



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

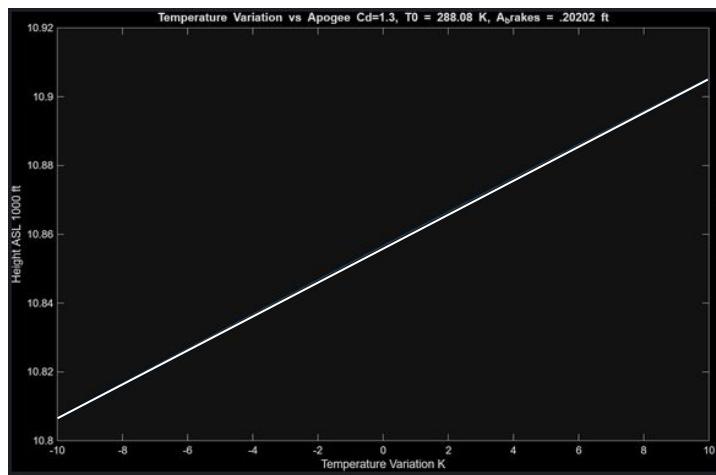
2025 IREC Clarification

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)



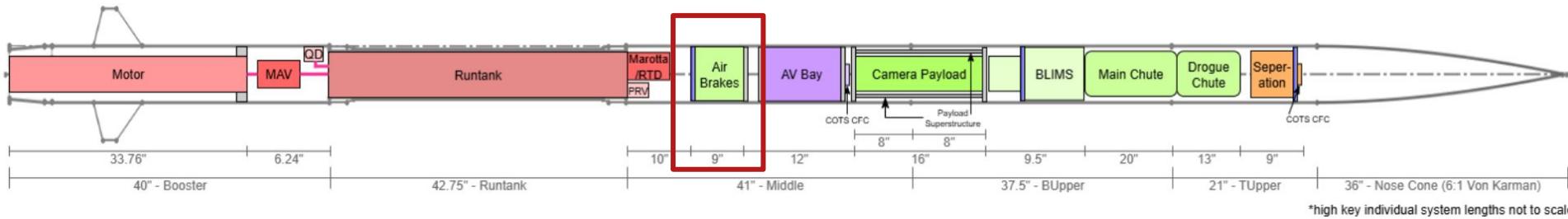
Pretty linear variation: 7 ft/K

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

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

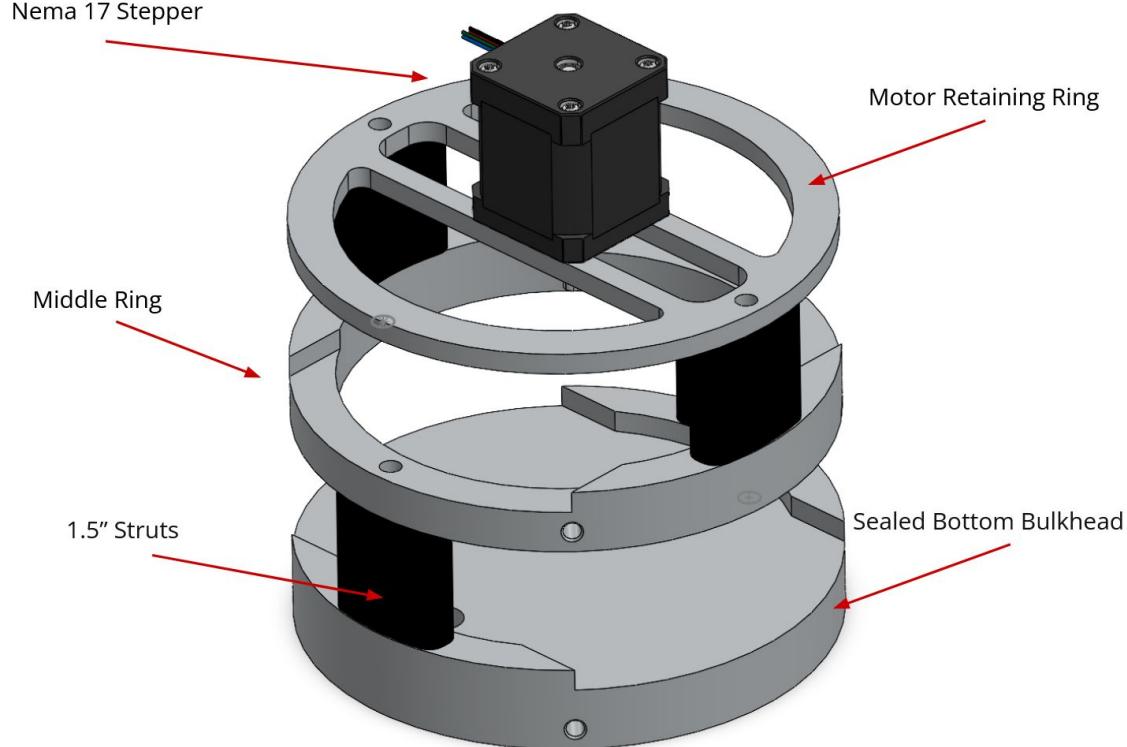
System Overview

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

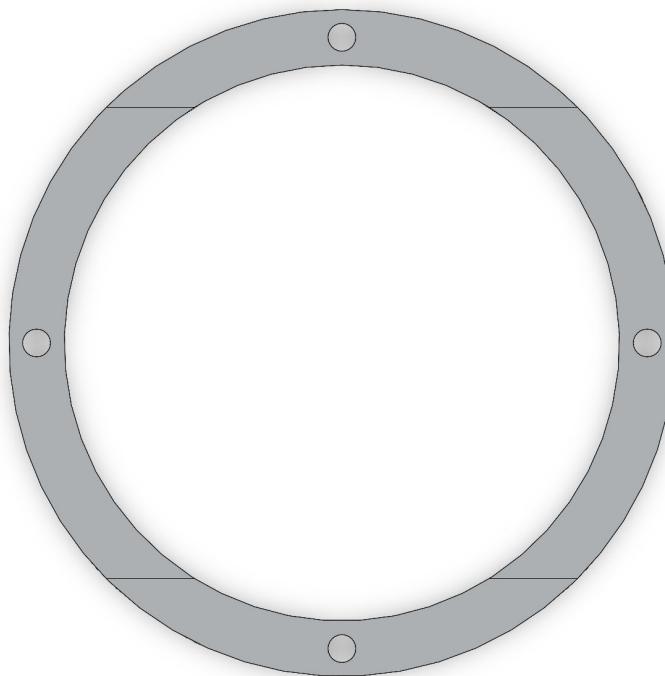
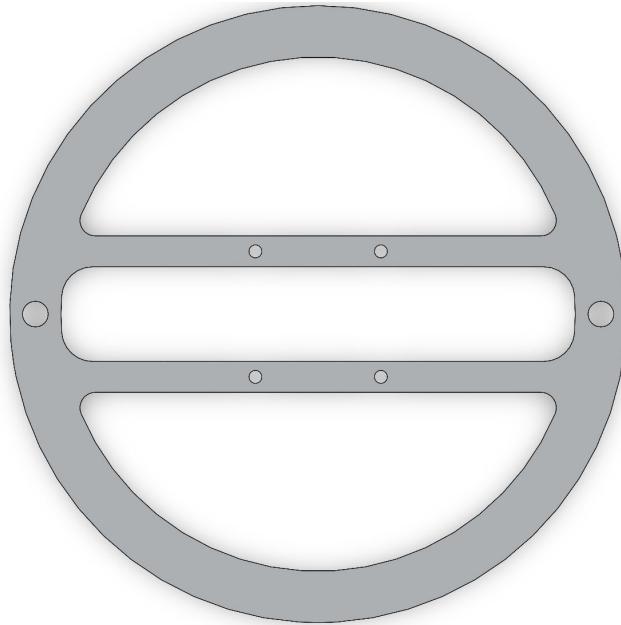


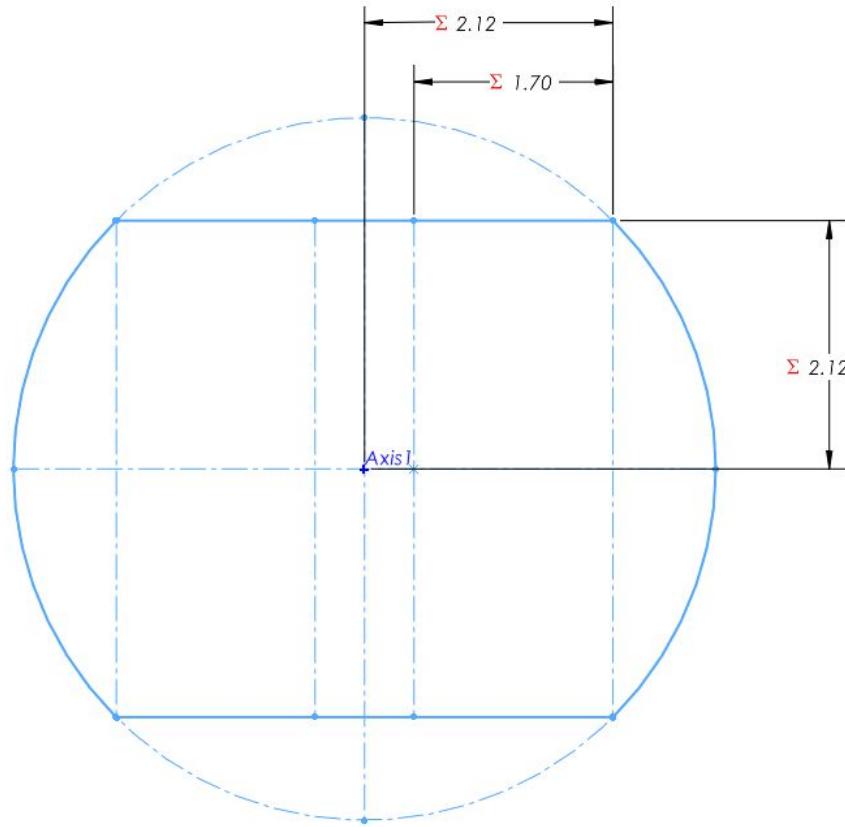
System Overview

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

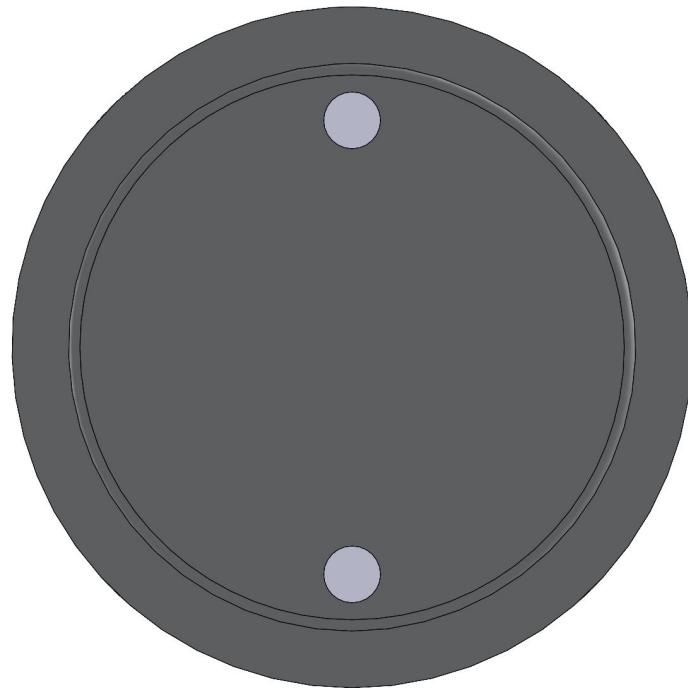
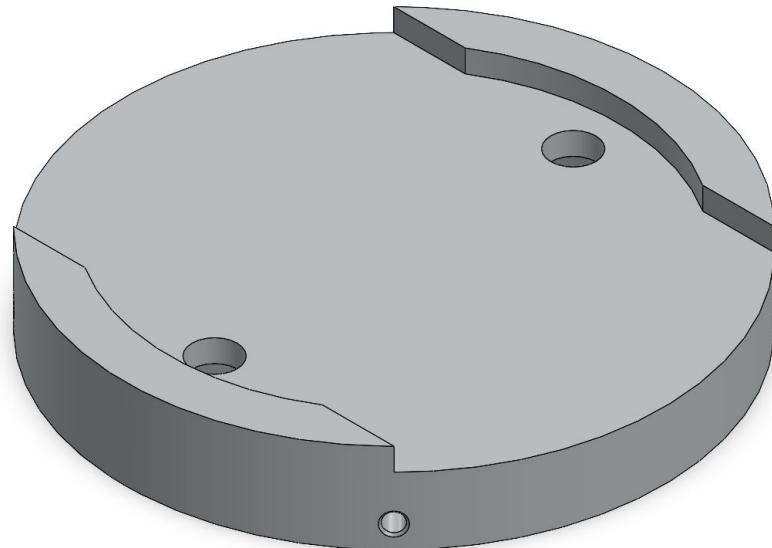


Motor Retaining and Middle Rings





Bottom Sealed



Fastener Calcs

Fastener: Black Oxide: 1/4" 20.

Maximum Aerodynamic Load +System

Mass: 142.6 lbf

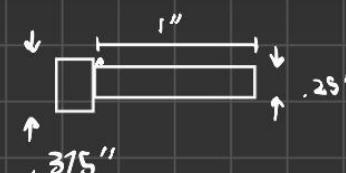
x8 Fasteners

Black Oxide Alloy Steel.

$\sigma_u = 170 \text{ ksi}$

$T_u = (.6) \sigma_u = 102 \text{ ksi}$

$A = \pi r^2 = \frac{\pi}{4} (0.05)^2 = 0.05 \text{ in}^2$


$$V_{max} = T_u A$$
$$V_{min} = \underline{5007 \text{ lbf}}$$

1.5" PETG Struts

4x Struts. Used for spacing and clocking

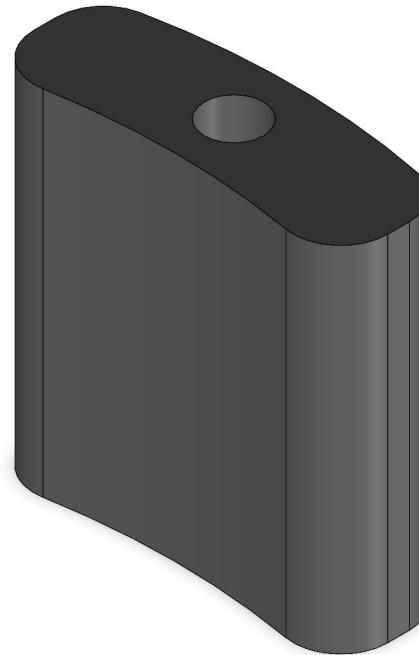
Cross Sectional Area: .66 in²

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