Long Duration Mars Simulation at the Moon - Project TerraLunar

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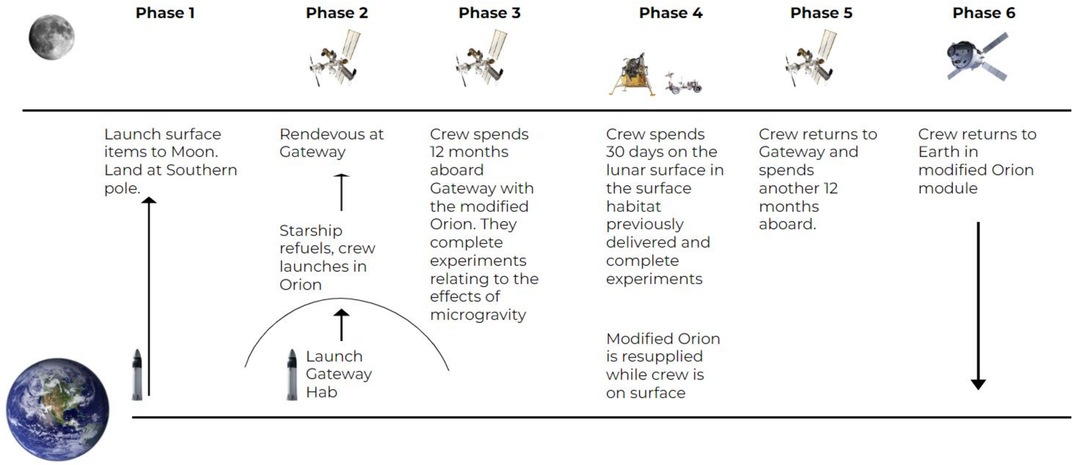
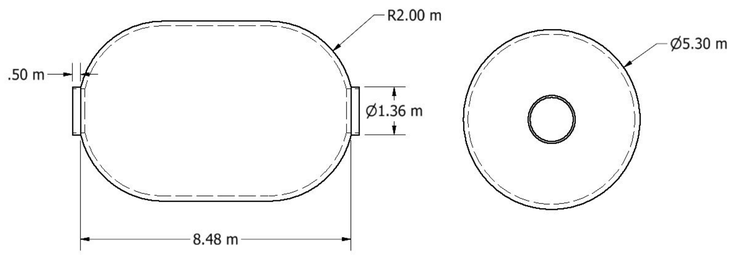
Mission Timeline



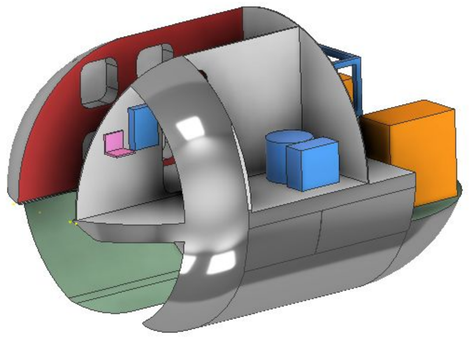
Orbital Infrastructure - Keya

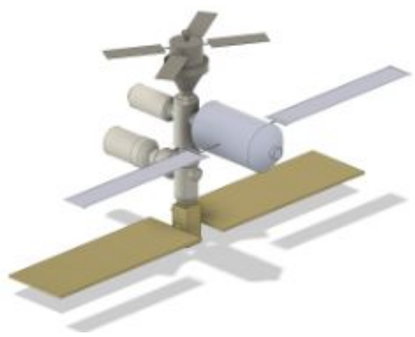
- Support 4 crew members for two 1-year periods in orbit (with a one month break in between)
  - Include protection from external elements
- Be able to dock with NASA's Lunar Gateway for the entire mission duration with the International Docking Standard (IDS)
- Include a solar array to power itself in addition to Gateway's power supply



Portion	Mass (kg)
Propulsion	3,000
Power & Radiators	13,690
Structural	29,500
Equipment	1,830
Total	48,020

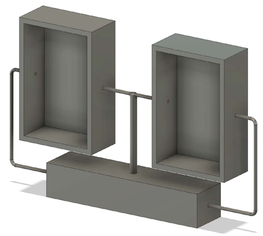
Segment	Volume (m^3)
Crew Quarters	40.9
Galley	31.3
Medical & Training	29.4
Laboratory	22.3
Total Habitable	123.7





Operations

- Experiments
  - Hydroponics Garden
  - Cyanobacteria Generator
  - AR/VR Capabilities



- Abort options
  - From Gateway: An Orion capsule will always be docked to Gateway, to allow for the crew to undock and return to Earth at any point during the mission
  - From Lunar surface: Starship HLS will remain on surface nearby SHELL, allowing crew to abort to orbit and dock to Gateway at any point during the mission

Lunar Infrastructure - SHELL

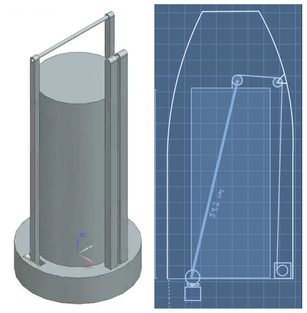
- Needs to support 4 crew members for 30 days on the surface of the Moon
- Needs to be able to prepare all crew members for a typical Mars Surface Mission.
- Needs to be sized appropriately to be configured in a standard SpaceX Starship cargo bay

Portion	Mass (kg)
Power & Radiators	3,030
Structural	16,400
Consumables	740
Equipment	6,600
Total	26,770

Segment	Volume (m^3)
Floor 1	16.3
Floor 2	22.1
Floor 3	16.96
Endcap	15.2
Total Habitable	73.56

Hardware - SHELL Unloading Crane

- Uses a pulley and winch system to lift SHELL up from the floor of the Starship Cargo Bay
- Two motorized arms will swing SHELL out of Starship and gently lower it to the Lunar Surface



Cost Estimations

Developed Spacecraft	Cost ($M)	Units	Scaled ($M)
SLS	2500	2	5000
Starship Cargo (Super Heavy included)	480	2	960
Starship HLS (Super Heavy included)	320	1	320
NASA SEV Rover	203	1	203
SLS + Orion	2000	2	4000

Produced Spacecraft	Cost ($M)	Units	Scaled ($M)
Orion Block 2	871	2	1567.8
SHELL	691	1	691
Keya	627	1	627

Total Cost for TerraLunar ($M)	11,776