</td>
<td>± 140 K</td>
</tr>
</tbody>
</table>

* The farside is closer to the Sun at noon, so it gets ~1% more solar energy than nearside.
** There is, however, several weeks each year where T < 200 K.

DH72 + HVF (VRHOM) 91 T3.2
Polar Temperatures

- Temperatures in shadowed craters are estimated to be as low as 40K.
- Water ice may be stable up to 110K.
- These temperatures are similar to those on Titan, Triton, comets, and in Saturn’s rings.
Visibility

- Distances are hard to evaluate (objects are farther away than they appear)
- Most shadows visible from orbit (e.g., shadows in crater floors) are not visible on surface, so locating one’s position and the positions of target features is difficult
- A lot of the lunar topography is beneath the intercrater surface and, thus, not visible from afar
- Shadows that are visible are best seen when viewing orthogonal to sunlight
- Contrast of lunar surface material is “washed-out” when moving away from Sun
- Colors appear to change with Sun angle; the same area can appear light gray, dark gray, or brown
- The Sun is very bright
Dust

• Silt-sized, generally 40 to 100 microns in size (and 10-20% less than 20 microns in size)

• Very sharp

• Electrostatically-charged by passing sunlight (UV)

• Adheres to painted and metallic surfaces with a strength of $1 \times 10^4$ and 2 to $3 \times 10^3$ dynes/cm$^2$, respectively. Also adheres to fabrics, where irregular dust particles get tangled with fabric surfaces and cause wear

• See briefing titled “Parameters of Lunar Soils” for additional information
Ionizing Radiation

- Refer to the briefing titled “Ionizing Radiation on the Moon”
Other Parameters

• Gravity

• Length of day (and night, with implications for $T$ and solar-charging)

• Micrometeorite impacts

• Exploration-generated “atmospheres” can contaminate the lunar surface environment