NC STATE UNIVERSITY

Department of Mechanical and Aerospace Engineering

Team Ballunar Eclipse

Ballunar Tower

Aerospace Engineering Capstone Senior Design 2023-2024

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mechanical & aerospace ENGINEERING

Mission Overview

Purpose: Design, build, and test inflatable tower that can be used on the Moon for lifting communication equipment along the surface.

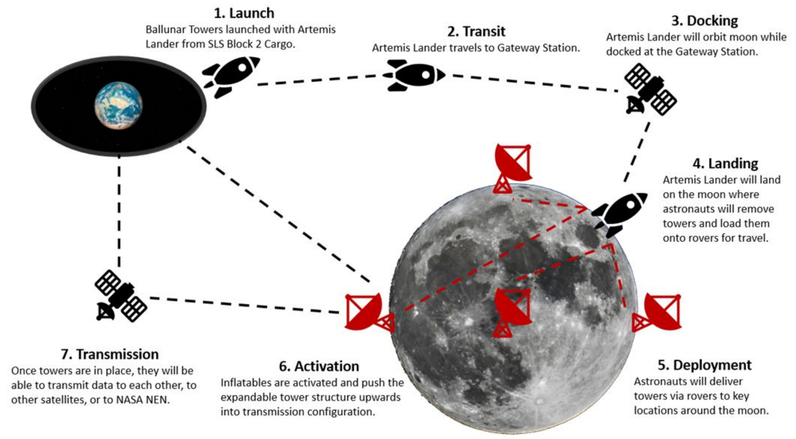
Customer Requirements:

- The Computing System shall handle all processing needs of the systems.
- The Controls and Guidance System shall handle all motors for drilling.
- The Inflatable shall survive under extreme conditions.
- Tower shall withstand impacts of micrometeoroids and lunar dust.
- Tower shall weigh under 80 kilograms.

Objectives:

- Achieves inflation immediately after anchoring and is able to inflate in under 20 minutes.
- Operational immediately after inflation.

CONOPS



Inflatable Testing

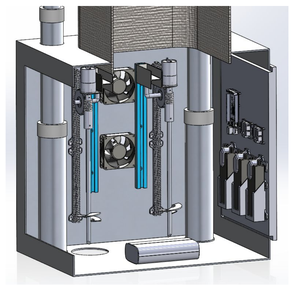
Overview Video

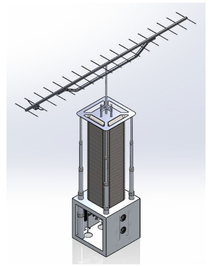
Inflation Video

Design Solution

Subsystems:

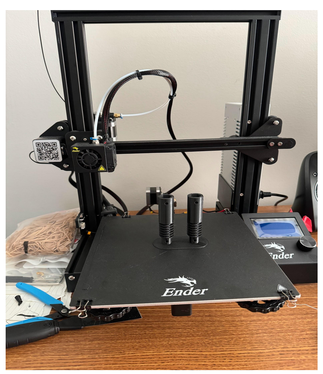
- Thermal Control
  - Intake and Exhaust PC Fans
- Power and Electric
  - Zee 3S 5200 mAh 50C 11.1 V Lipo Batteries
- Structures and Materials
  - Aluminum 6061
  - Silnylon
  - Grounding Anchors
- Communication and data handling
  - Model Antenna (PVC)
- Payload
  - Compressed Air
  - Portable Tire Compressor
- Controls
  - L298N Motor Driver
  - 12V DC Brushless 30 RPM Motor
  - Worms Gears

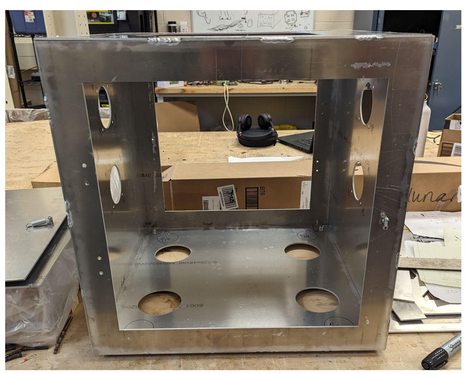




Manufacturing

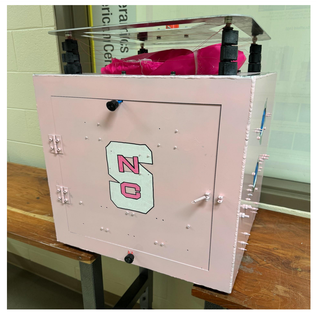
- The structure of the box was entirely made out of 6061 Aluminum Alloy that was cut using the waterjet and then welded together.
- The battery holders, tracks, gears, and gear holders were all 3D printed using PLA.
- The inflatable is nylon fabric impregnated with silicone and was cross-stitched then sealed with silicone sealant.
  - Two steel plates sandwich the material and allow for an intake and outtake valve.
- A model antenna was created using PVC.





Final Prototype

Prototype Specification	
Height	58 Inches
Weight	53 lbs
CubeSat Size	150U
Inflation Time	18 Minutes
Lift Weight	15 lbs
Air Pressure	1.5 PSI
Inflatable Volume	2.97 ft^3



Functional Block Diagram