Lunar Refueling Station

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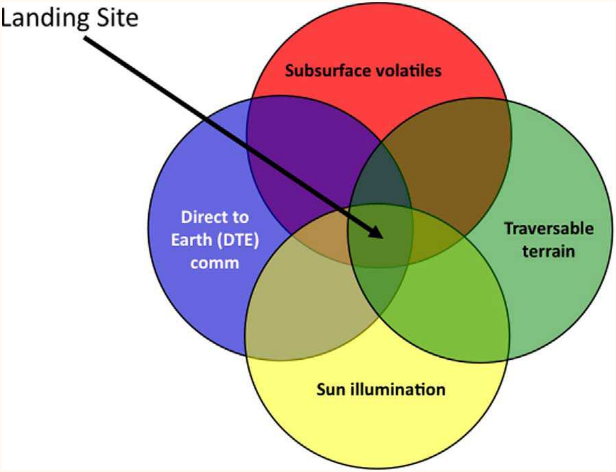
Goal of Project

- Design a habitat that is suitable for habitation by at least two humans.
- Maintain a stable temperature of $\approx 300K$
- Protect from environmental hazards (Solar flux, cosmic rays...)
- Generate power for air and water recycling and treatment.
- Assume food can be initially supplied from rations sent from Earth

Location of Habitat

The location of the base must then take in to account proximity to probable water locations as well as areas of illumination for solar power and heat generation as well as line of sight for communication.

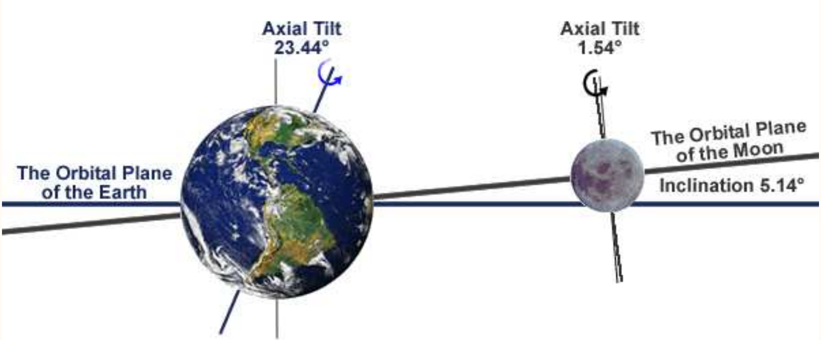
Location of Habitat



Acesss to water, ilumination, communication, and mobility. [6]

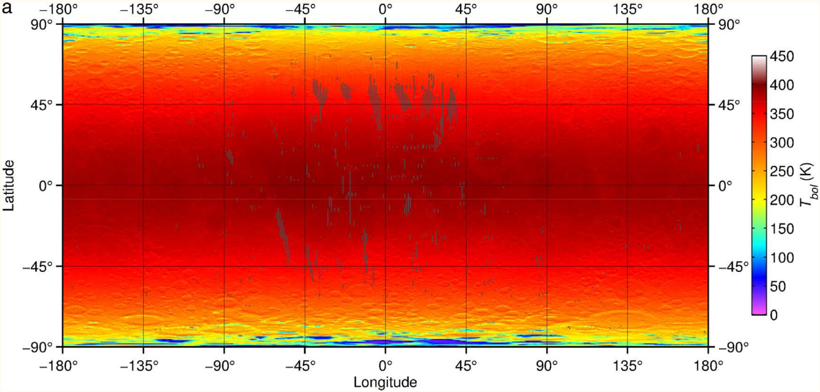
Why the lunar Poles

The moon resides along the elliptical plane. As a result the poles receive much less light than the lower latitudes. There are craters on the moon then that are permanently shadowed regions or **PSR**s. There are also highlands that remain permanently illuminated (**PIR**s).

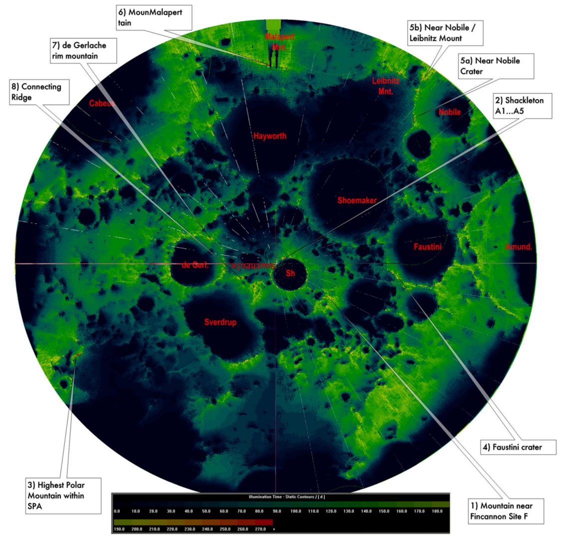


Temperatures at the Lunar Southern Pole

The Shackleton crater at the lunar south pole is a highly researched area for habitation. The temperature varies from a high of $213K$ and a low of $50K$ [8].



Illumination at the Lunar South Pole

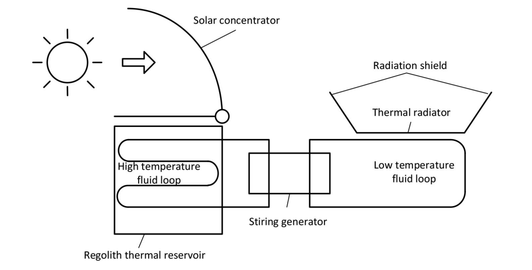


Map of cumulative illuminated days at the lunar South Pole ($-85°$ ... $-90°$S).

The incident angle of sunlight rotates by 360° over a month period. The further from the center of the pole the higher a solar collector would need to be recieve maximum illumination. [1]

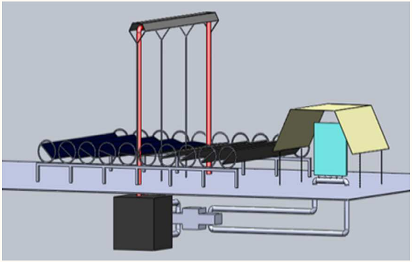
Power Demands

Each inhabitant at a minimum will require 3kWe. Photovoltaic arrays have been extensivly and reliable used in space and surface explorations. PV systems will require energy storage systems for times of little to no illumination. Nuclear power would provide continuous power but present several saftey and political barriers to become feasible[4].

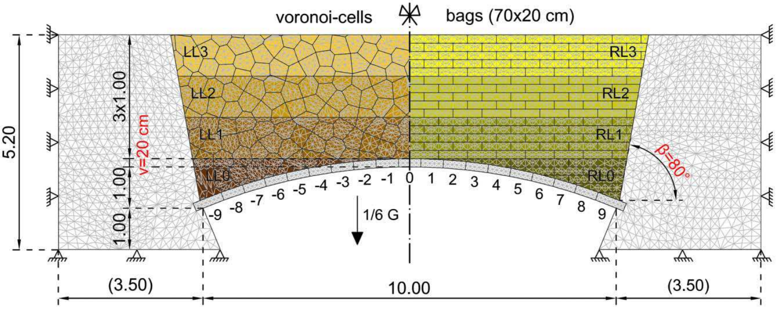


Schematic of a lunar based solar thermal power system [16]

The Stirling generator converts the thermal energy stored in lunar regolith into electrical power.[2][5]



The moon regolith itself can be used as shielding and insulating material to protect against extreem temperatures and frequent micro-meteorite bombardment (10-30Km/s) as well as solar and cosimic radiation. [7]



Food, Oxygen, and Water needs

Minimum and expanded mass inputs and outputs of human needs [11,13].

	Minimum (kg/day)	Expanded (kg/day)
Input		
O_2	0.93	0.93
Food solids	0.70	0.70
Water in food	1.29	1.29
Food preparation & drinking water	2.50	2.50
Hygiene water	0.40	25.40
Total input	5.82	30.82

Life Support Systems (LSS) need effecient managament of Oxygen, food, water, and saftey.[3]

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