



# Airbrake Integration IDR

**Owner: Langston Johnson**  
**Saturday, October 16th, 2025**

# PDR Action Items

- PDR Summary:
  - Analysis
    - Follow up with IREC on Deployment Conditions
    - Run numbers with Midland altitude and temperature
  - Integration
    - Baseline analysis satisfactory – focus on a mechanism and mechanism analysis/integration
    - Use CAD to better inform electrical pass through constraints

# 2025 IREC Clarification

## 7.4 BOOST PHASE DORMANCY

7.4.1 Control actuator systems (CAS) shall remain in a neutral state until one of the following conditions is met:

7.4.1.1 The launch vehicle's boost phase has ended (*i.e.*, all propulsive stages have ceased producing thrust).

7.4.1.2 The launch vehicle has crossed the point of maximum aerodynamic pressure (max Q) in its trajectory.

7.4.1.3 The launch vehicle has reached the following:

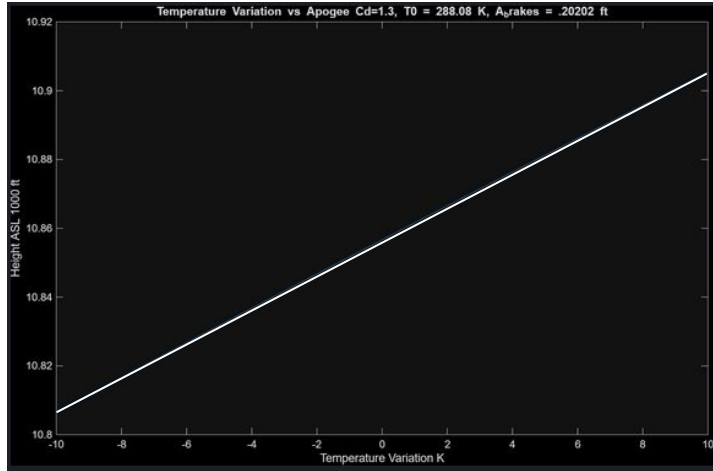
7.4.1.3.1 For 30K flights: an altitude of 6,000 m (19,600 ft) AGL.

7.4.1.3.2 For 10K flights: an altitude of 2,000 m (6,500 ft) AGL.



# Effects of Temperature Variation

Temperature AGL used in model: 288.08K (14.93°C)



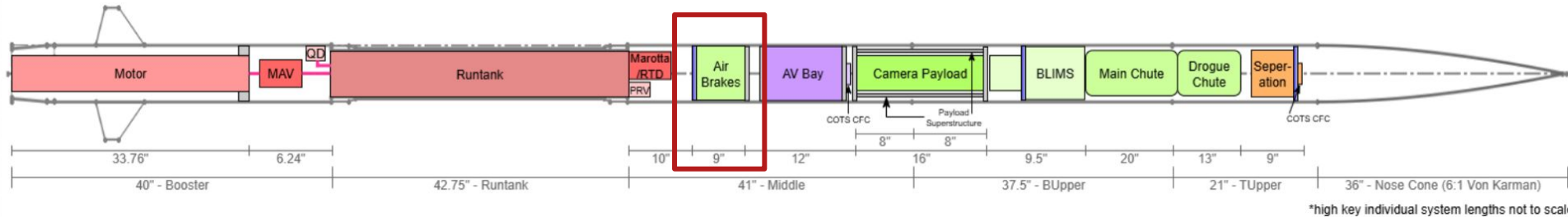
Pretty linear variation: 7 ft/K

Which means our delta-h could be 140 ft less than modeled previously.

(7% reduction in performance when compared to test launch conditions)

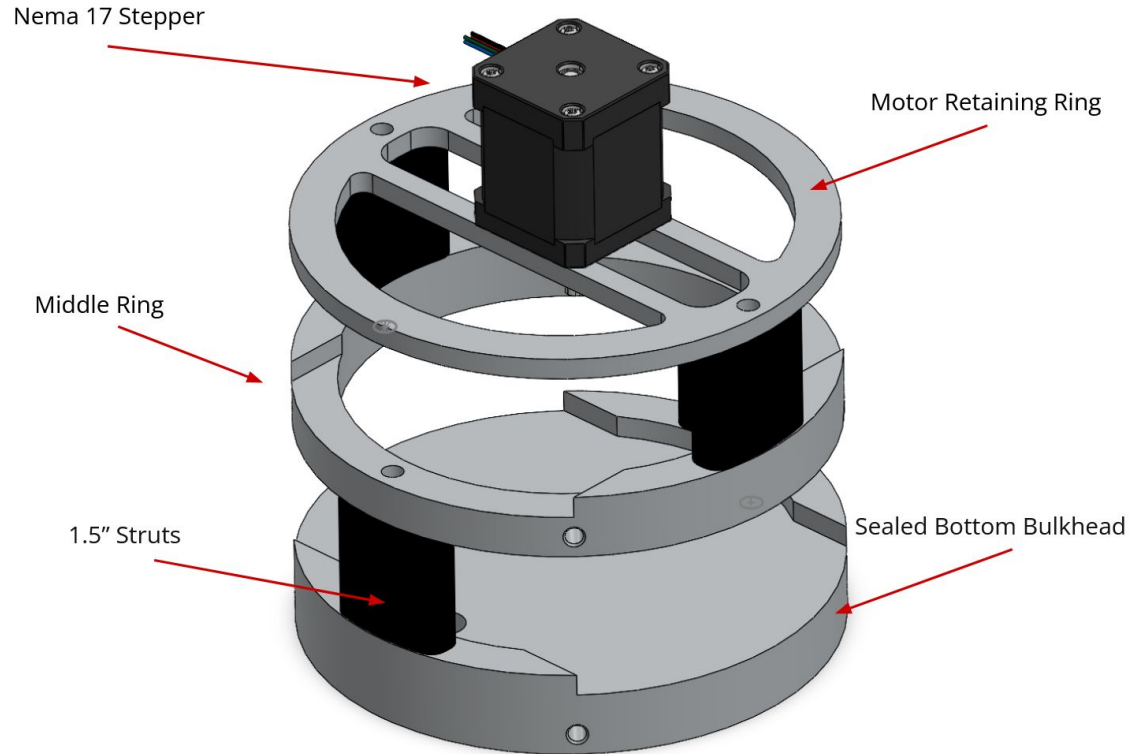
# System Overview

- Function(s): Transfer Aerodynamic Load from Airbrakes to Airframe
- Parents: Launch Vehicle
- Children: Airbrake Mechanism

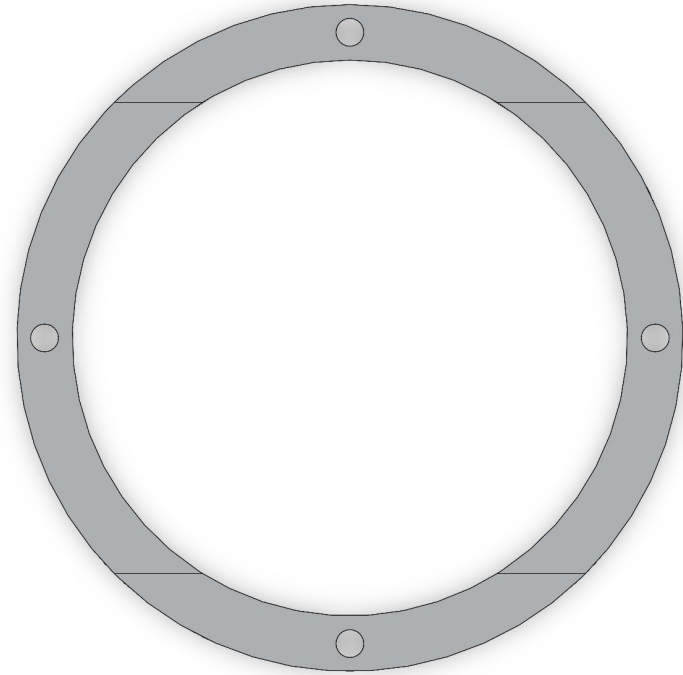
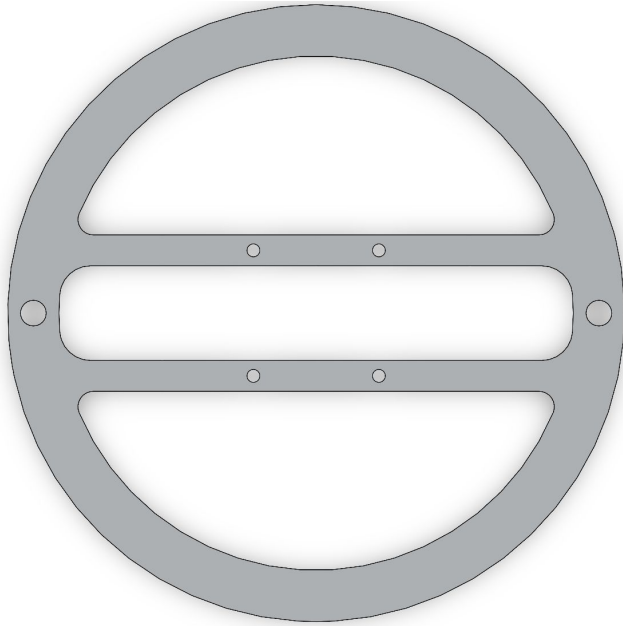


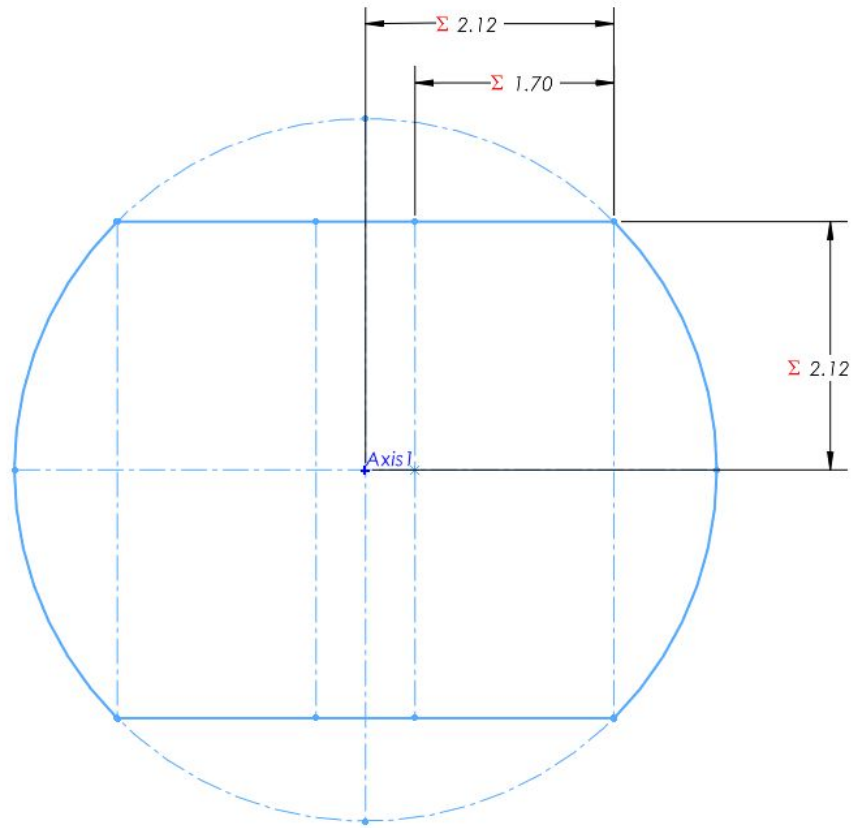
# System Overview

- System Mass: 2.3 lbs
- System Height: 6.89"



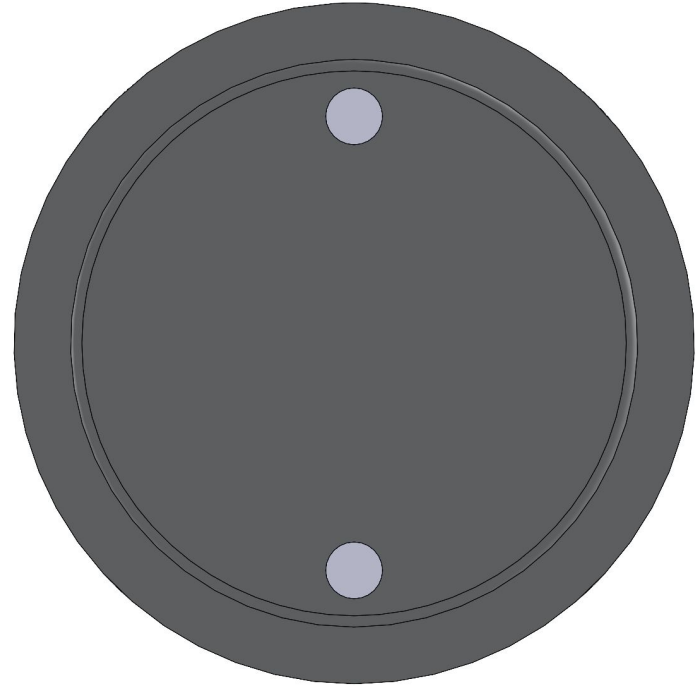
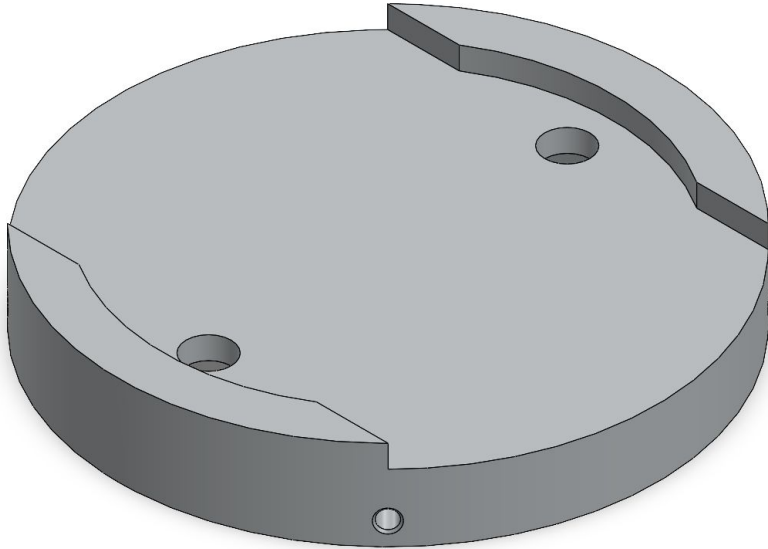
# Motor Retaining and Middle Rings







# Bottom Sealed



# Fastener Calcs

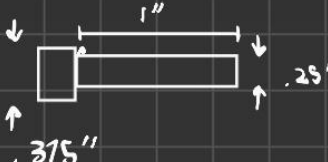
Fastener: Black Oxide: 1/4" 20.

Maximum Aerodynamic Load +System

Mass: 142.6 lbf

x8 Fasteners

Black Oxide Alloy Steel

$$\sigma_u = 170 \text{ ksi}$$
$$\tau_u = (.6) \sigma_u = 102 \text{ ksi}$$
$$A = \pi \left( \frac{.25}{2} \right)^2 = \frac{\pi}{64} \approx 0.05 \text{ in}^2$$
$$V_{\max} = \tau_u A$$
$$V_{\max} = \underline{5007 \text{ lbf}}$$


The diagram shows a rectangular cross-section of a fastener. The length is labeled as 1". The diameter is labeled as .25". The height is labeled as .375". Arrows indicate the dimensions.

# 1.5" PETG Struts

4x Struts. Used for spacing and clocking

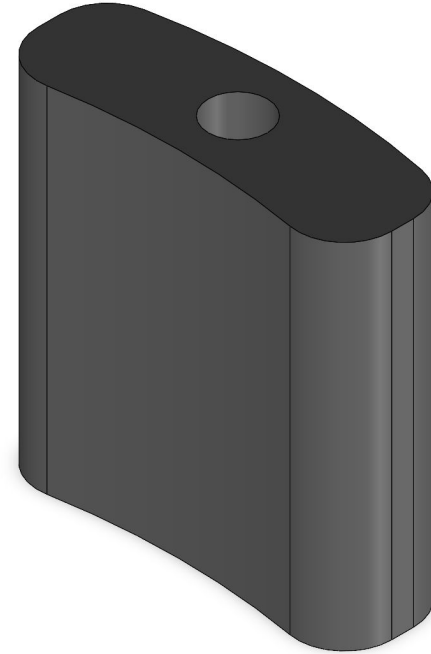
Cross Sectional Area:  $.66 \text{ in}^2$

Compressive Strength (7000 psi)

Shear Strength: (9000 psi)

Maximum Torque: 16335 lb in (184 kN cm)

Maximum Compression Load: 4620 lb



# Next Steps

- Analysis
  - Wind Tunnel Testing for single leaf
- Integration
  - Mechanism Integration
    - Finalize Strut Height
    - Finalize Leaf Bed Integration
  - Wire Routing CAD
  - Structural Ansys for Middle Ring, Bottom Sealed, and Struts
  - Mass Reductions