Deployable Space Baffle Imaging System

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Objectives

Design, build and test a prototype for a space – based deployable, optical lens alignment structure

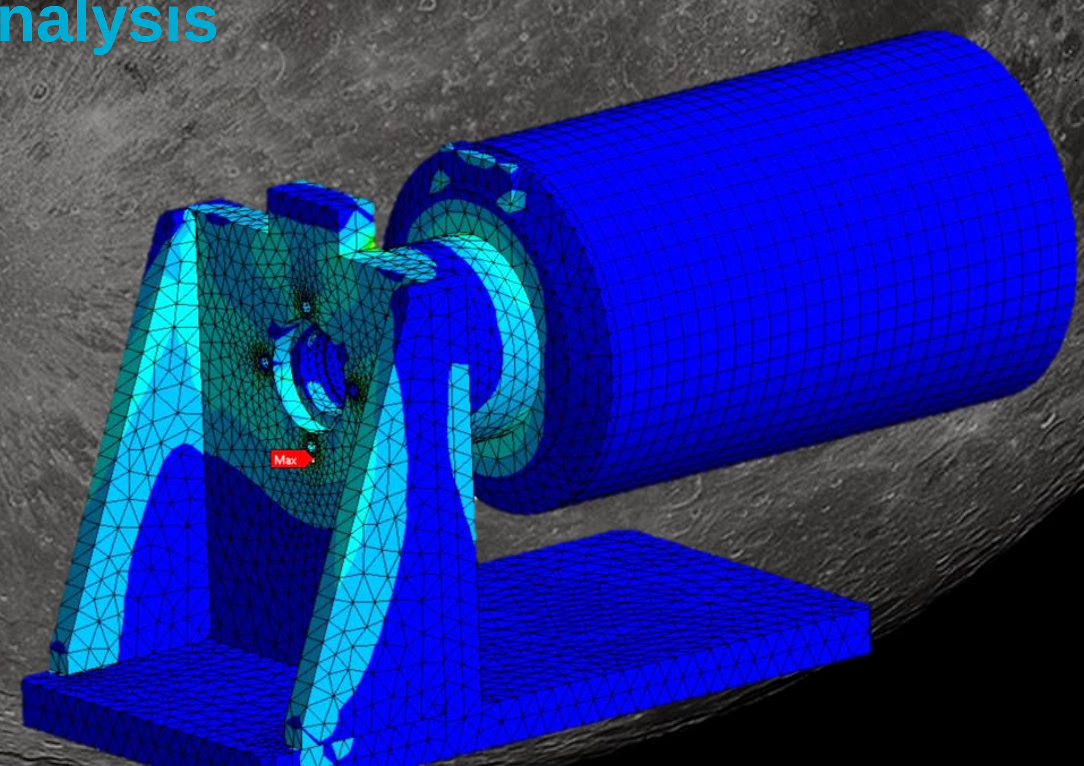
Challenges included:

- Maintaining lens alignment through launch and space environments
- Blocking stray light without exceeding mass and volume constraints

Key Requirements

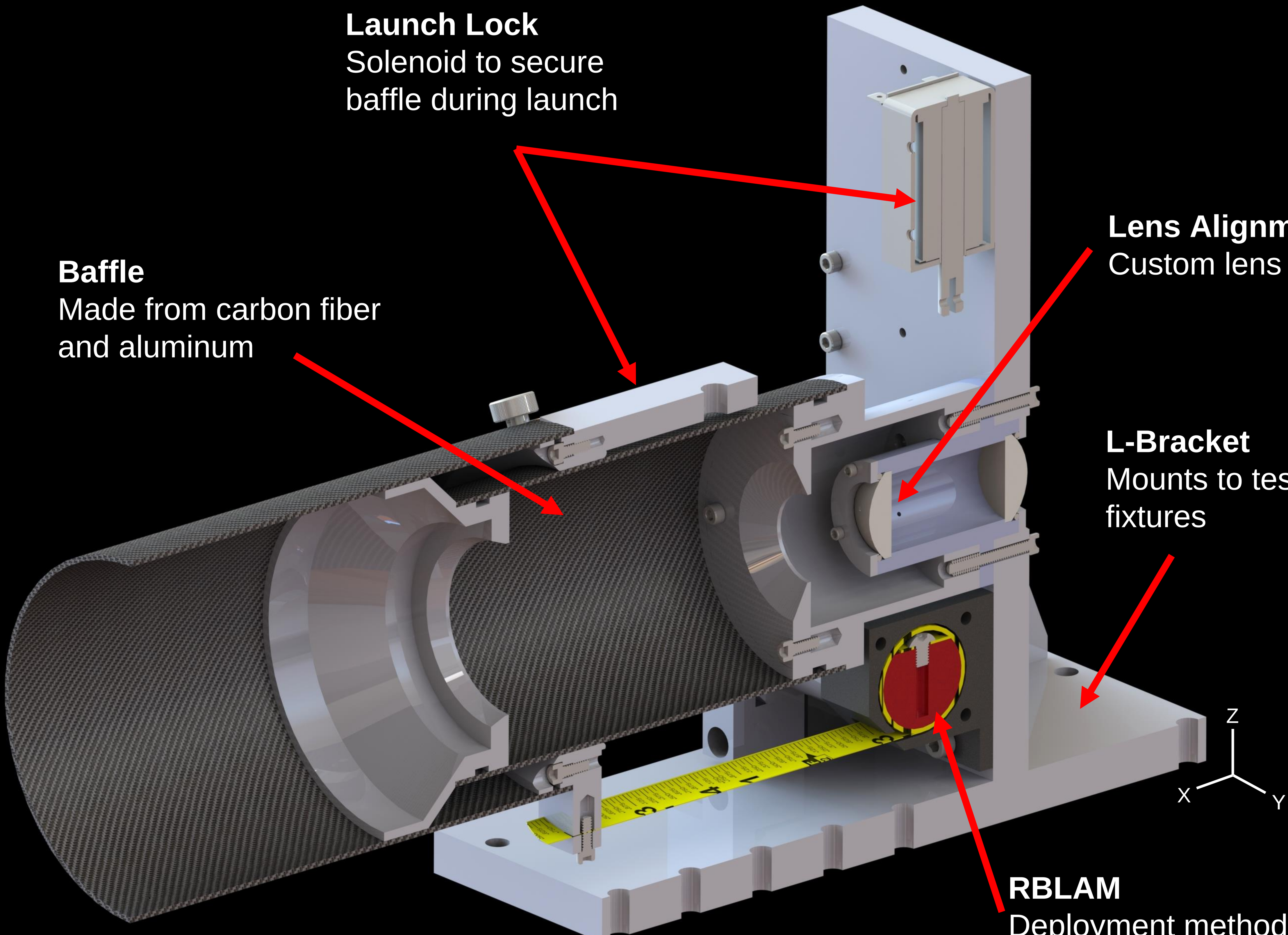
Category	Description	Result
Size	Shall fit in a 1'X1'X1' volume and weigh <5 lbs	☑
Light Attenuation	The baffle shall attenuate >99.5% of light outside 45°	☑
Thermal	Lenses stay aligned within a 2 cm diameter circle at 2m over a temp range of -40°C and 70°C	☑
Vibration	Survive a representative launch profile (NASA-STD-7002b)	☑

Analysis

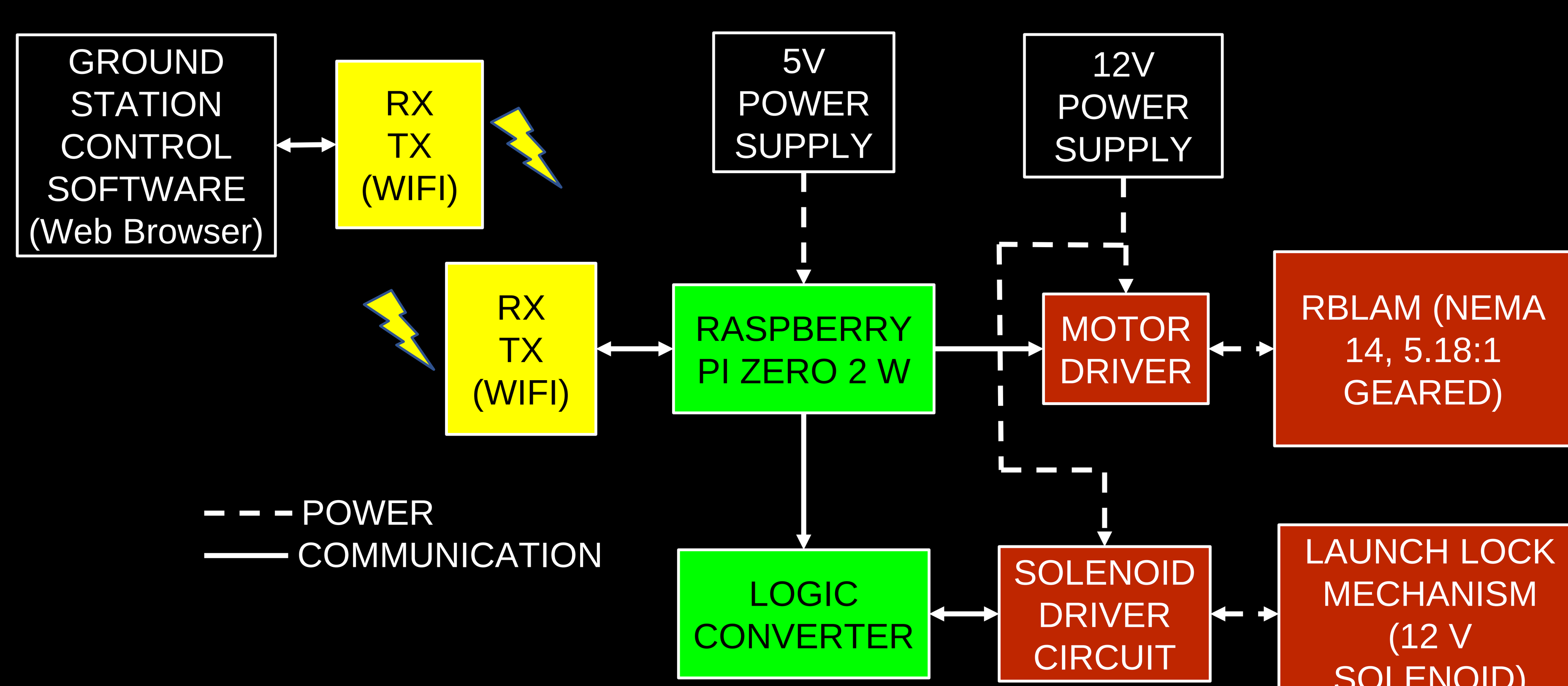


Safety Factor: 2.36

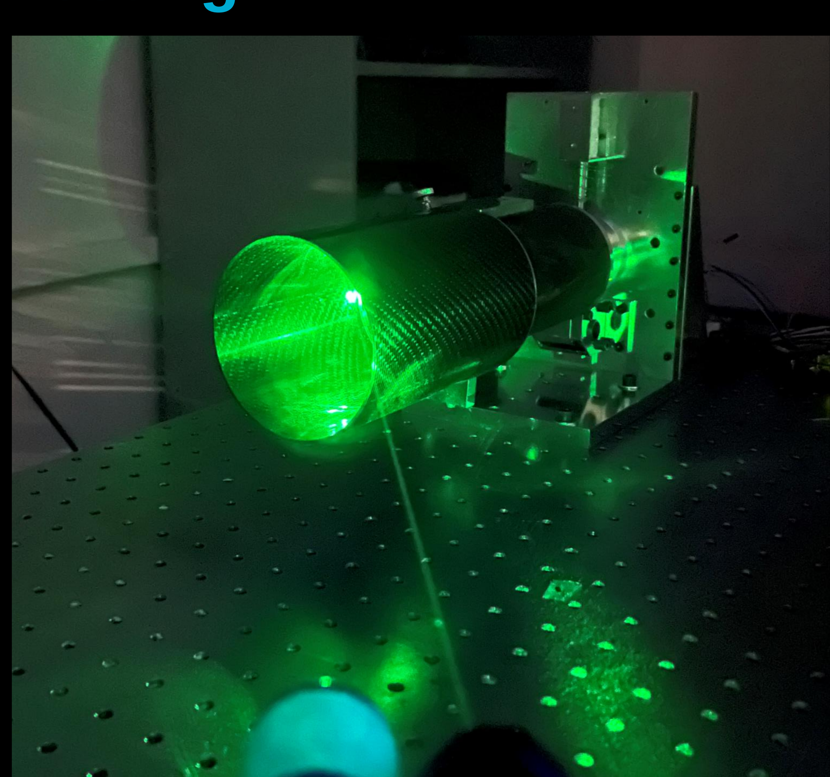
FEA modal analysis was performed to understand resonant frequencies and expected stresses



Electronics Diagram



Testing

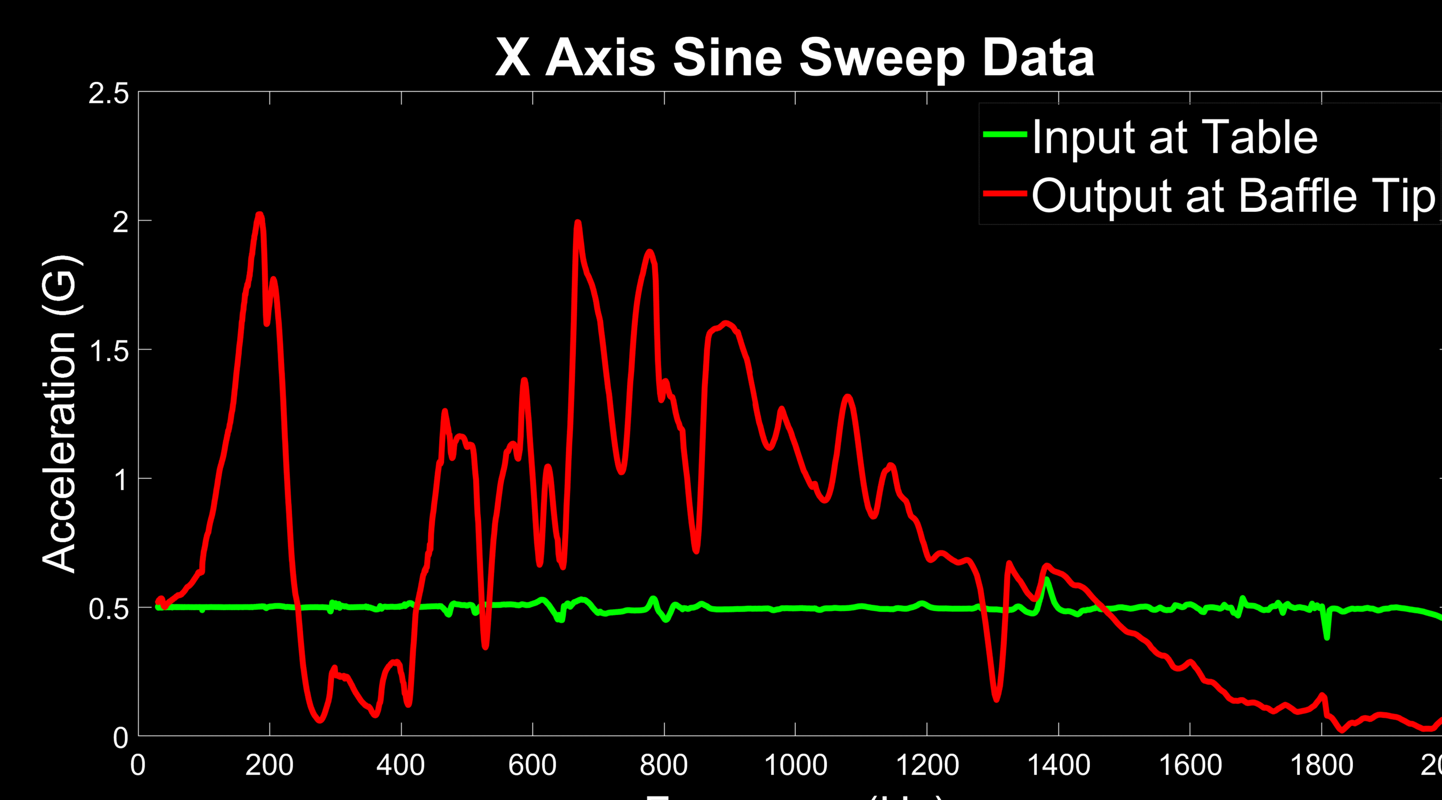


Light Attenuation Test Setup

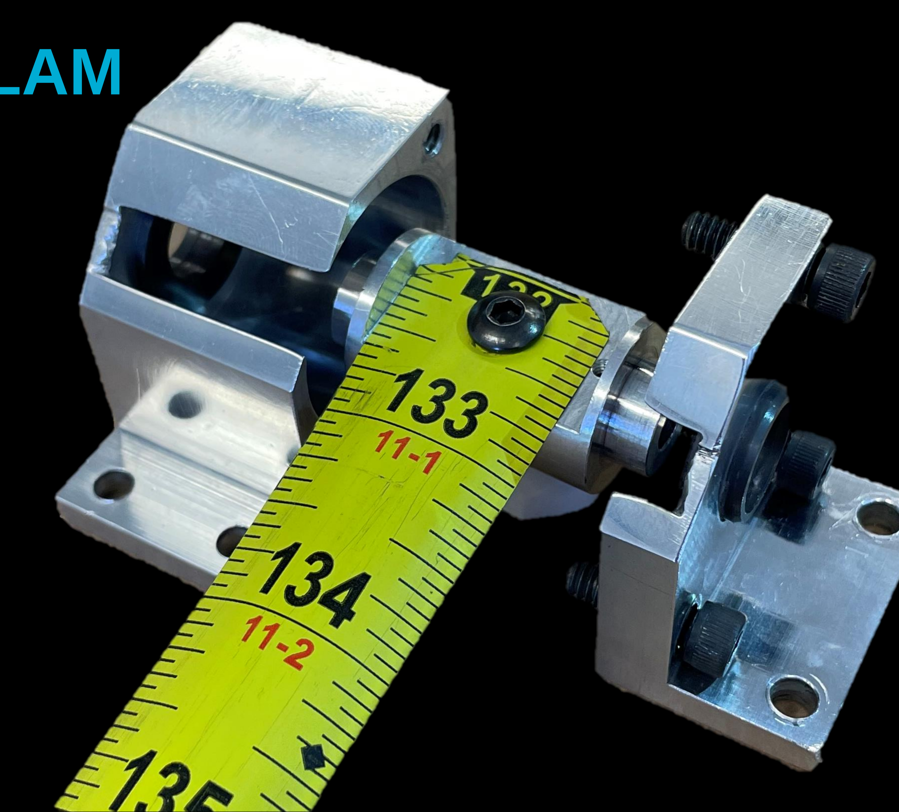
Light Attenuation
520 nm laser at 45° angle, photocell to measure light intensity at lens

Thermal
Cycled DSBIS in dry ice box and oven and tested lens alignment at each thermal extreme

Vibration
Random vibration and sine sweeps to simulate a launch environment

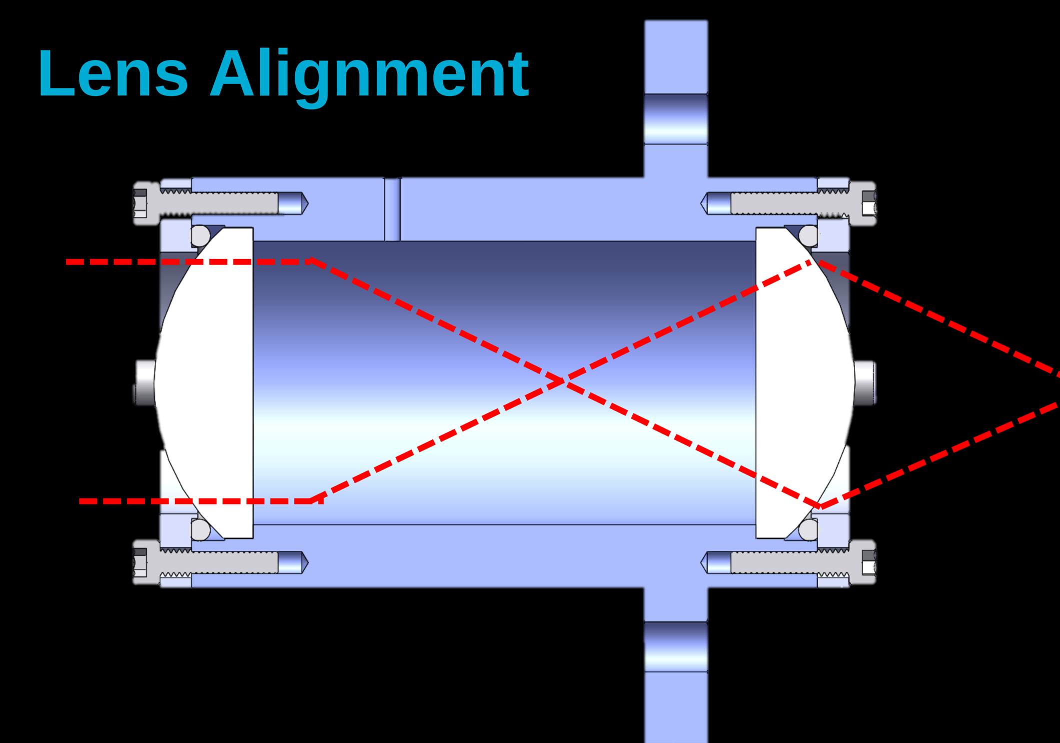


RBLAM



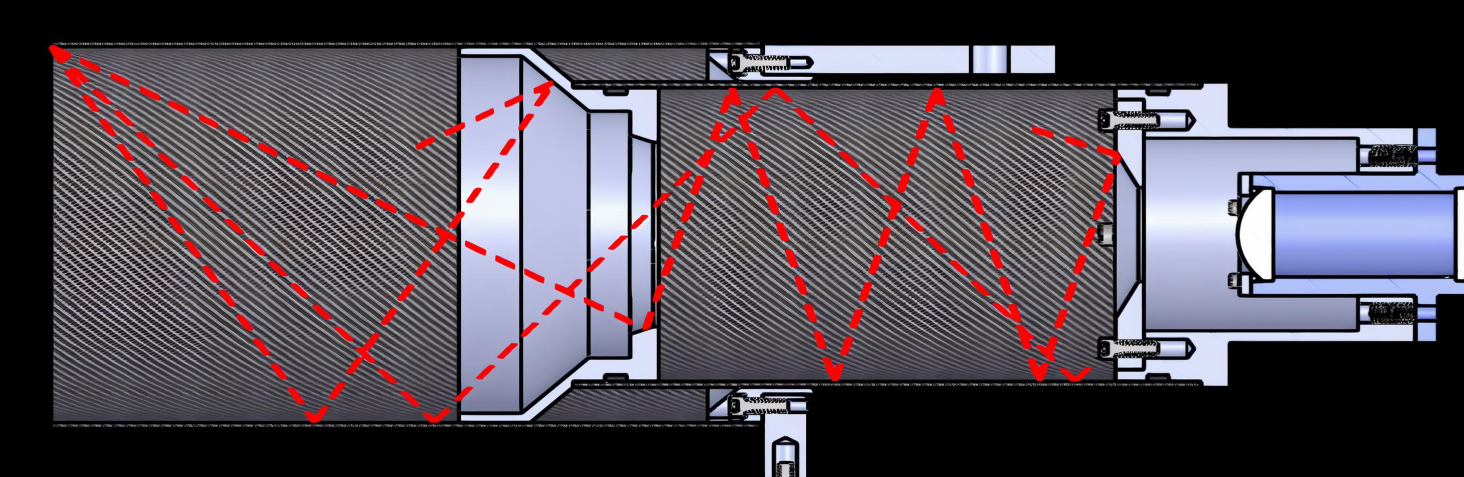
The Rotationally Based Linear Actuation Mechanism (RBLAM) is a motor driven tape measure used to extend the baffle

Lens Alignment



Custom lens tube to maintain alignment in space environments

Baffle



Light rays are absorbed or reflected in baffle before reaching lenses

Conclusion/Lessons Learned

- Learned the importance of tolerances, testing early, and prototyping often
- Successfully designed, tested, and demonstrated a novel deployment system for space applications
- Maintained optical alignment through all required environments

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