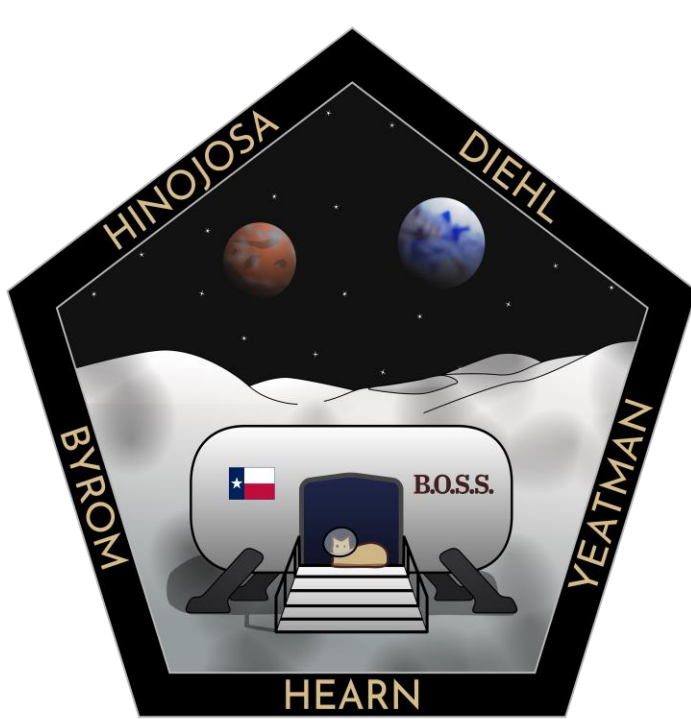




Project Description

NASA’s plans for Lunar and Martian exploration require sustainable surface habitat modules that are not only safe and functional, but are also manufacturable, modular, and adaptable to extreme conditions. This project envisions the design of a **scalable habitat module**, conditioned for both Lunar and Martian surfaces that will balance crew **safety**, **manufacturability**, product **longevity**, and efficient **transport** from the Earth to the Moon or Mars.

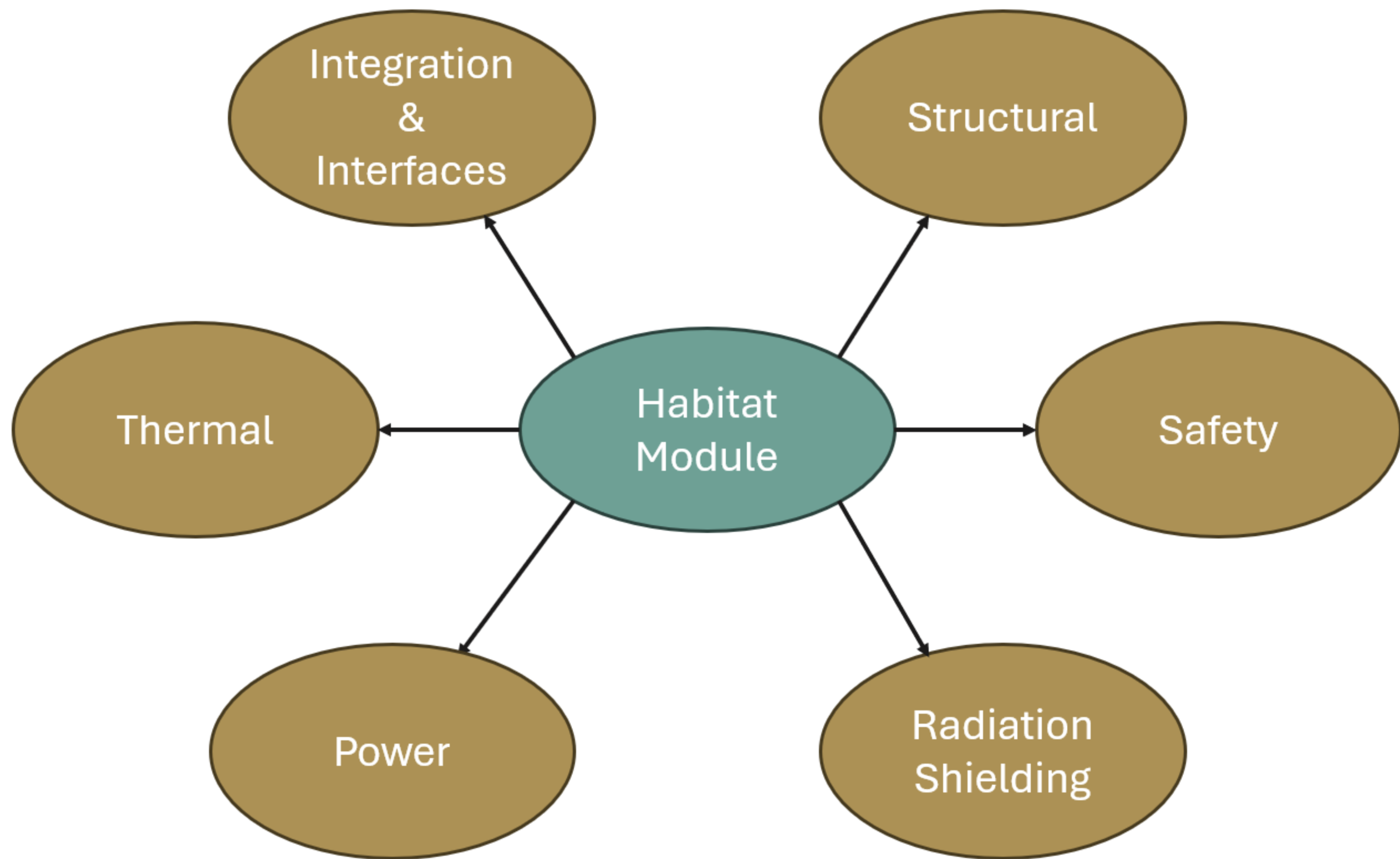
Module Functions

- Provide habitable pressurized volume
- Protect crew from external hazards
- Enable surface operations, crew mobility, scalability, and modularity
- Maintain thermal control
- Distribute power and data
- Allow safe assembly, deployment, and operation
- Allow efficient maintenance and repair

Constraints

Mass Limit: ≤ 10 metric tons for launch configuration
Surface Size per Module: ~50-80 m² useable floor area
Thermal Range: Survive -130°C to +120°C(lunar), -90°C to +20°C(Mars)
Radiation Protection: At least 10 g/cm² equivalent shielding
Assembly Time: < 30 days with crew and/or robotic systems
Power Interface: 5-20 kWe capability, battery or fission ready

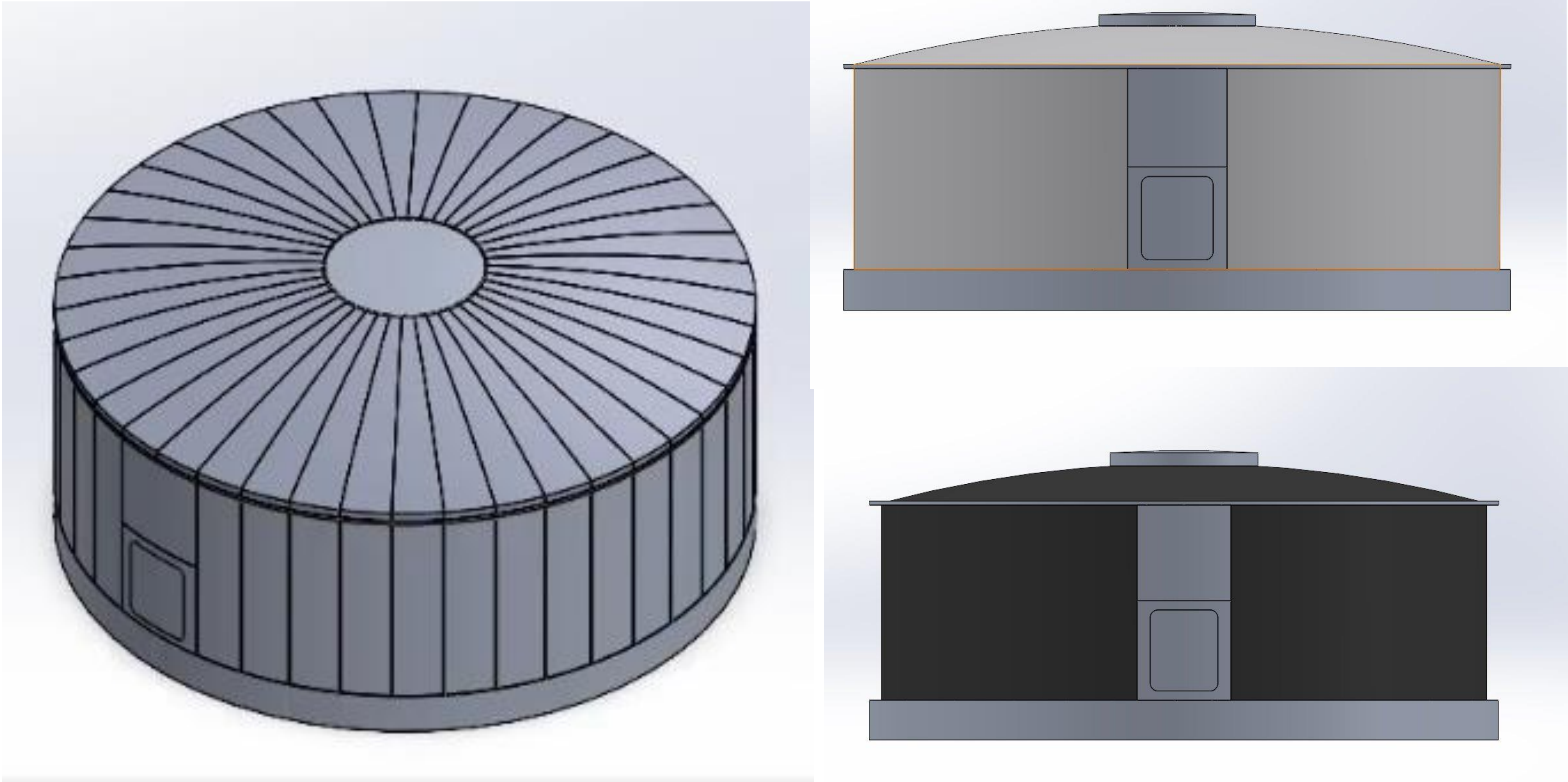
Subsystem Breakdown



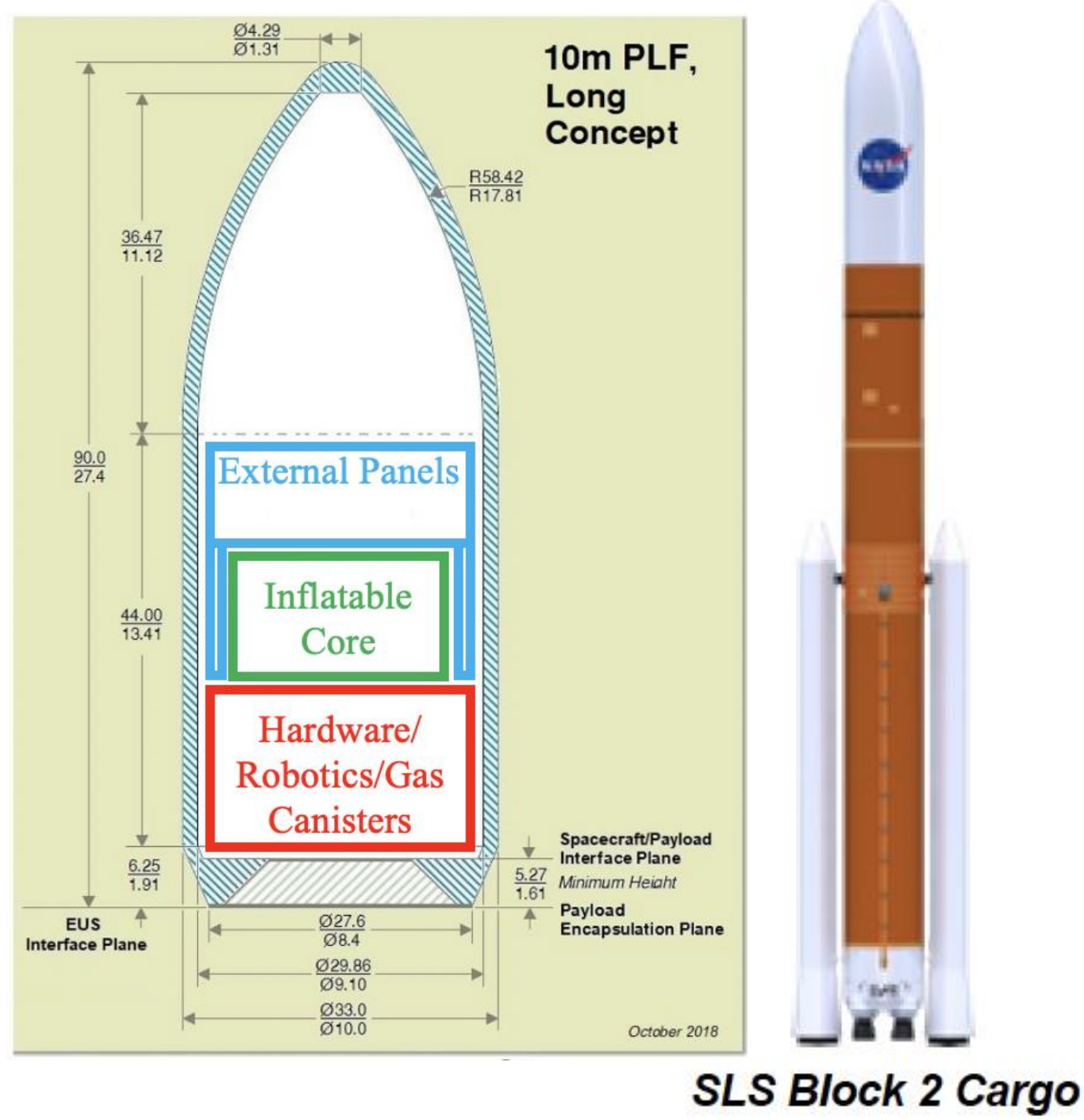
System Architecture

Subsystem Solutions:

- Structural:** Internal inflatable structure and rigid external MMOD shielding panels. Structure is 8 meters in diameter and 3.5 meters tall.
- Thermal:** MLI layer and ECLSS
- Radiation:** MMOD external and MLI internal layers
- Integration/ Interfacing:** Quest Airlock and Common Berthing Mechanism
- Power:** Kilopower-style nuclear reactor



Launch and Assembly

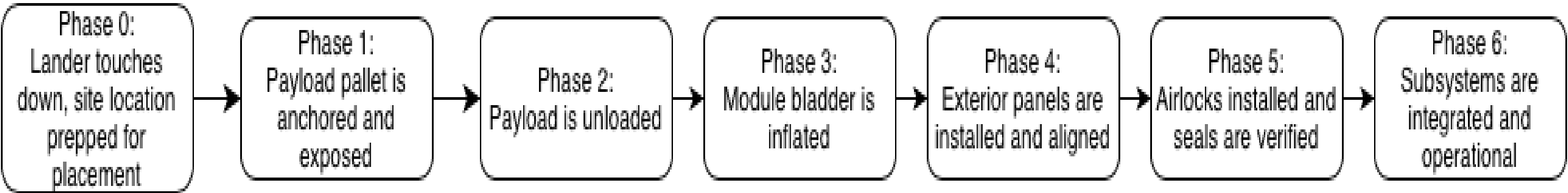


Hybrid Method: Combined approach with an inflatable core interior and rigid exterior shell, using a "clip-on" panel mechanism, allowing for compact stowing, ease of assembly, and repair and maintainability.

Fastening: A variety of temporary fastening techniques can be employed, such as:

- Ball and socket
- Magnetic fasteners
- Wedge-lock fastener

Assembly Time: Each phase of the assembly can be completed within 1-2 days.



Weight

Item	Weight (kg)	Material
Inflatable Interior	305	Nomex, Rubber, Vectran, MLI
Compressed Air Tanks	726	Steel
HAB Module Base	3740	Aluminum 2090
HAB Module Floor	1357	Aluminum 2090
MMOD External Wall	1632	Aluminum 2090, Nextel, Kevlar
MMOD External Roof	1392	Aluminum 2090, Nextel, Kevlar
Total	9152	

Conclusions

The habitat designed meets the constraints set out by NASA and will work in a Lunar or Martian environment. The modular structure provides a balance between crew safety and ease of assembly. It also provides a way for the external structure to be repaired without losing pressure in the module. Future plans include testing using finite element analysis to verify the structural integrity of the module. Manufacturing a 3-D printed scale model for a physical representation will follow.

Next Steps

- Continue creating detailed CAD model
- Complete detailed FEA
- Assess weight reduction possibilities
- Packaging and assembly optimization
- Assess manufacturing and ISRU options
- Prototyping

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