

The “Thermal Challenges of Landing in the South Pole of the Moon”

Travel Guide for the Explorer... and the Tourist



This South Pole adventure represents the greatest thermal challenge for visitors and machine because of its temperatures, its daylight and night times, and its craters as points of interest. The guide gives recommendations to the explorer on what to wear for outdoors adventure, and what to wear indoors to be safe and comfortable inside Lunar Landers.

Malapert Mountain, located at the lunar south pole, is a potential site for future missions due to the nearly constant sunlight and the ideal conditions for line-of-sight communications with Earth. [NASA/GSFC/Arizona State University]

Exploring the Moon – NASA EG-1997-10-116-HQ

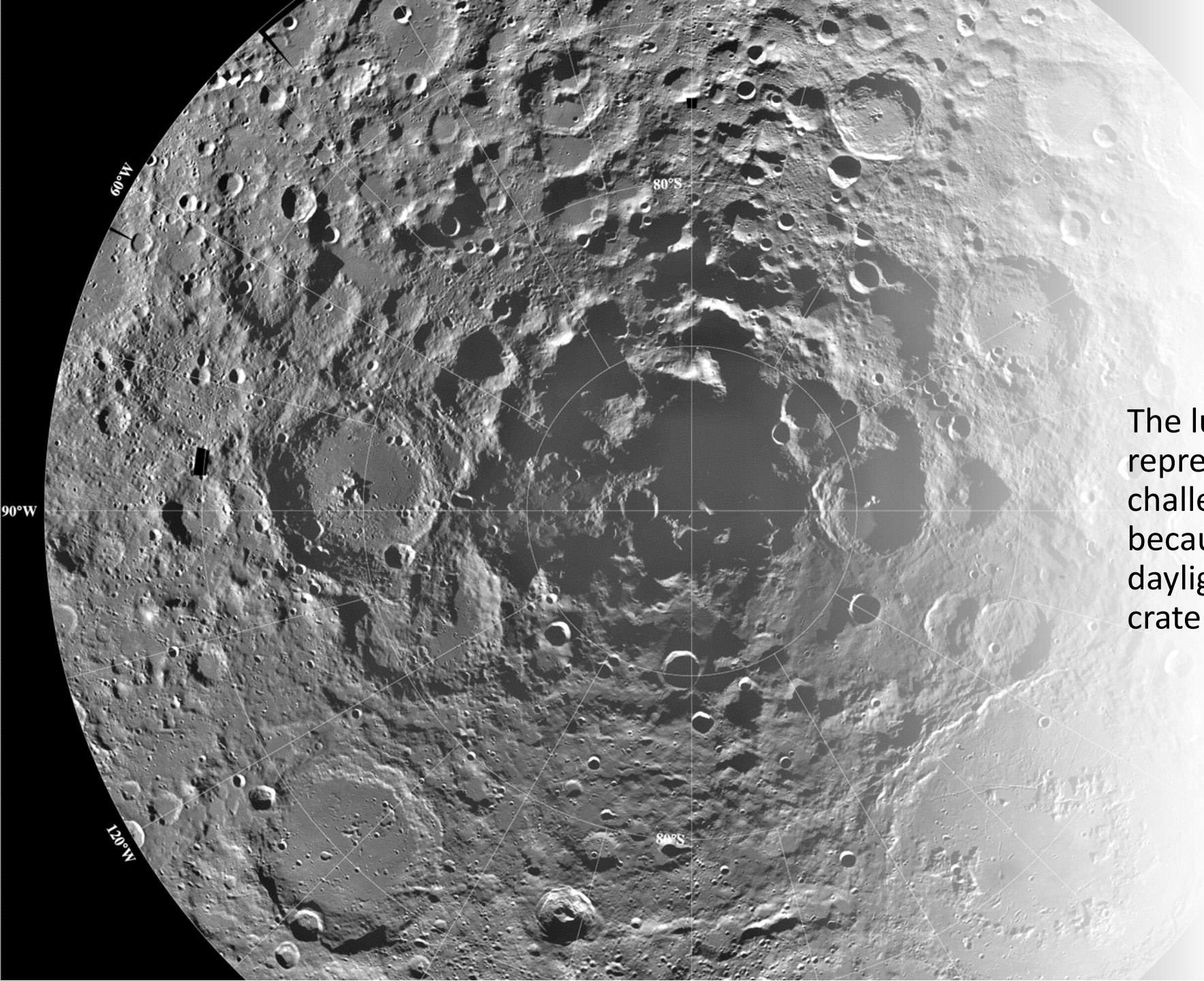
Adapting to the travel conditions and spending a few days on the Moon – it is much more than jet lag!



“Gravity, Atmosphere, Geography, Length of Day, Temperatures”

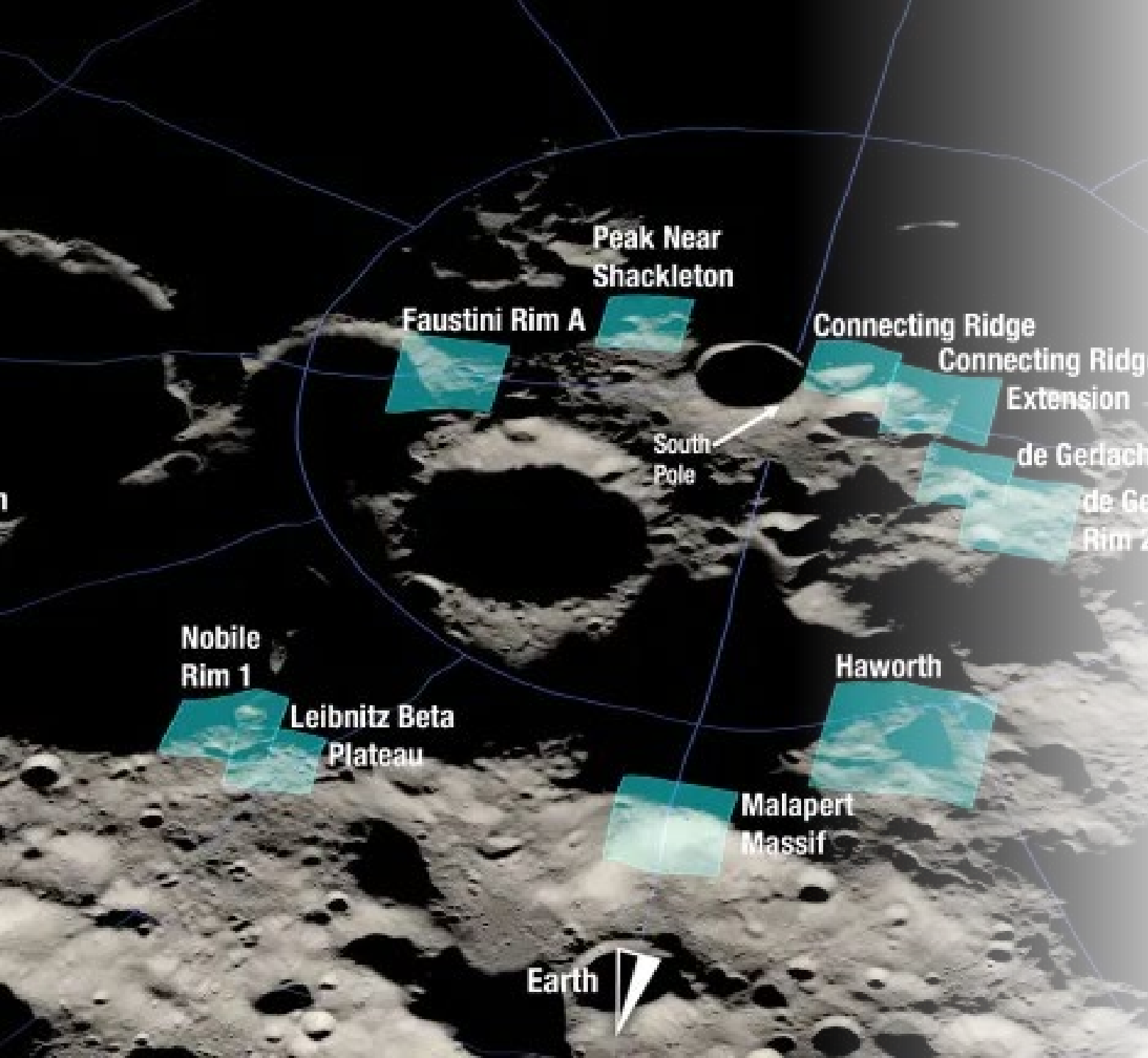
Property *	Earth	Moon
Surface Gravity	9.8 m/sec/sec	1.63 m/sec/sec
Sediment or Regolith	Silicon and oxygen bound in minerals that contain water, plus organic materials.	Silicon and oxygen bound in minerals, glass produced by meteorite impacts, small amounts of gases (e.g., hydrogen) implanted by the solar wind. No water or organic materials.
Atmosphere (main constituents)	78 % nitrogen, 21 % oxygen	Basically none. Some carbon gases (CO ₂ , CO, and methane), but very little of them. Pressure is about one trillionth of Earth's atmospheric pressure.
Length of day (sidereal rotation period)	23.93 hours	27.3 Earth days
Surface temperature	Air temperature ranges from -88°C (winter in polar regions) to 58°C (summer in tropical regions).	Surface temperature ranges from -193°C (night in polar regions) to 111°C (day in equatorial regions).
Surface features	25 % land (seven continents) with varied terrain of mountains, plains, river valleys. Ocean floor characterized by mountains, plains.	84 % heavily-cratered highlands. 16 % basalt-covered maria. Impact craters-some with bright rays, crater chains, and rilles.

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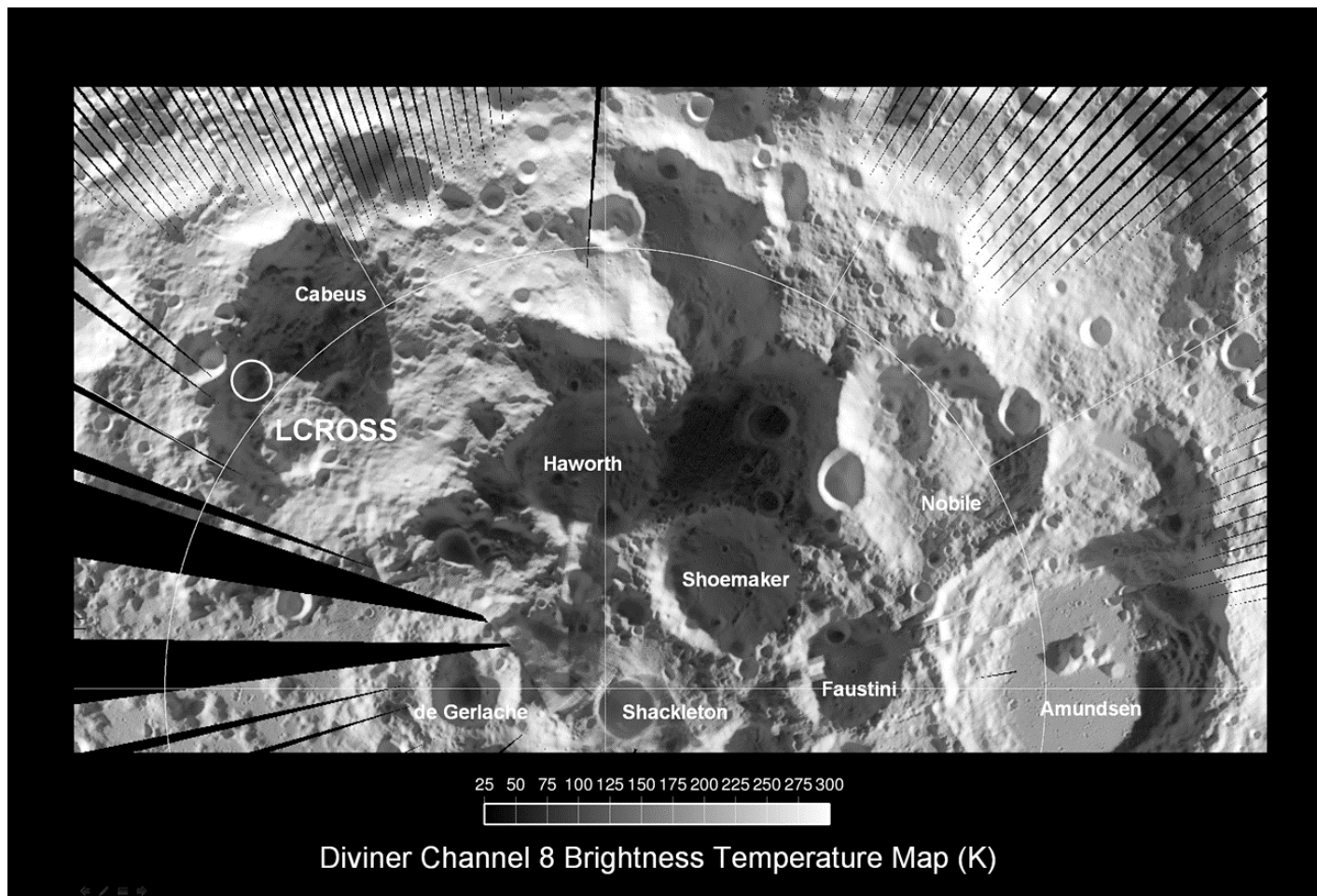
The lunar South Pole adventure represents the greatest thermal challenge for visitors and machine because of its temperatures, its daylight and night times, and its craters.

Landing Site



- **Candidate regions for an Artemis III lunar landing:**
- Faustini Rim A
- Peak Near Shackleton
- Connecting Ridge
- Connecting Ridge Extension
- de Gerlache Rim 1
- de Gerlache Rim 2
- de Gerlache-Kocher Massif
- Haworth

Shackleton crater from
the Diviner, an infrared
radiometer aboard
NASA's Lunar
Reconnaissance Orbiter
used to create
temperature maps of the
Moon's surface





Out of this World
Lodging!
Much more expensive
and more thrilling than
any five-star hotel

Illustration of SpaceX Starship human lander design that will carry the first NASA astronauts to the surface of the Moon under Artemis. **Credits: SpaceX**



The Astronaut's Gear for Space Exploration

- A spacesuit designed for specific environments in space
 - Vacuum, lunar surface, planetary surface (i. e., Low Earth orbit, Moon, Mars)
- Tools, lighting, cameras, tethers, containers, instruments, and more depending on the activities outside the spacecraft or space habitat

Apollo Lunar Gear



The New Lunar Gear

To ensure that all the vital functions of the entire lunar gear (space suit, backpack, and carry-on items) are protected:

- the outer fabric must have high emissivity and low absorptivity for thermal management of the space suit and powered hardware;
- covers of non-powered hardware assemblies must at minimum prevent materials from getting damaged by the extreme temperatures;
- space suit outer fabric and hardware covers must also be resistant to abrasion, prevent sharp lunar dust particles from penetrating the suit and contaminating hardware assemblies;
- in addition, these outer fabrics should not attract positively charged dust during the lunar day.

In development...