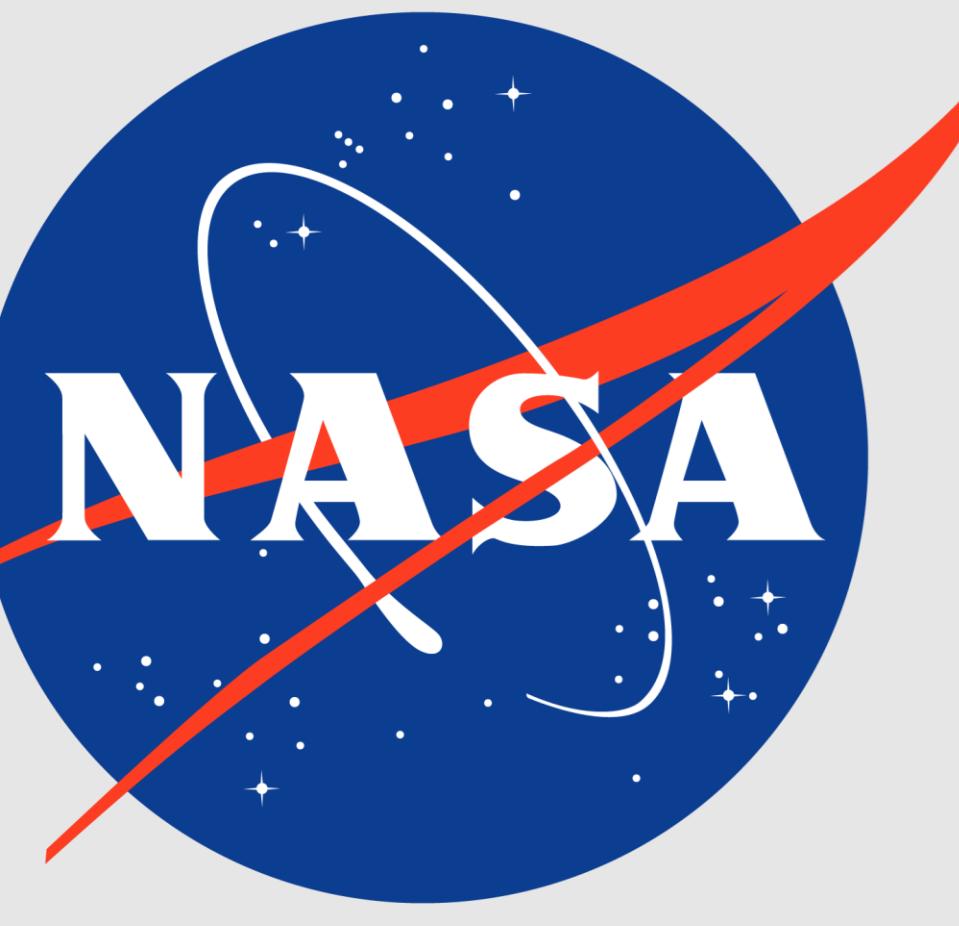


# Caltech HABITAT ORIENTABLE AND MODULAR ELECTRODYNAMIC SHIELD

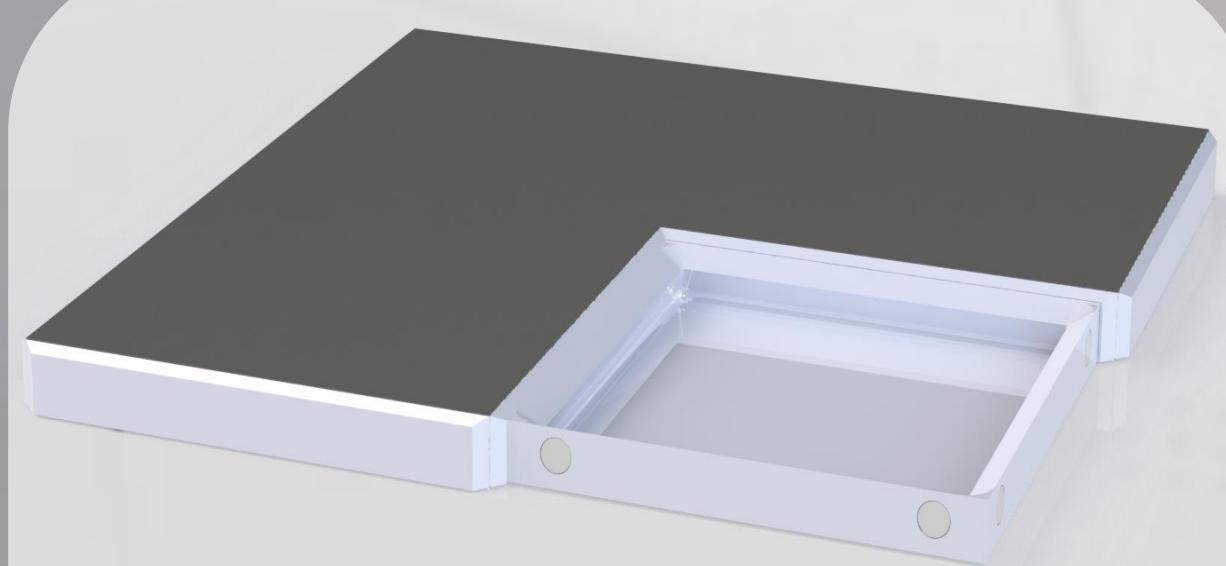
**AIAA**  
SHAPING THE FUTURE OF AEROSPACE

California Institute of Technology



## HOMES OVERVIEW

Lunar dust is a barrier to a sustained lunar presence. To address this, we developed HOMES, a set of **modular** and **rotationally symmetric** panels embedded with an **electrodynamic dust shield** (EDS) to move dust in any desired direction without any moving parts. The HOMES panel has been developed to Technology Readiness Level 5. The system advances the state-of-the-art of EDS technology by introducing modularity and adaptability that has never been seen before. This system expands potential use cases of EDS technology, including applications inside lunar habitats



Render of 3 HOMES panels, end caps, and collection panel assembled



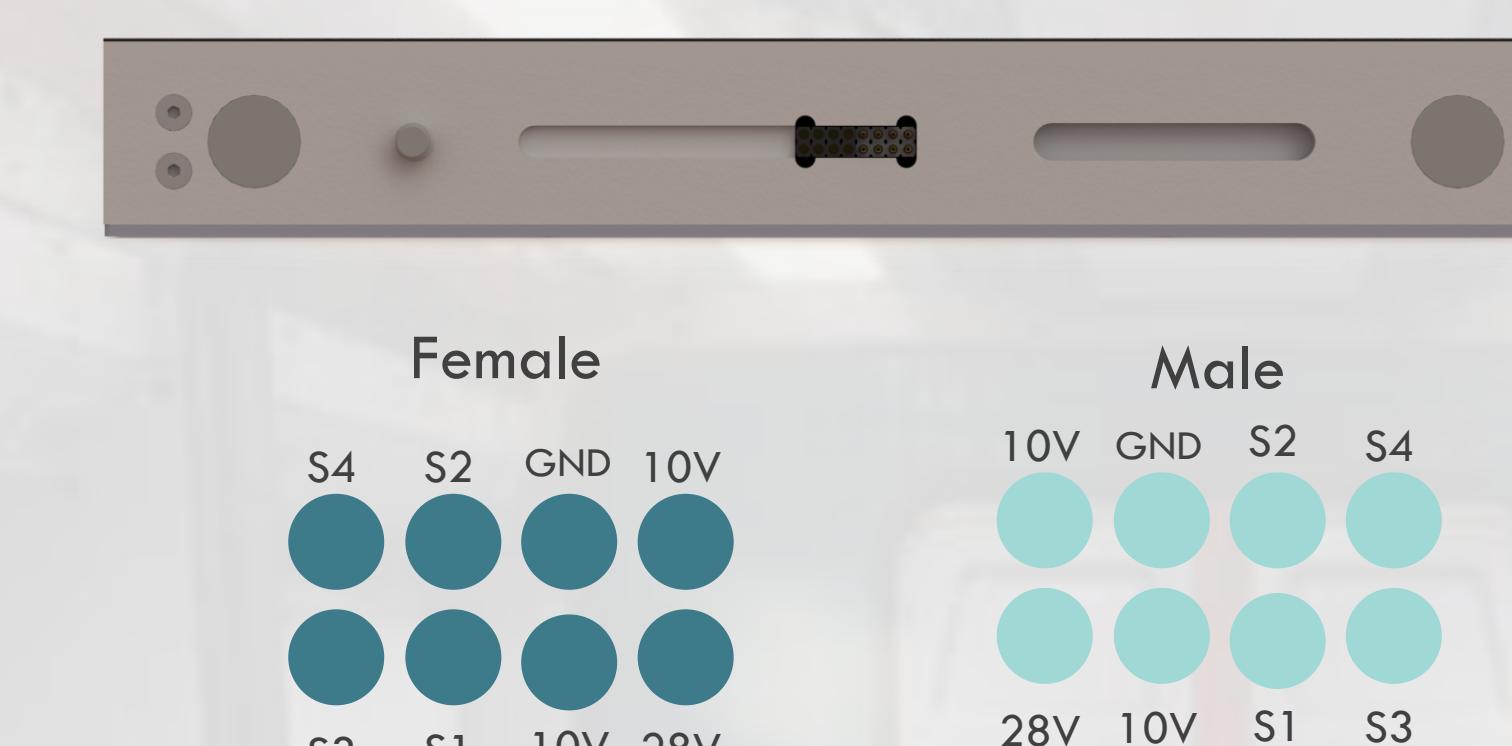
2 real-life HOMES panels and end caps assembled

## Structural Design

- Panel:** PEEK sidewalls, PEEK top plate, aluminum bottom plate, EDS, power supply PCB, panel junction
- End caps:** solid PLA structure, panel junction
- Collection panel:** solid PLA structure, 60° angle of repose cavity, panel junction



Render of a single HOMES panel showing panel junctions



Panel junction render and pin configuration to facilitate modularity and rotational symmetry

## SYSTEM OVERVIEW

Habitat Power Source

### EDS PCB

- Set of electrodes, alternate through 4 phases
- Conformal coating and Kapton dielectric tape

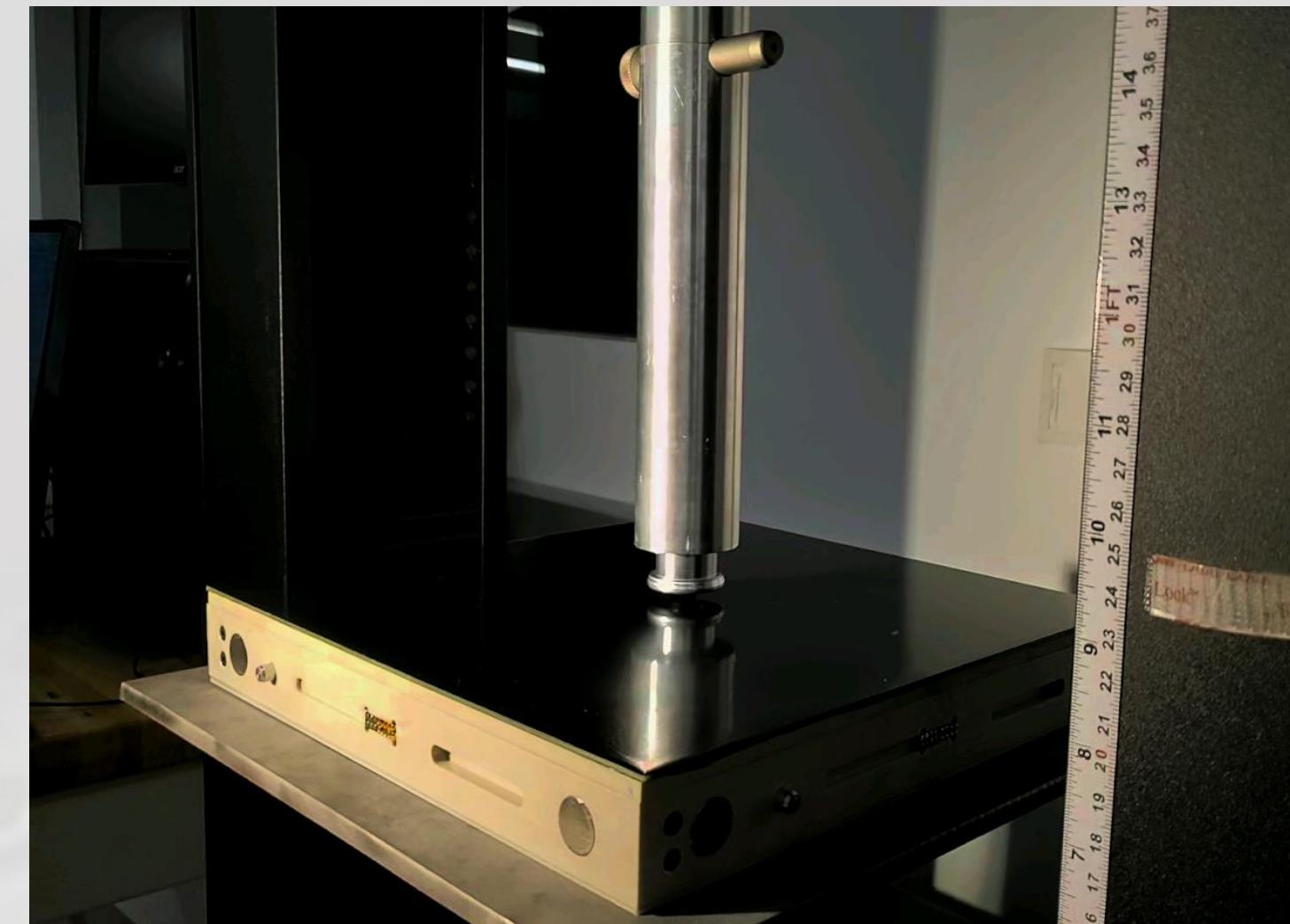
### Control Module

- Toggle switches to activate system
- Convert 28 VDC power source
- Propagate 4 phase potential to panels
- Indicator LEDs to show status

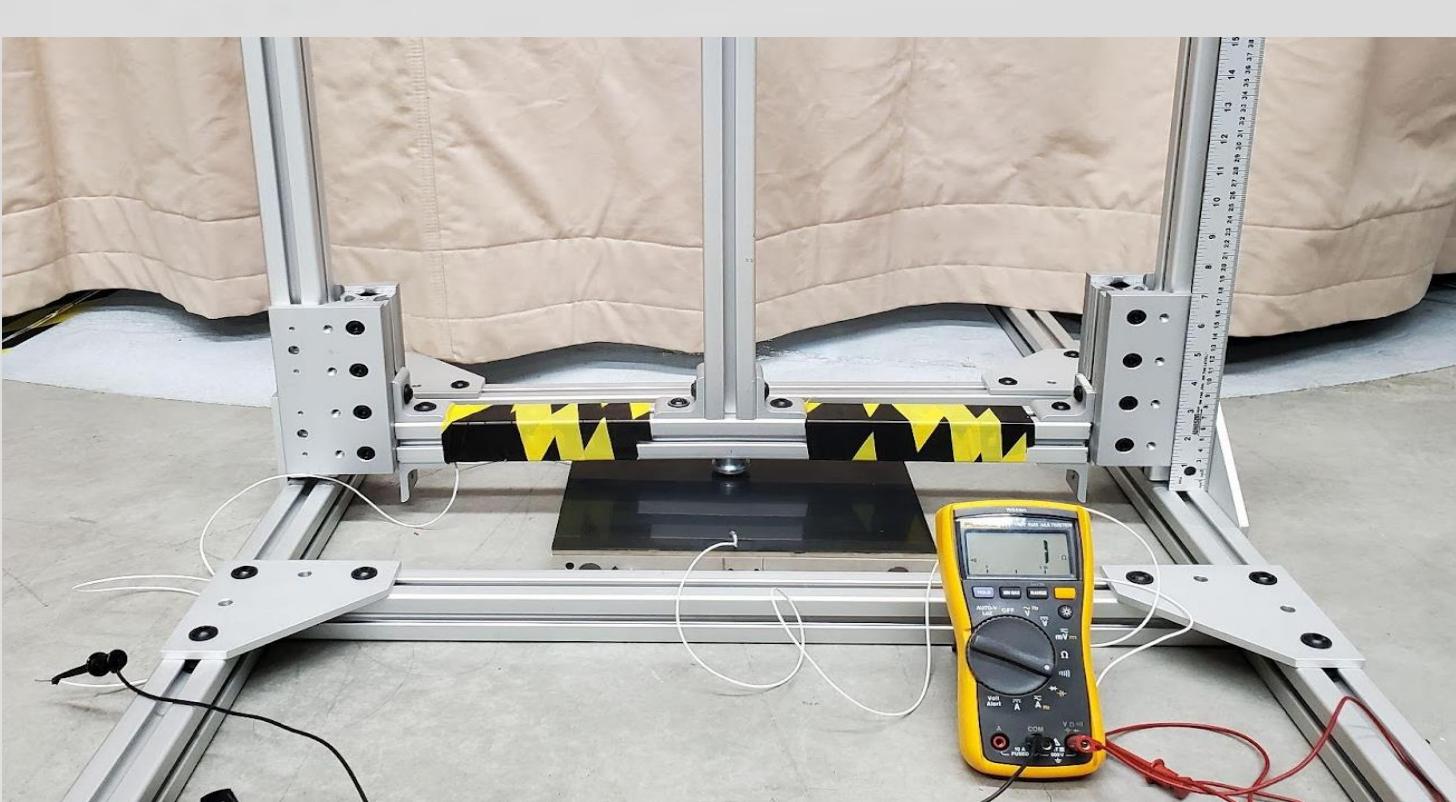
### Power Supply PCB

- Step up phases to 3.8 kV square waves
- 4 MOSFET switching circuits, DC-DC step up converter

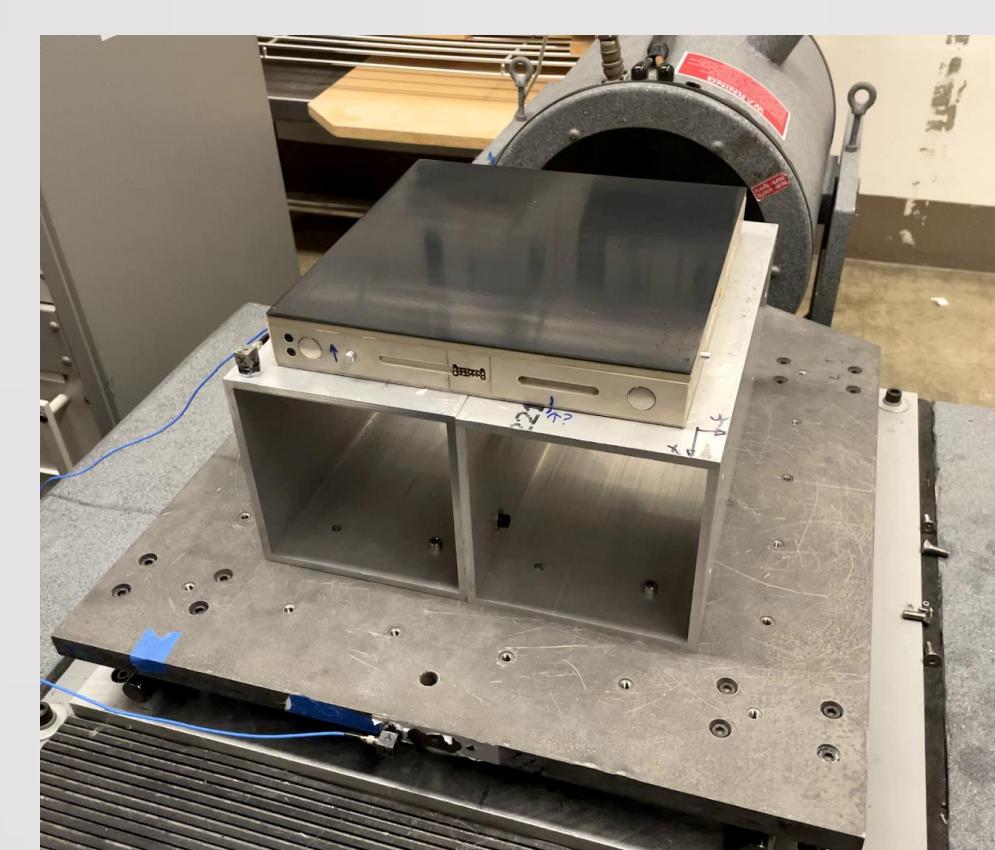
	Test Name	Description	Conditions	TRL	Results
Electrical	Duct Locomotion	EDS functionality with modularity	Sieved LHS-1 onto HOMES	4	< 45 $\mu$ m dust was moved off HOMES
	High Potential	Arcing thresholds characterization of EDS PCB	1-5 kV testing with varying levels of dielectric potential	4	Conformal coating was found to be better than Kapton for EDS PCB
	Accelerated Lifetime	Accelerated electronic lifetime test through continuous cycling	Simulating 15 years of use on the Moon	5	Still in progress
	Quasi-Static Spherical Load	Sustained astronaut weight from a point load	Simulating standing on HOMES with pebble stuck in boot	5	<b>Passed</b> with 442.8 N that was sustained for 20 seconds
	Impact	Sharp impact from a point load	Simulating jumping on HOMES with pebble stuck in boot	5	<b>Passed</b> with a 100 kg impact impact from 24.7 cm in lunar gravity
Mechanical	Vibration	Identification of latent defects and manufacturing flaws	Minimum workmanship random vibration test	5	<b>Passed</b> PVTR 7 standard in NASA-STD-7001B



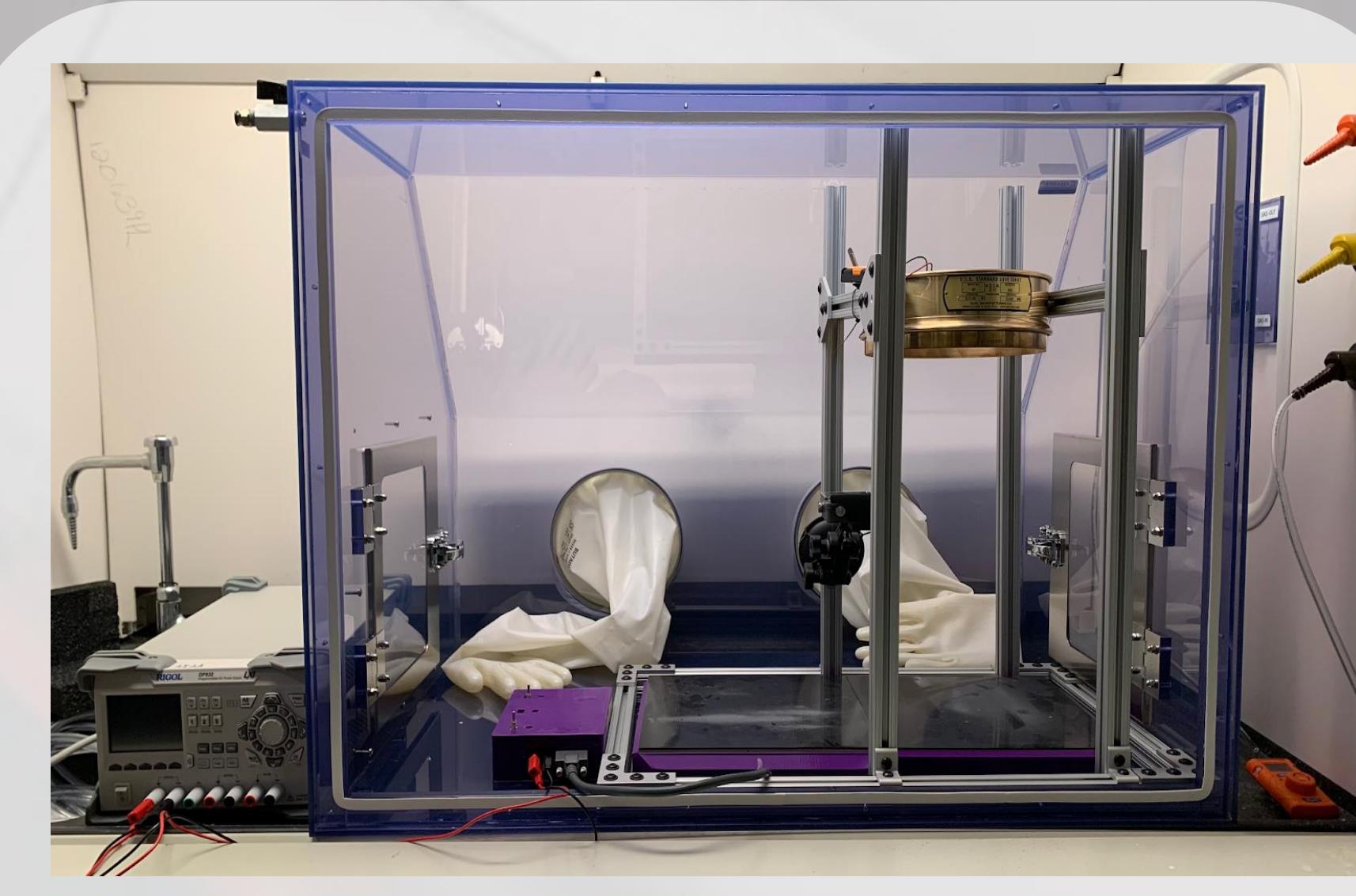
Quasi-static load test rig



Impact test experimental setup



Random vibration test experimental setup



Experimental setup for accelerated lifetime test