



# The Hawk's Nest

Cole Curtis, Calvin Rampy, Syllas Anderson, Andrew Tomlinson, Erik Molina  
Faculty Advisor: Dr. Youssef Hamidi  
Mechanical Engineering Program – College of Science and Engineering

## ABSTRACT

This project develops a lightweight, deployable, and structurally reliable lunar habitat capable of supporting long-duration human missions on the Moon. It addresses critical constraints such as launch mass, rapid assembly, extreme thermal conditions, and micrometeoroid impacts.

## Project Background

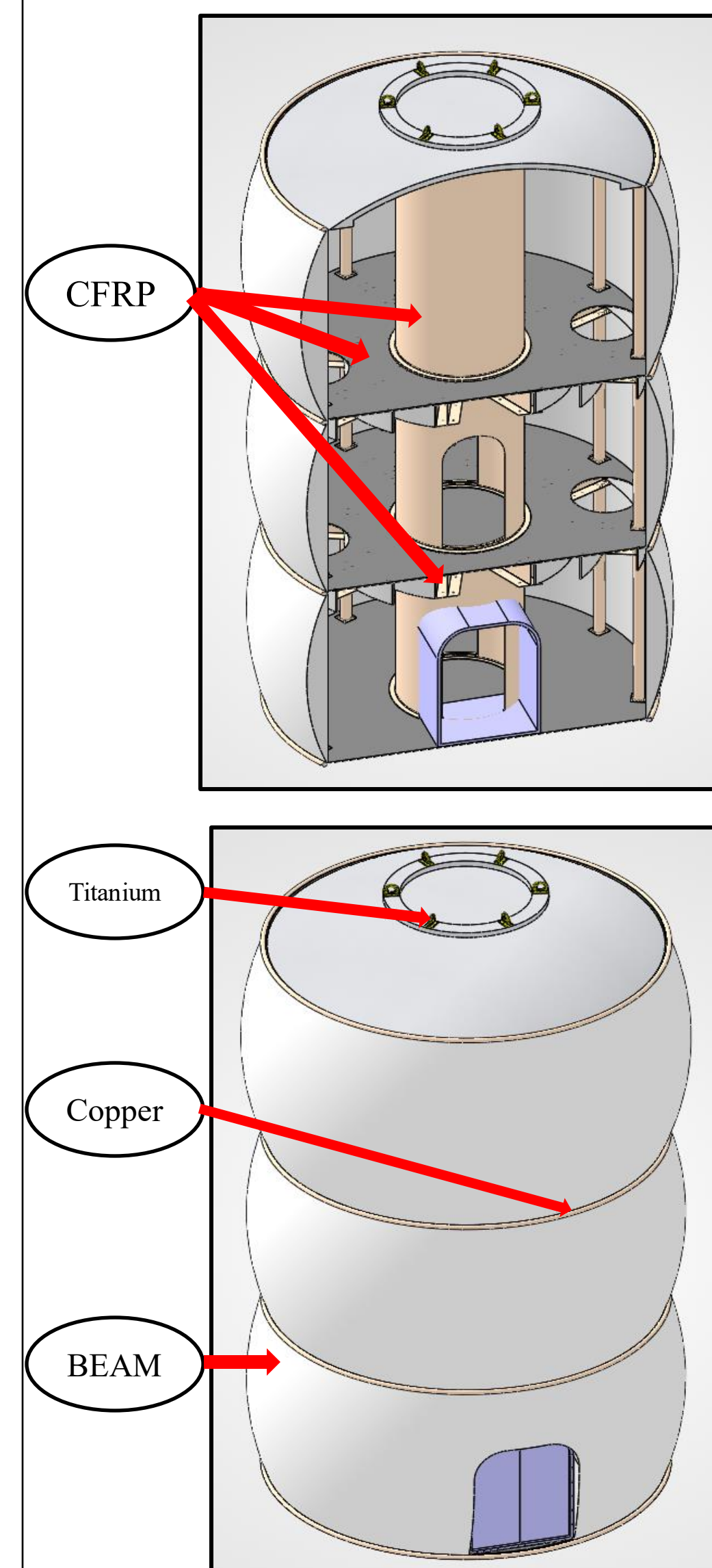
1. NASA's renewed interest in the moon has sparked the need for scalable lunar habitats.
2. This will support long duration crewed stays on the lunar surface.
3. Current leading design is Habitation element of Artemis base camp but has not yet been implemented.

## Objectives

1. Mass (<10 tons).
2. Assembly time (<30 days).
3. Radiation protection (>10 g/m<sup>2</sup>).
4. Usable Area (50-80 m<sup>2</sup>).
5. Exterior Volume (<317.6 m<sup>3</sup>).
6. Foundation Size (<120 m<sup>2</sup>).
7. Payload Capacity (< 458 m<sup>3</sup>).

## RESULTS & DISCUSSION

### Final Design:



### Specifications

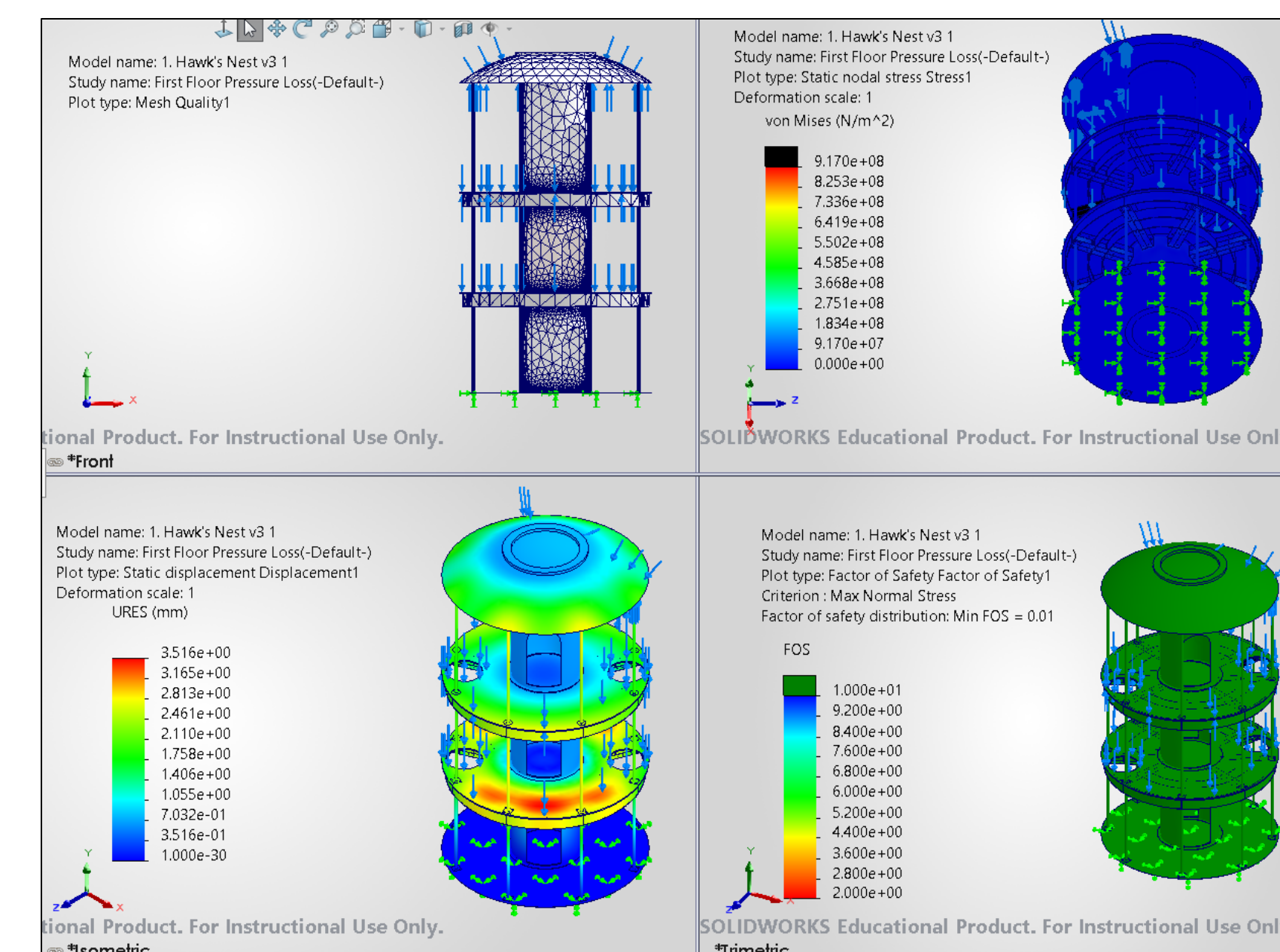
1. Frame - carbon fiber reinforced polymer (CFRP)
2. Skin - bladder like the ISS BEAM module.
3. Interface – secured with copper clamps.
4. Roof - features lift point hooks made of titanium.
5. Habitat - assembled then launched on New Glen.

### Results

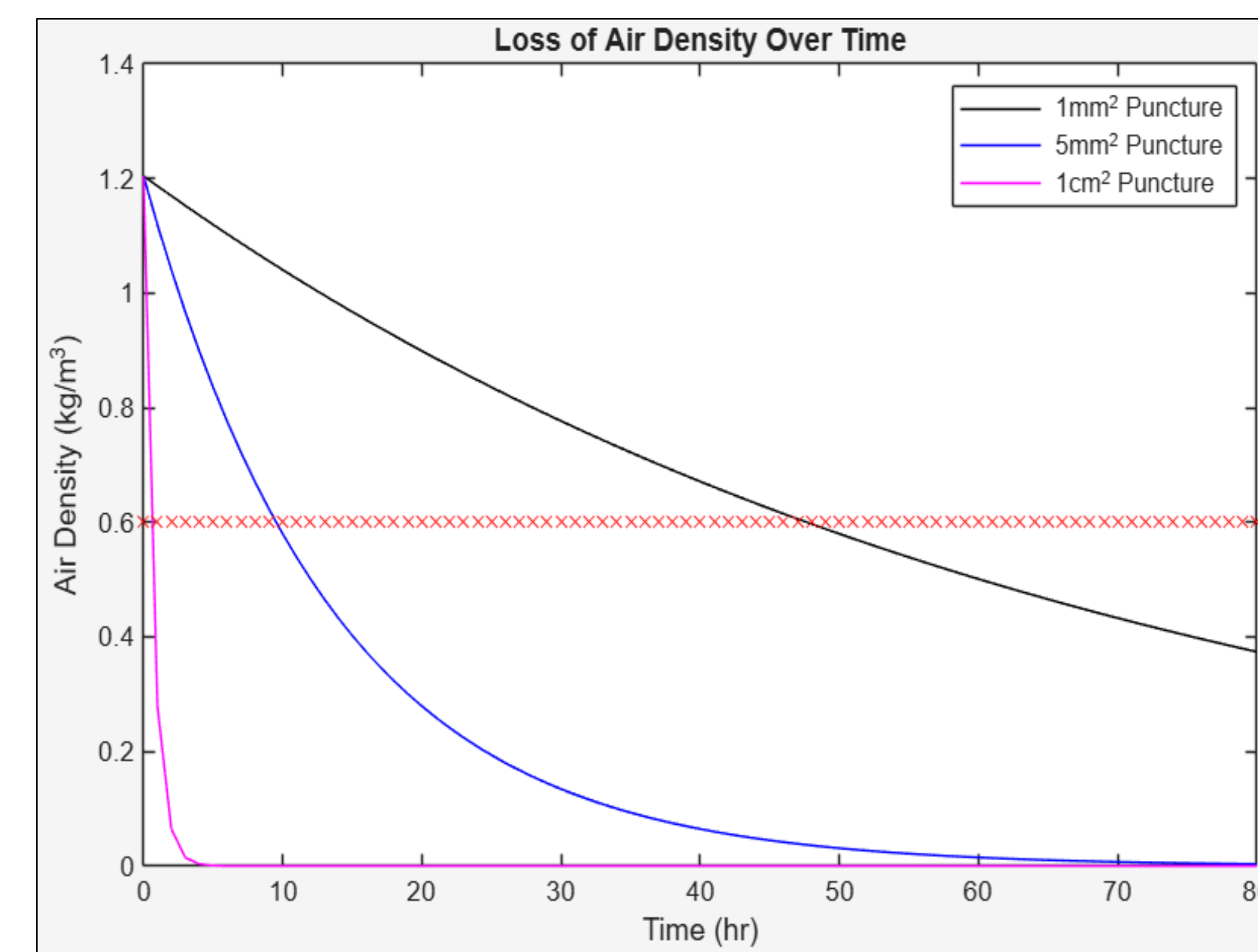
1. Mass is estimated at 9,999 kg.
2. Usable floor area of 75.68 m<sup>2</sup>.
3. Exterior Volume Estimated 350 m<sup>3</sup>.
4. Foundation Size 34.21 m<sup>2</sup>.
5. Mass Shielding 10.07  $\frac{g}{cm^2}$  (optimized placement).

### Simulations:

#### Finite Element Analysis

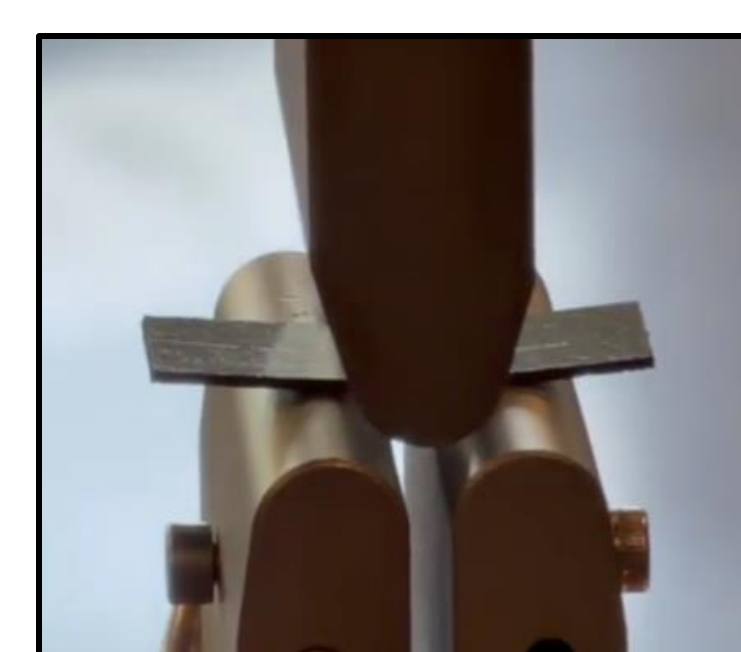


#### Depressurization Event



### Physical Testing:

#### 3 Point Bending



	Flexure Strain (Displacement) At Break (Standard) (%)	Flexure Stress At Break (Standard) (MPa)	Flexure Displacement At Maximum Flexure Stress (mm)	Flexure Strain (Displacement) At Maximum Flexure Stress (%)	Calculated Applied Load (N)	Max Stress (Psi)
<b>AVERAGE</b>	3.29	48.77	0.85	2.38	101.81	132,673.16
<b>Sample Standard Deviation</b>	0.44	14.87	0.14	0.40	8.34	9,302.09
<b>Coefficient of Variation</b>	13.37%	30.49%	16.19%	16.69%	8.20%	7.01%

## FUTURE WORK

### Limitations:

1. Assumptions & Simplifications
2. Complexity: Composites > Metals

### Refinements:

1. Detailed Computational Analysis
2. Additional Physical Testing

### Testing:

1. Assembly Test – First Floor
  - CFRP 1<sup>st</sup> Floor Compression Test
  - HUD Code: **CFR 3280.401**
  - Strain Gauges & P3 Indicator
2. Hydrostatic Test - System
  - Build Full CFRP Assembly
  - Get BEAM Fabric - Pressurization
  - Run Hydrostatic Test

## CONCLUSIONS

This design concept combines a BEAM-derived multilayer inflatable bladder and a CFRP frame to meet space flight requirements. The Hawk's Nest is designed to ensure the safety of crew members during future long duration lunar missions.

## Acknowledgements

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## References

[1] NONE YET ©