



Marshall Space
Flight Center

NeXolve
Technology for Today & Tomorrow

The Lightweight Integrated Solar Array and Transceiver (LISA-T)

TRL6 4-petal Omnidirectional ambient deployment
10/06/2016





Thin-film solar arrays for small spacecraft

Sprat

September 2018 || John Carr, Ph.D



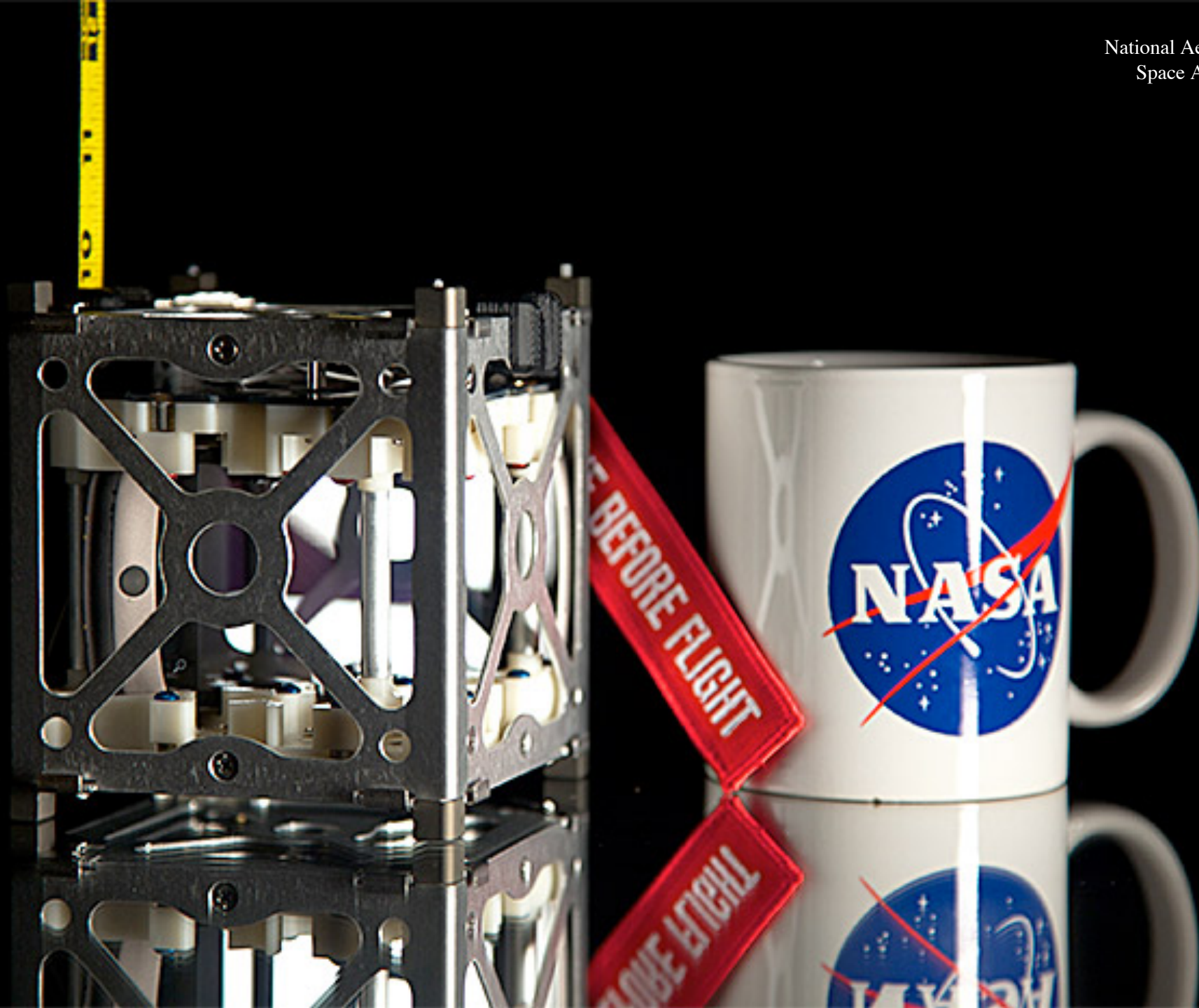
National Aeronautics and
Space Administration

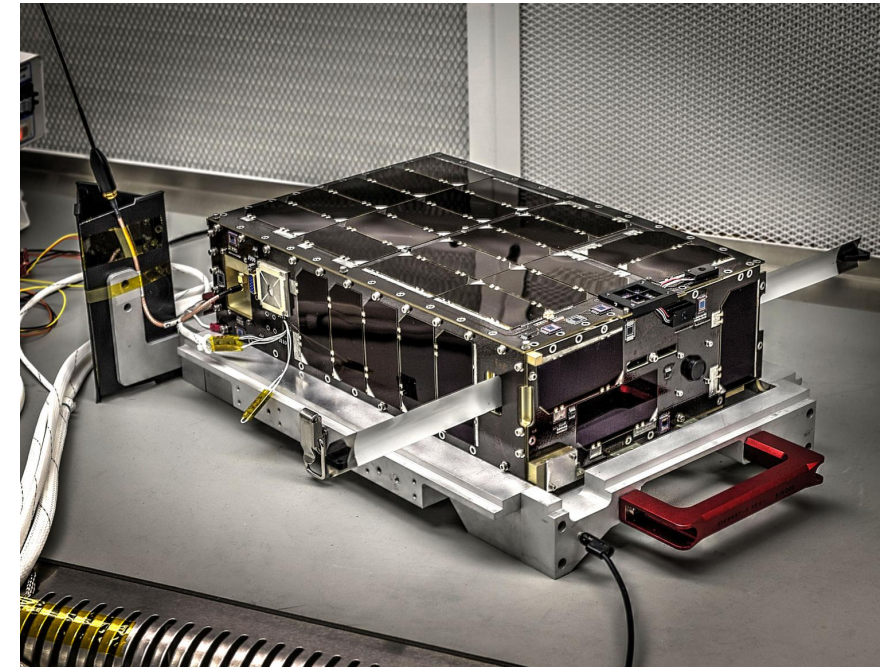
[MOTIVATION]



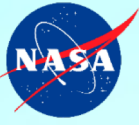
Small spacecraft are *power starved*







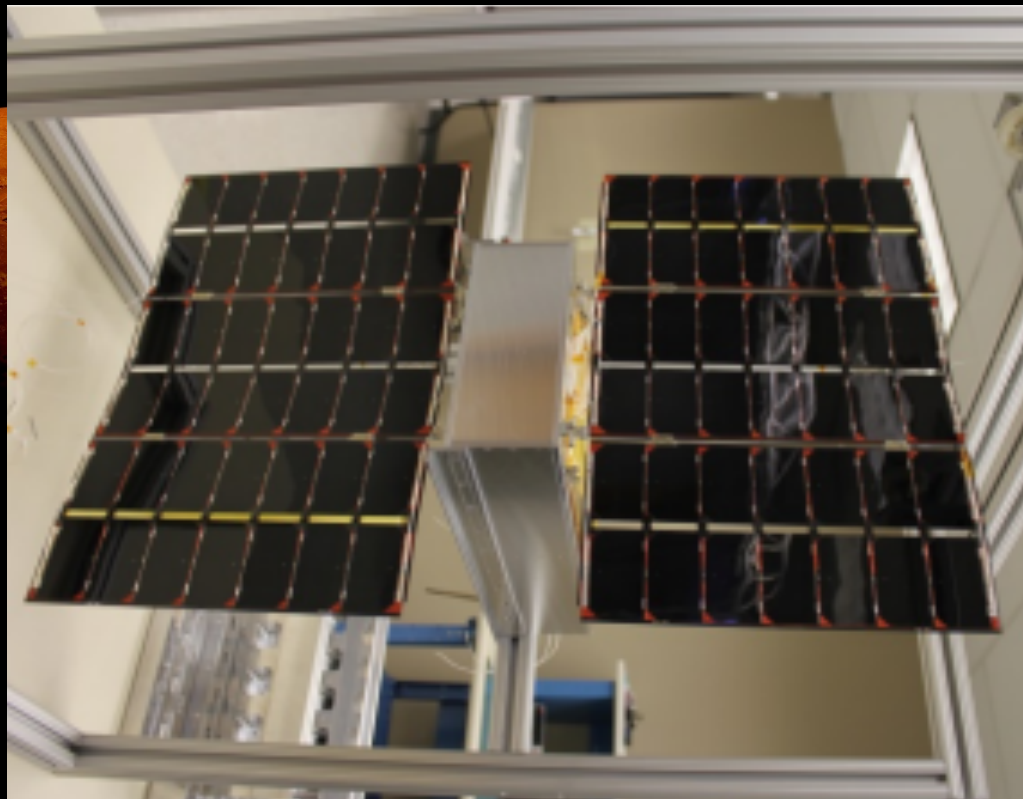
Surface area, mass, and volume are *limited resources*.



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Capability is
choked...





Grow spacecraft...or shrink subsystem...



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[OUR THIN-FILM SOLUTION]



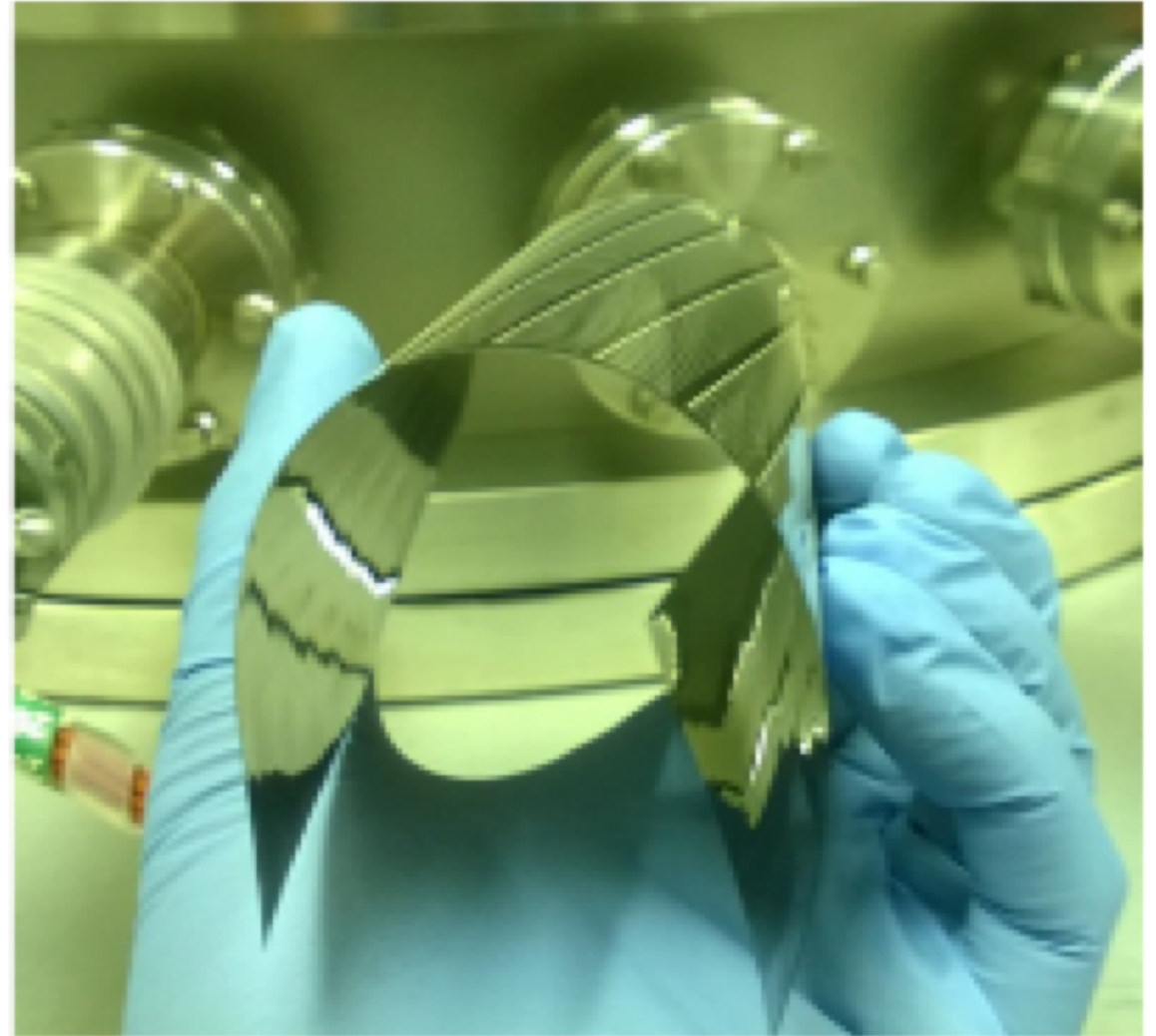
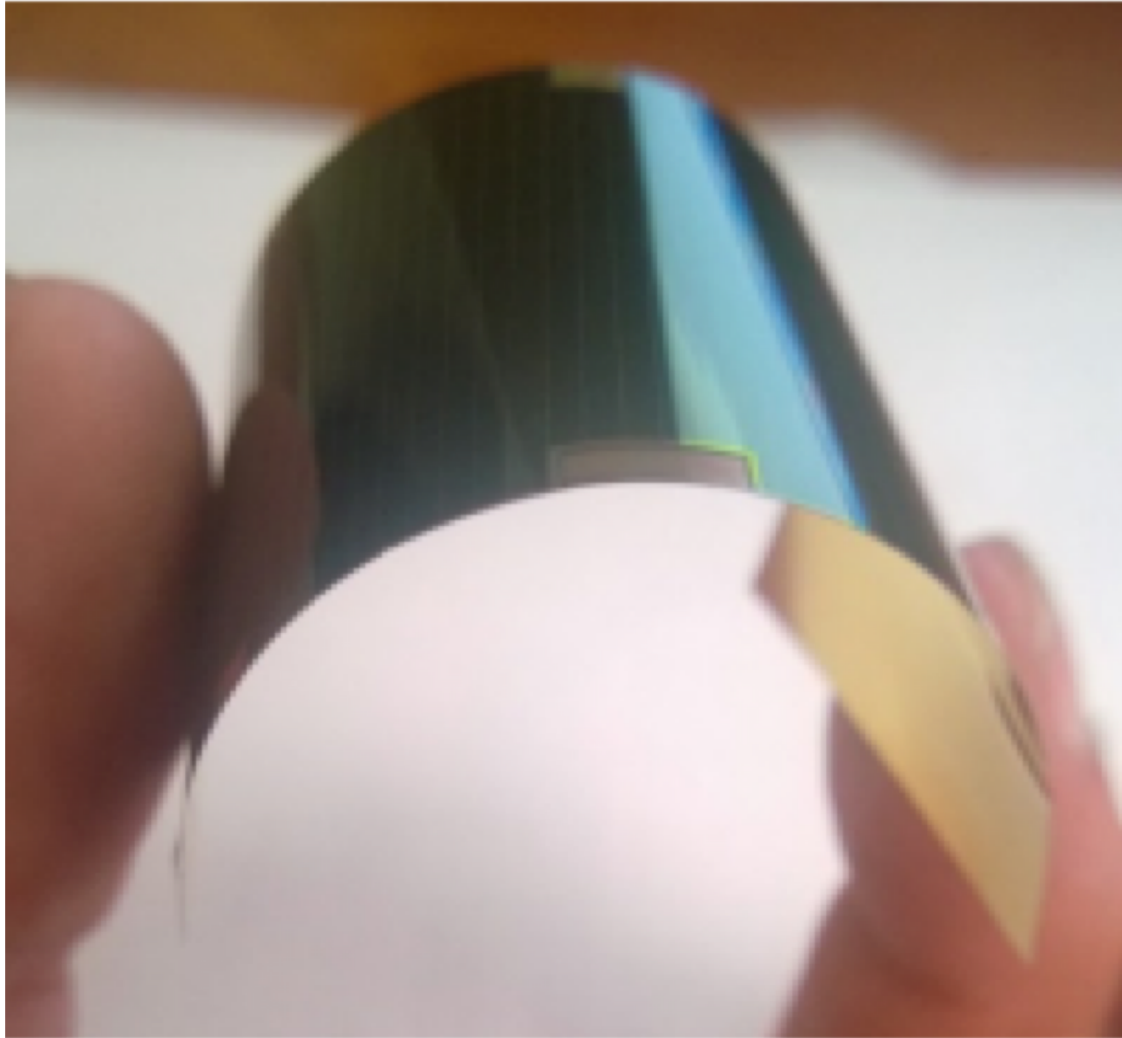
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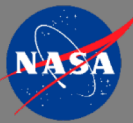


NEAScout Solar Sail

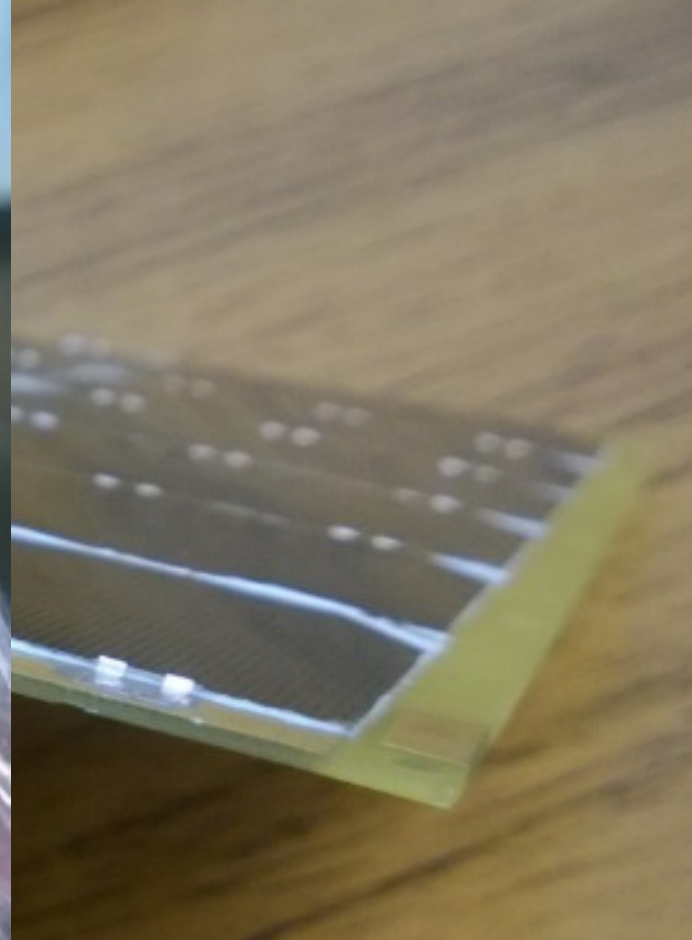


Coupled with thin-film solar cell work throughout the community...





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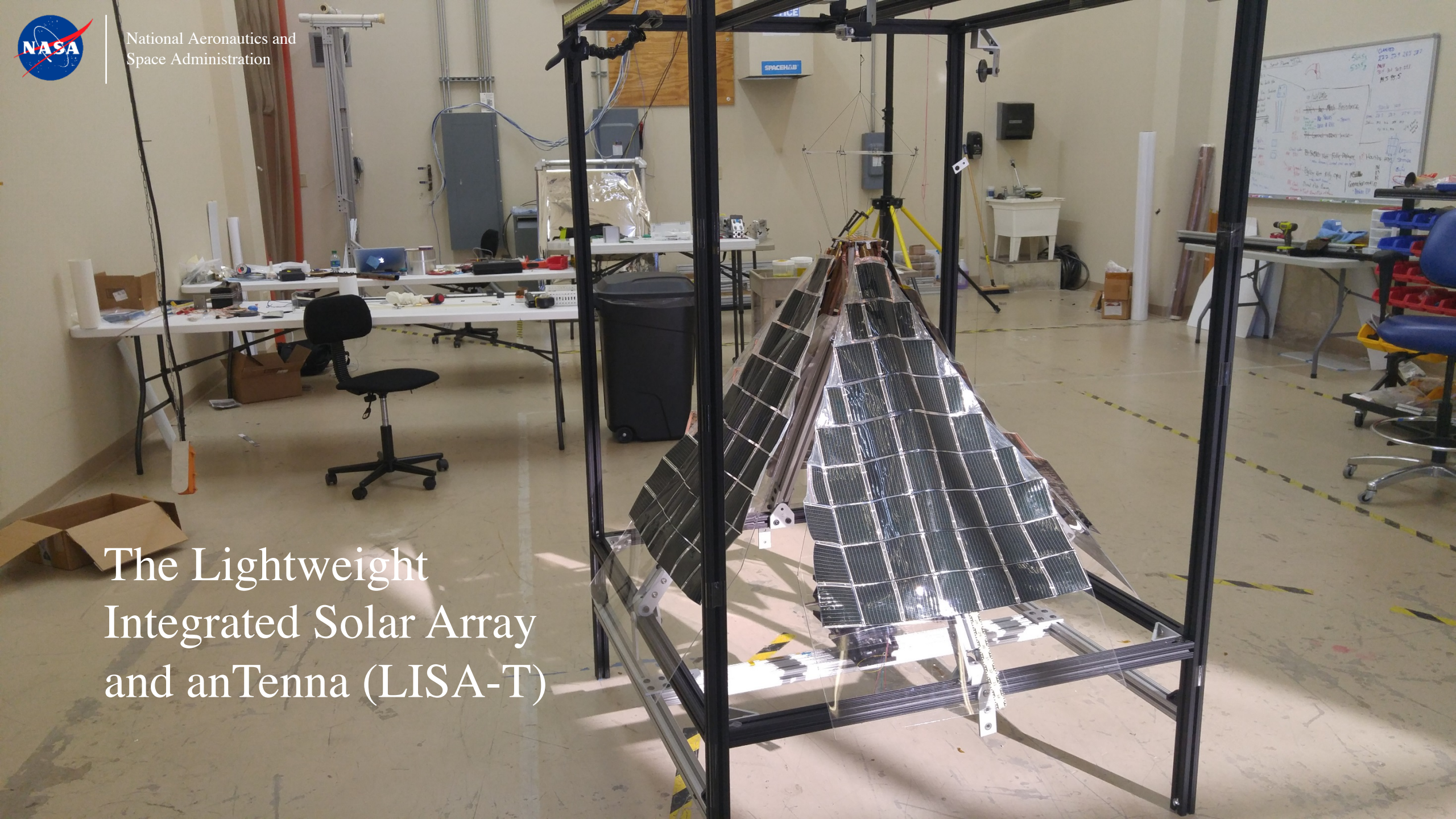
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[THE LISA-T SYSTEM]



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The Lightweight Integrated Solar Array and anTenna (LISA-T)





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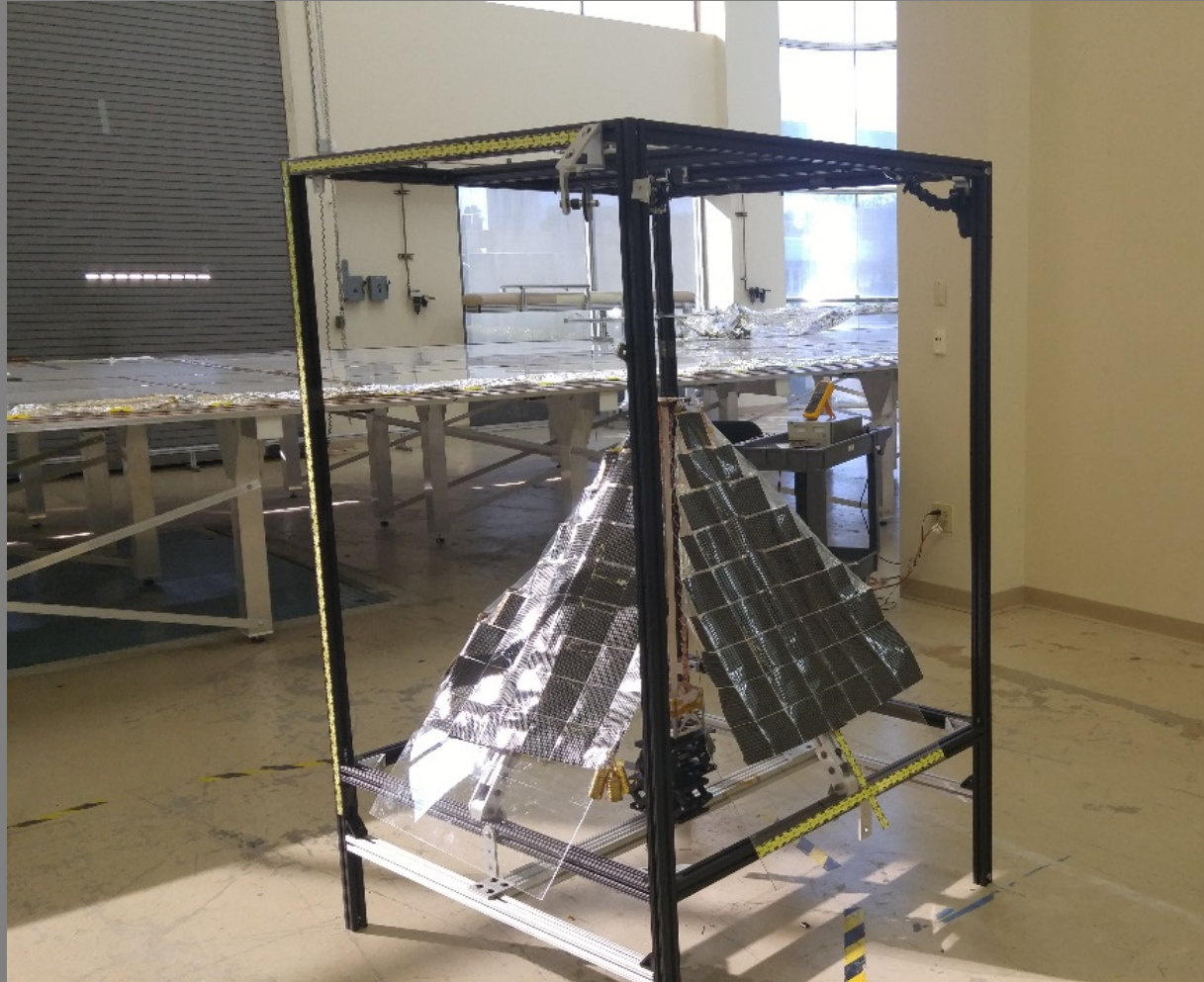
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The Lightweight Integrated Solar Array and Transceiver (LISA-T)

TRL6 4-petal Omnidirectional ambient deployment
10/06/2016



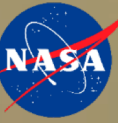
Omni – GN&C simplicity and non-pointed



Planar – pointed, high performance



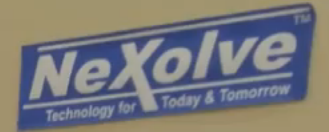
Core components can also be configured as high power planar



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The Lightweight Integrated Solar Array and Transceiver (LISA-T)



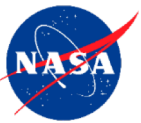
TRL6 4-petal planar
ambient deployment
11/10/2016





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[LISA-T: KEY METRICS]



Solar Array Key Metrics

Planar

<i>Parameter</i>	SOA (best)	IMM Array	CIGS Array
<i>Flat Point panel</i>			
<i>Array power generation</i>	~80W (6U)	230.9W	134.0W
<i>Array stowage volume</i>	~142kW/m ³	461.8kW/m ³	340.0kW/m ³
<i>Array mass</i>	~130W/kg	378.5W/kg	250.9W/kg

Note: LISA-T power levels are scalable between ~50 and 500W+.

170 to 280% higher pointed power

300% better Stowage/Mass Rates

Scalable to 625% power increase or to meet current power levels w/ better stow/mass

Omnidirectional

<i>Parameter</i>	SOA (best)	IMM Array	CIGS Array
<i>Omnidirectional</i>			
<i>Array power generation</i>	7.3W (3U)	101.0W	60.0W
<i>Array stowage volume</i>	~33W/m ³	101.0kW/m ³	60.0kW/m ³
<i>Array mass</i>	~53W/kg	75.7W/kg	47.8W/kg
<i>Generation axes</i>	2-axis	3-axis	3-axis

800 to 1400% higher non-pointed power

Similar Stowage/Mass Rates

True 3-axis generation

IMM – Inverted Metamorphic Multijunction Solar Cell
 CIGS – Copper Indium Gallium (di)Selenide Solar Cell

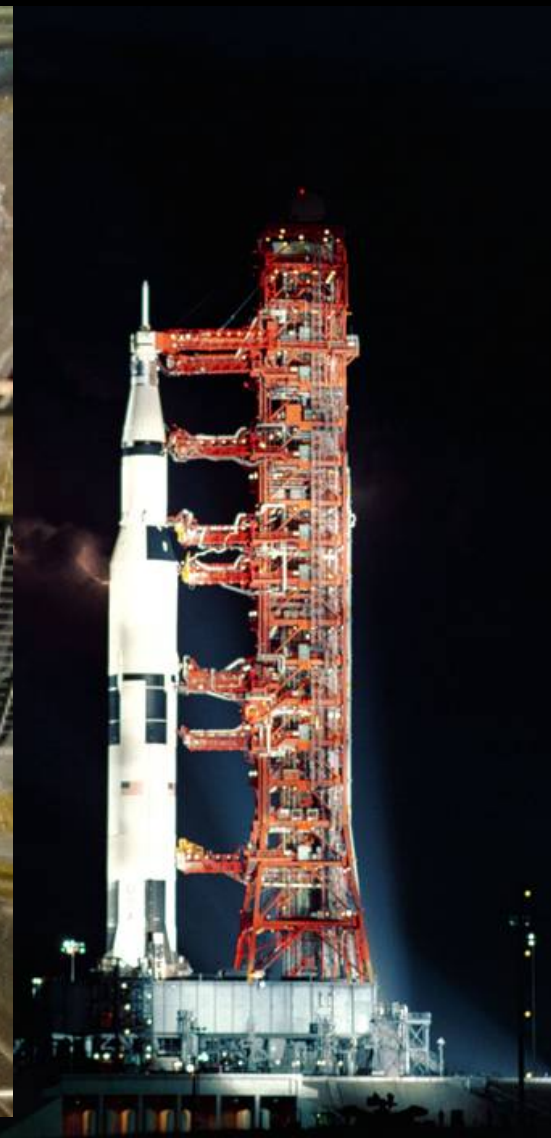


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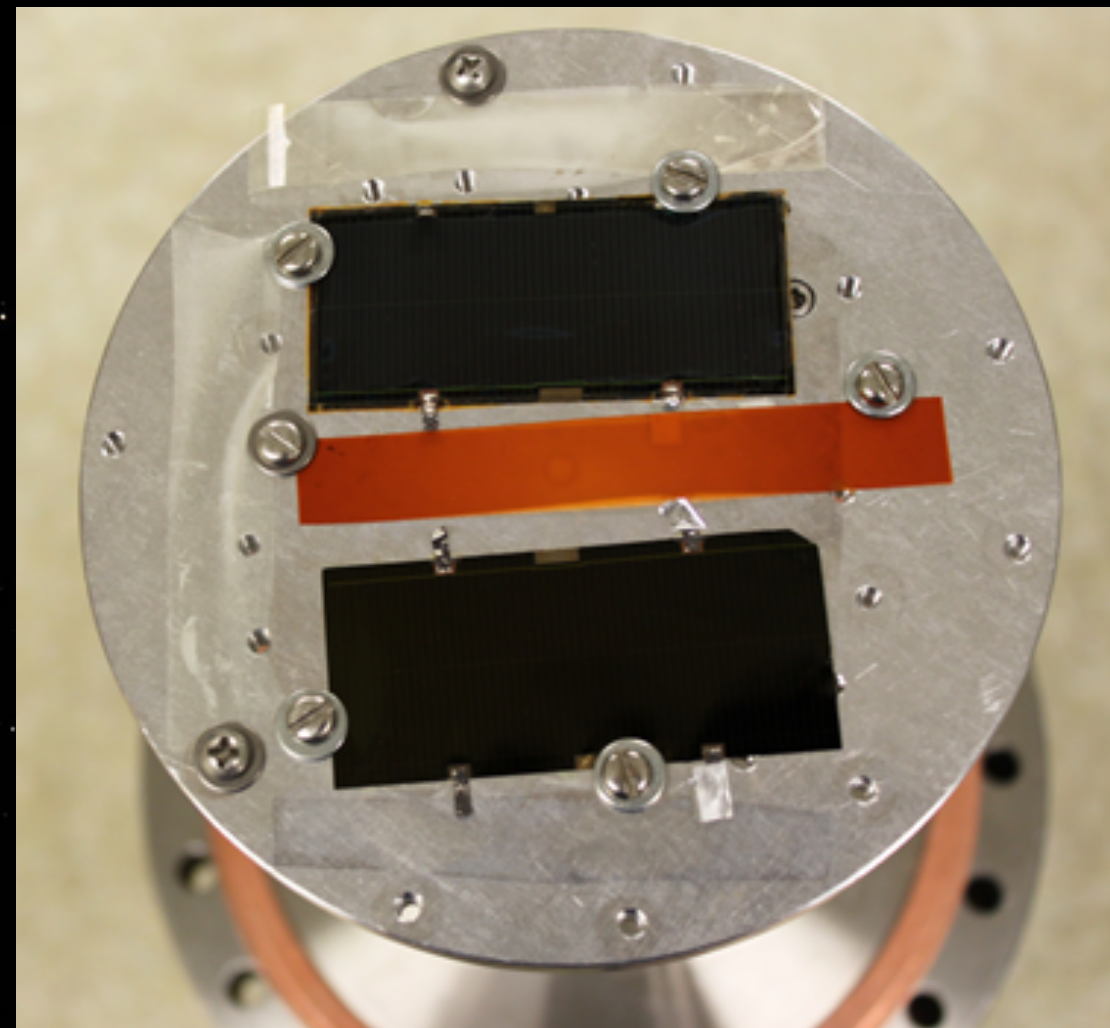
[ENVIRONMENTAL TESTING AND SURVIVABILITY]



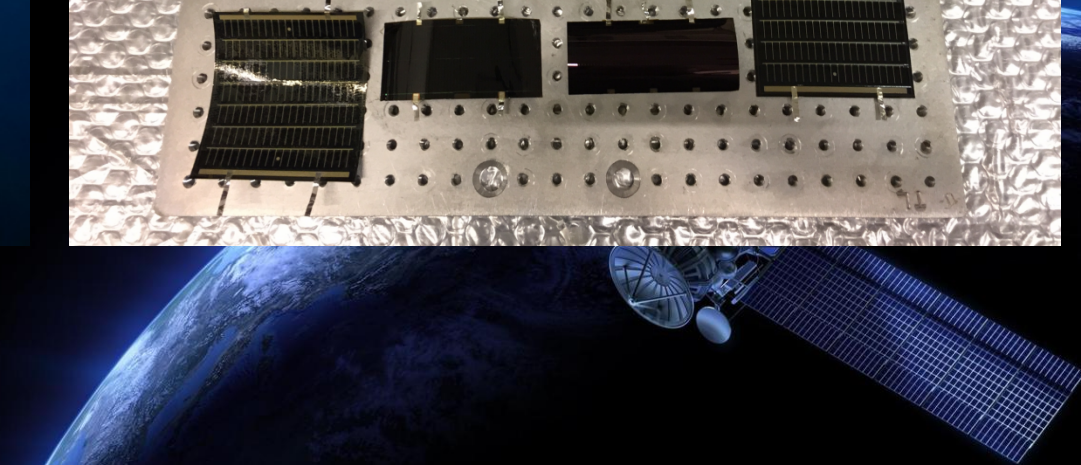
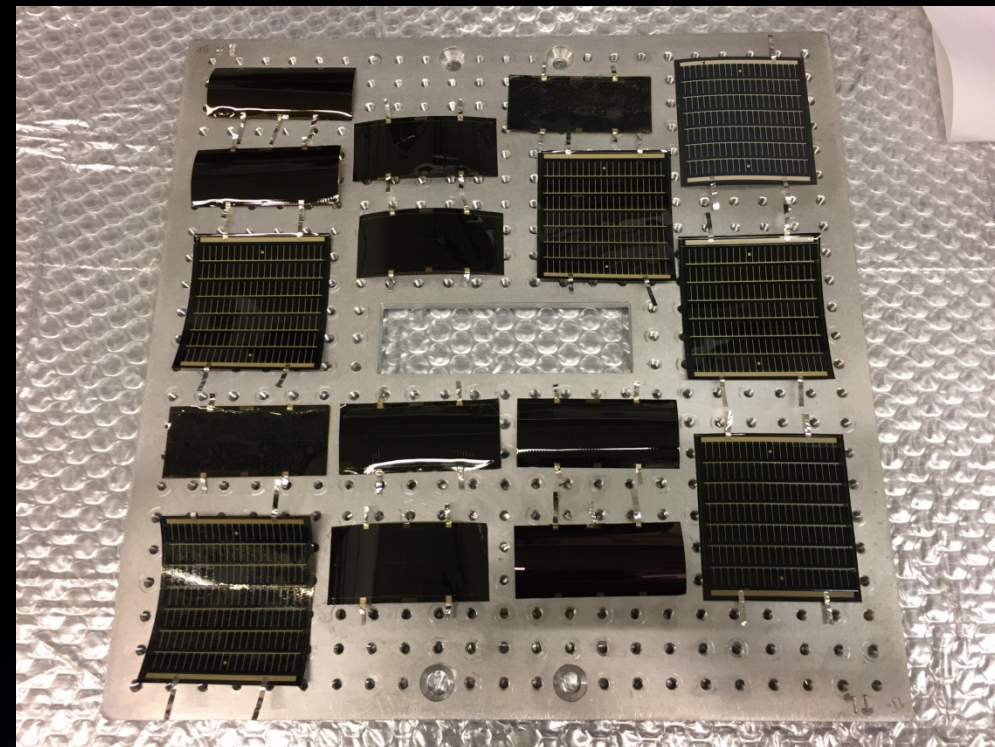
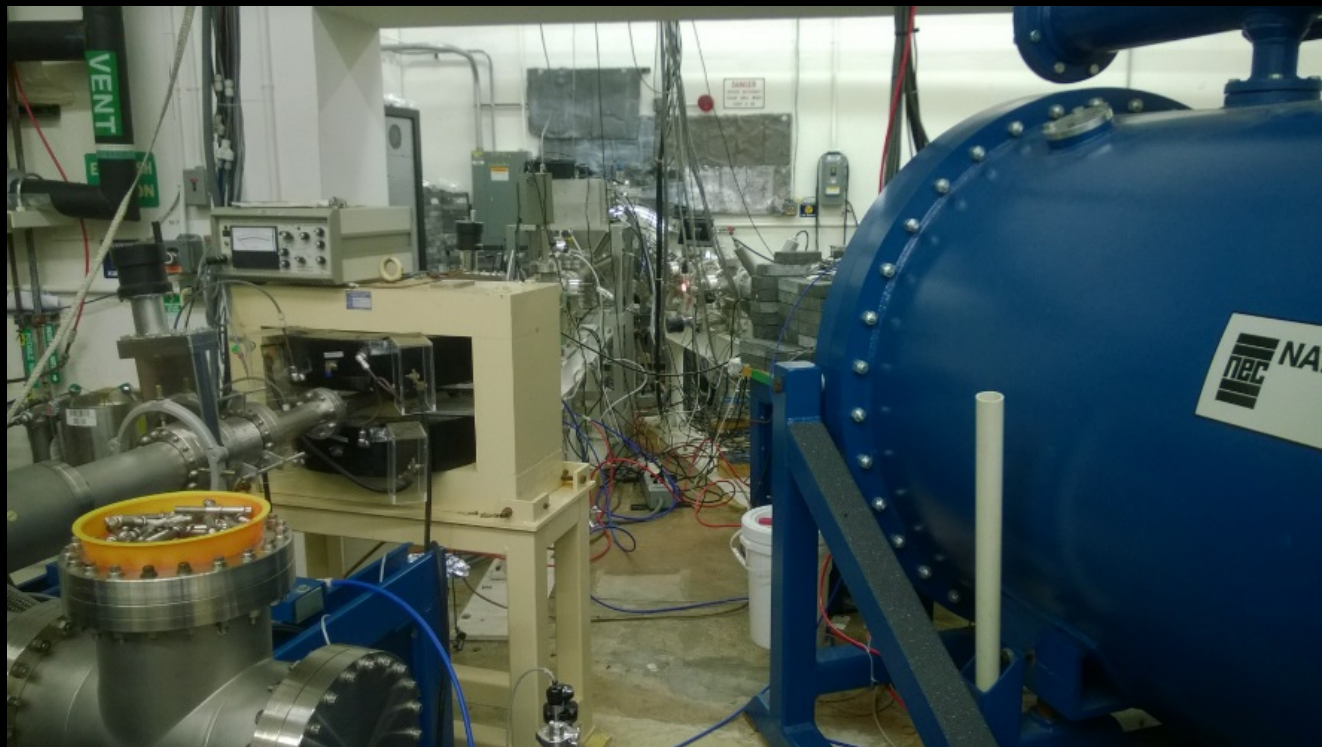
Humidity Exposure



Atomic Oxygen exposure

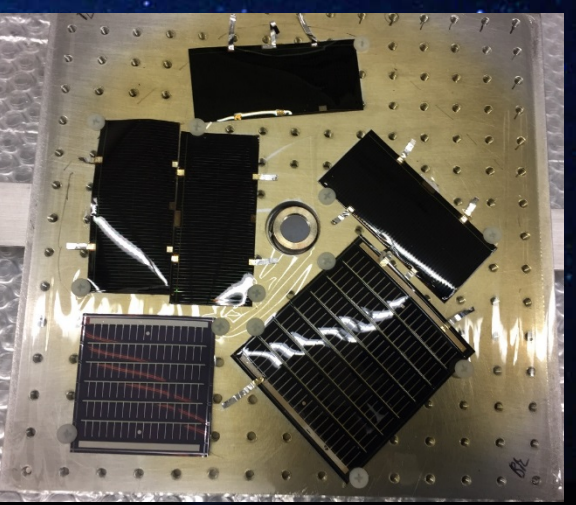
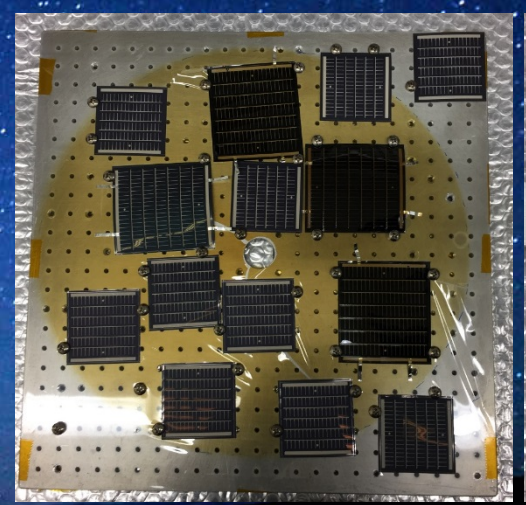
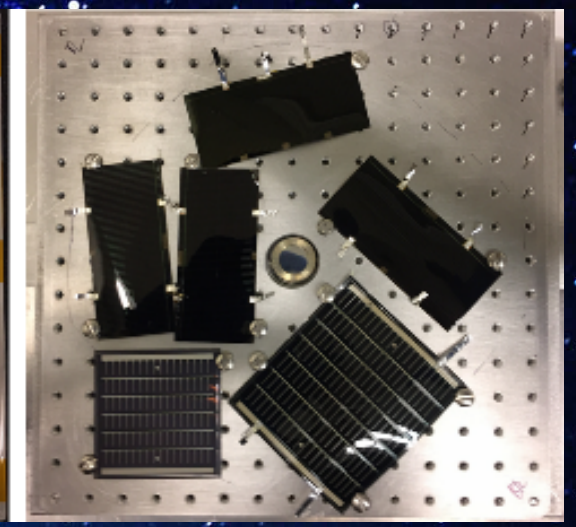
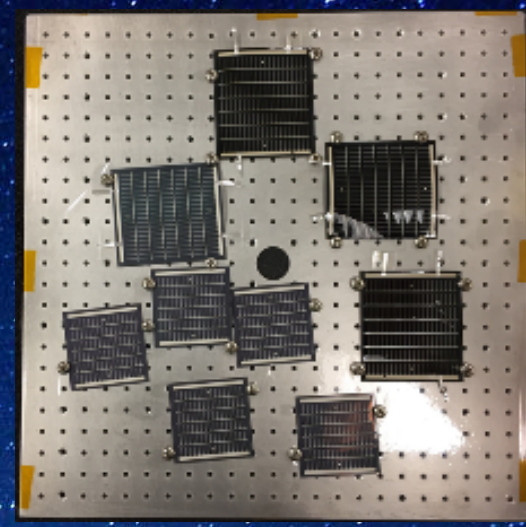
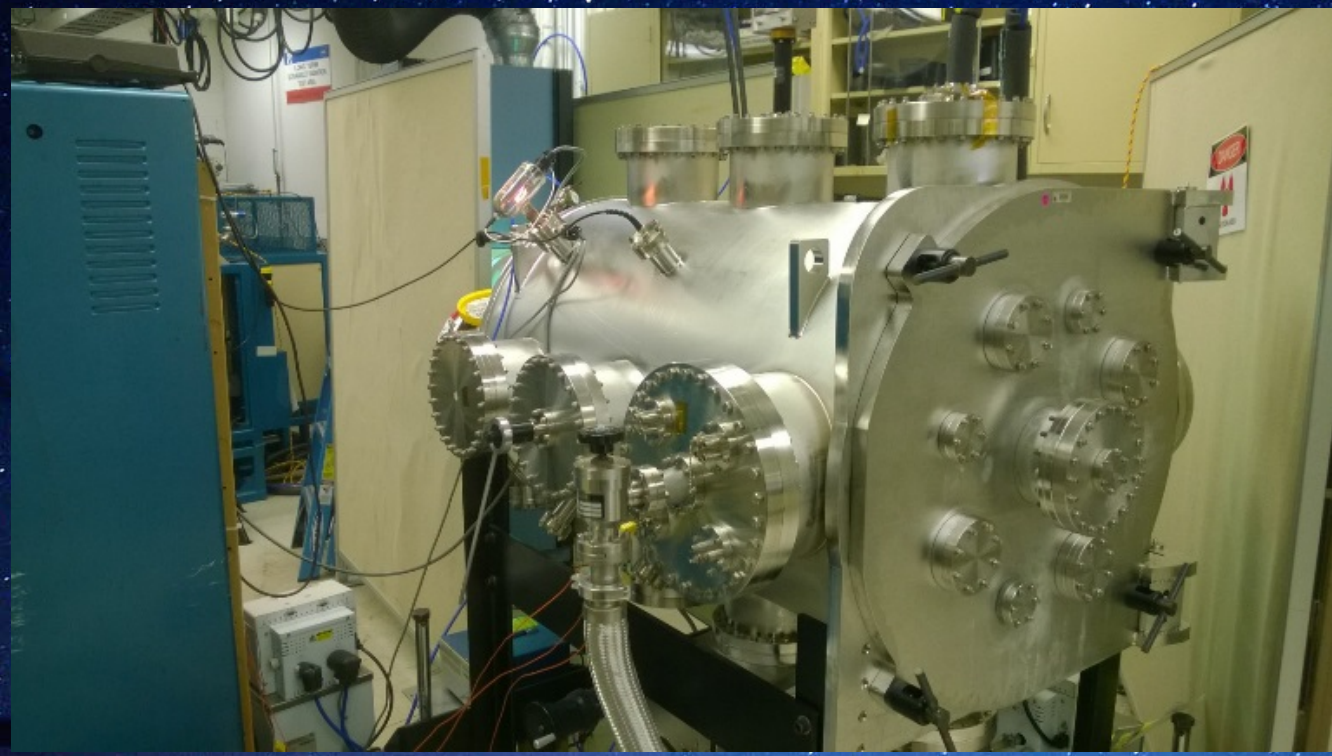


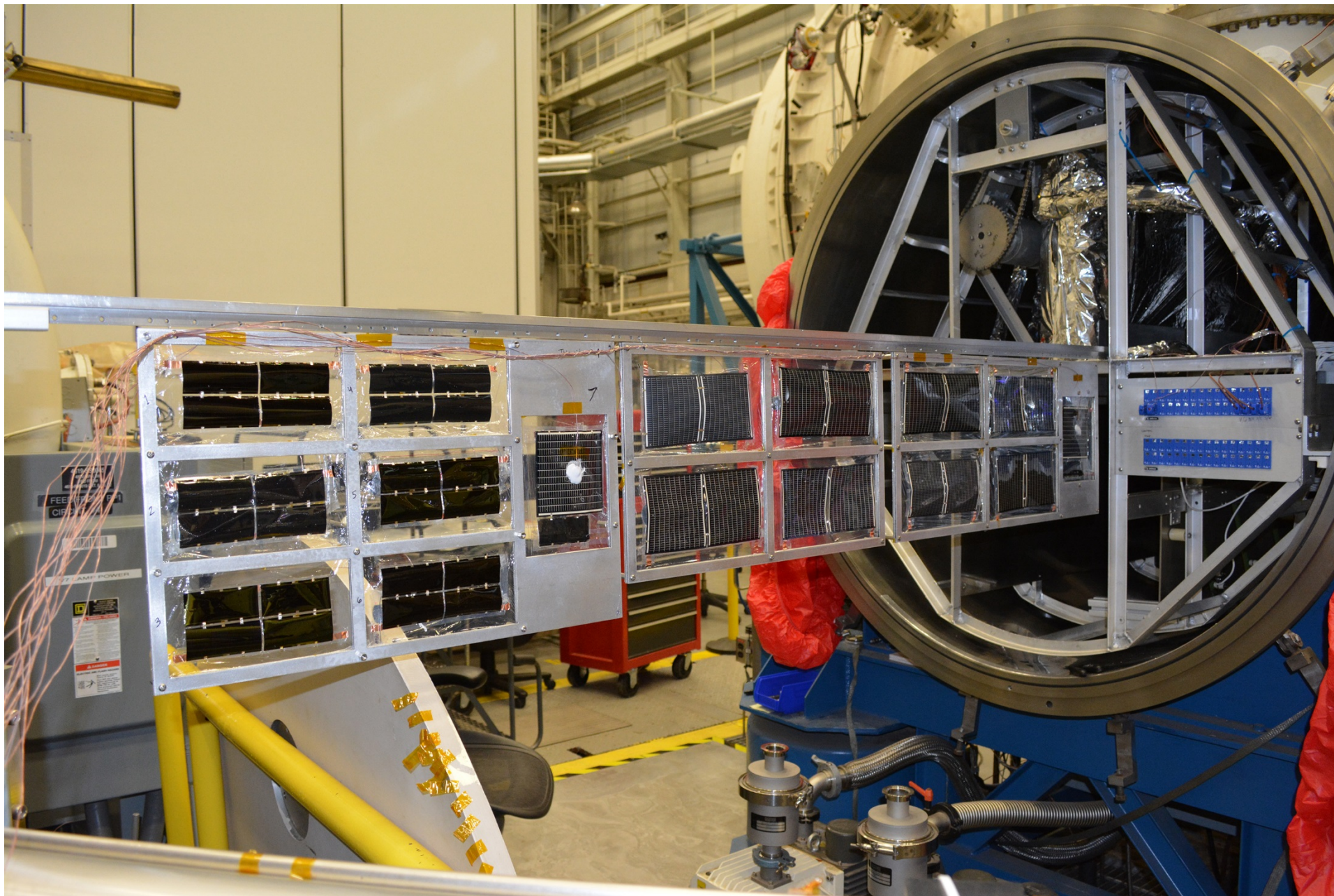
Particulate radiation exposure



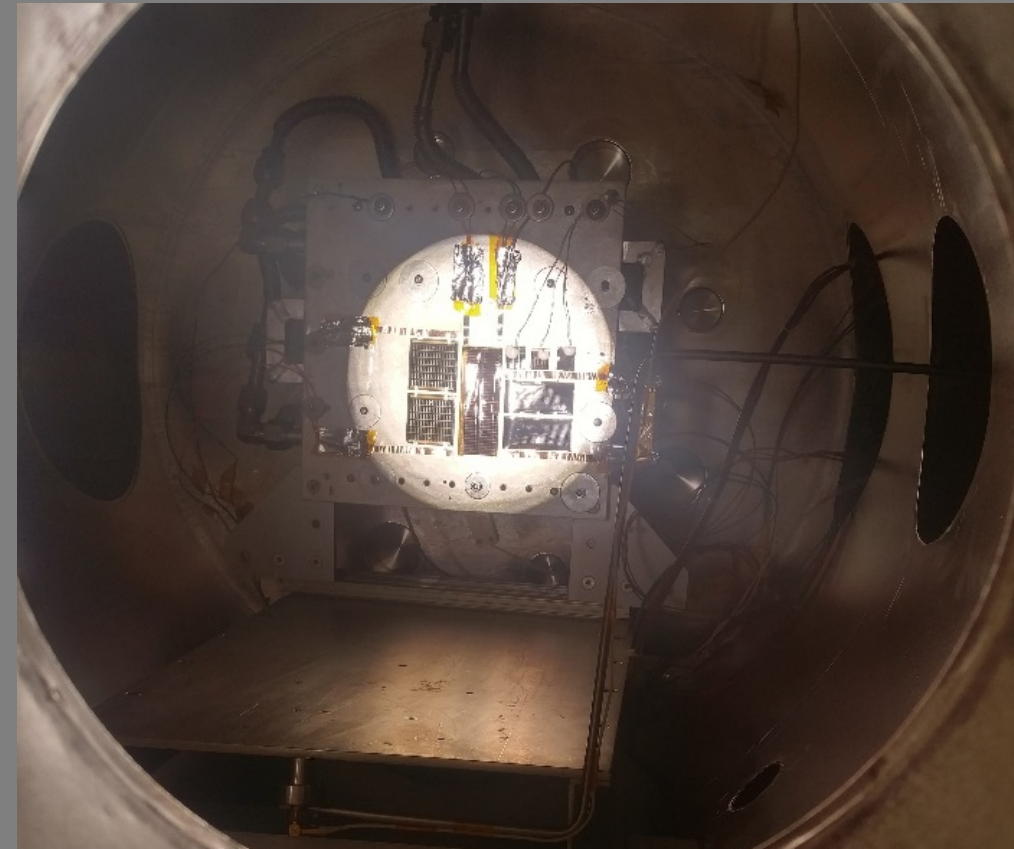
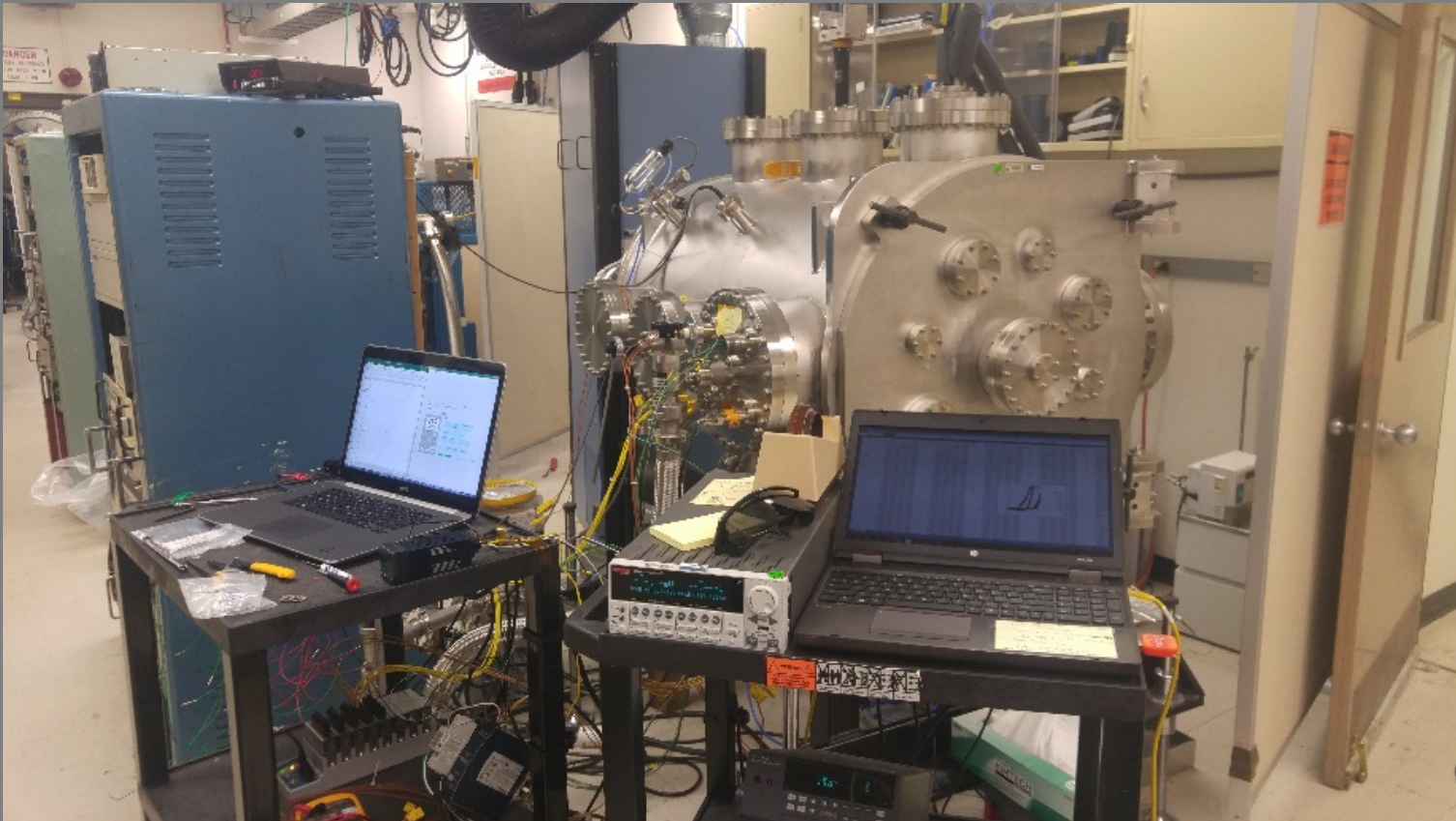
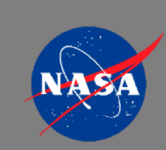


Near UV exposure





Rapid thermal cycling



Extended operation at temperature



Hot/Cold thermal vacuum deployments



Stowed
0s



1/4 Deployed
0.8s



3/4 Deployed
1.14s



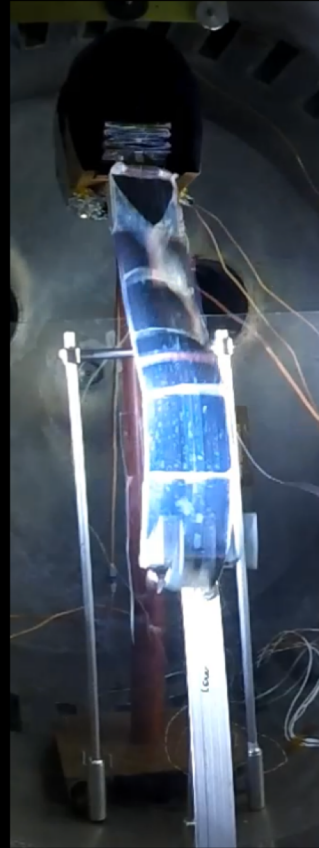
Deployed
1.40s



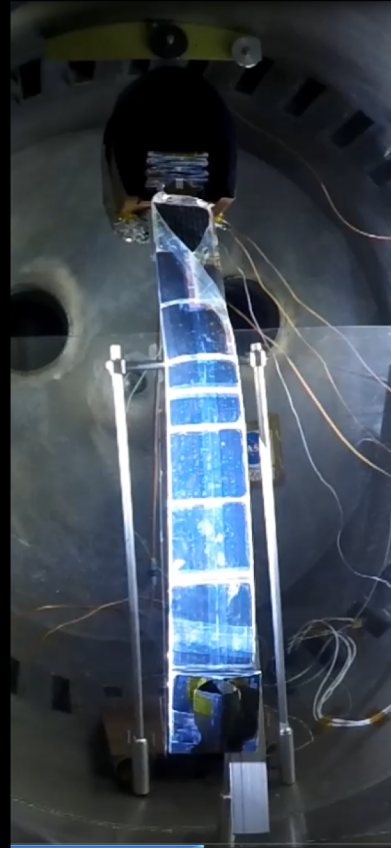
Hot/Cold thermal vacuum deployments



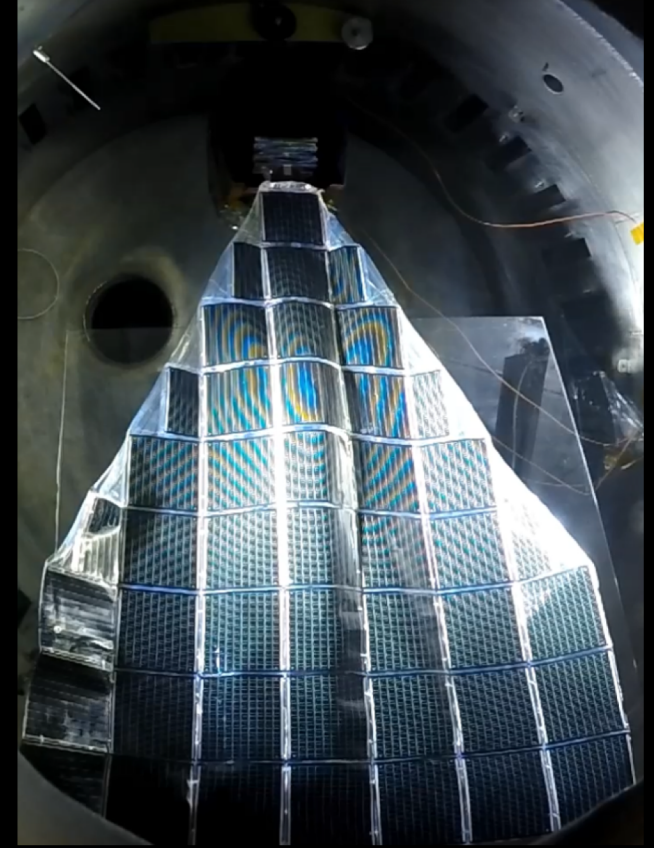
Stowed



Mast release



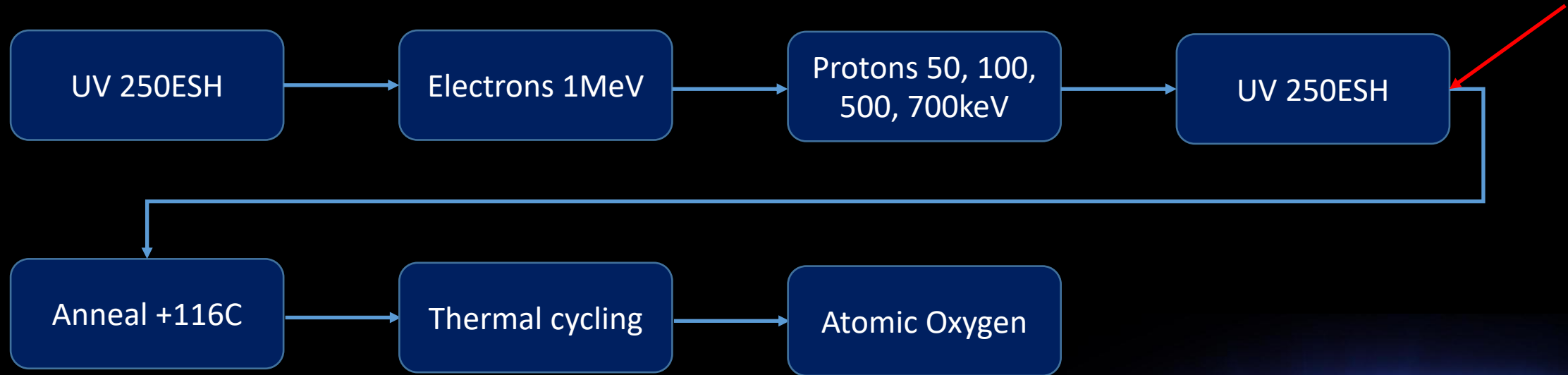
Mast deployed closed



Petal unfurled

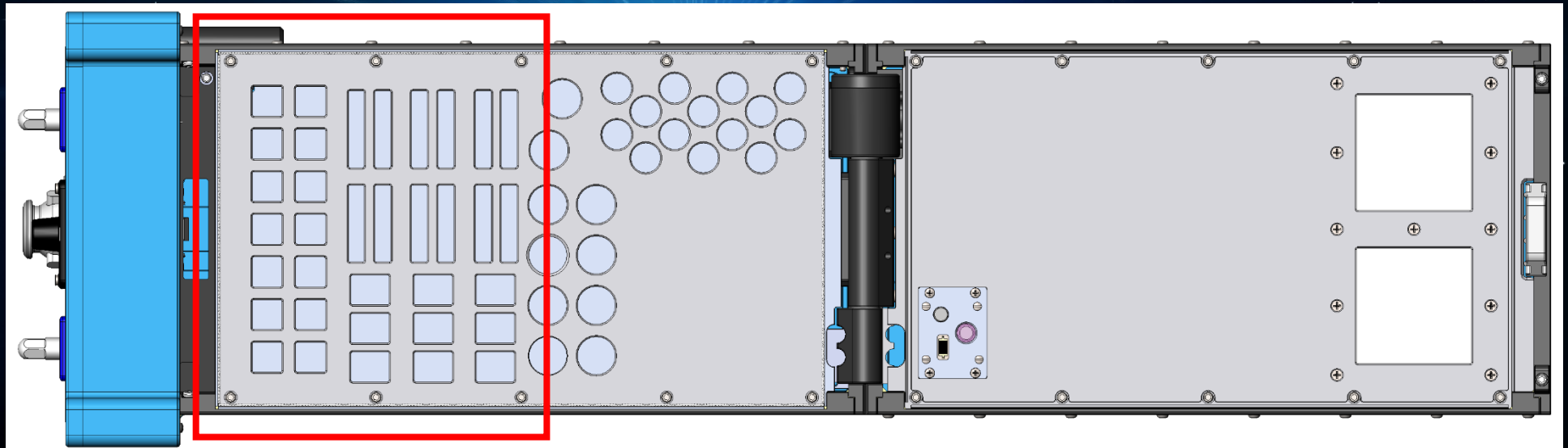


Sequential testing for 'combined' environments





MISSE10 November 2018



LISA-T sample real estate

MISSE10 November 2018

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High-Efficiency Low-Mass Solar Cell Systems
MISSE10 | 2018





LISA-T can operate/survive in LEO and is moving forward...





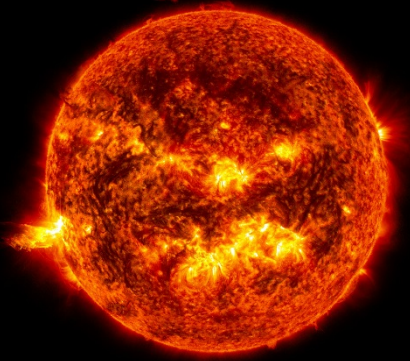
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[TRL 7 FLIGHT DEMONSTRATION: LEAPEM]

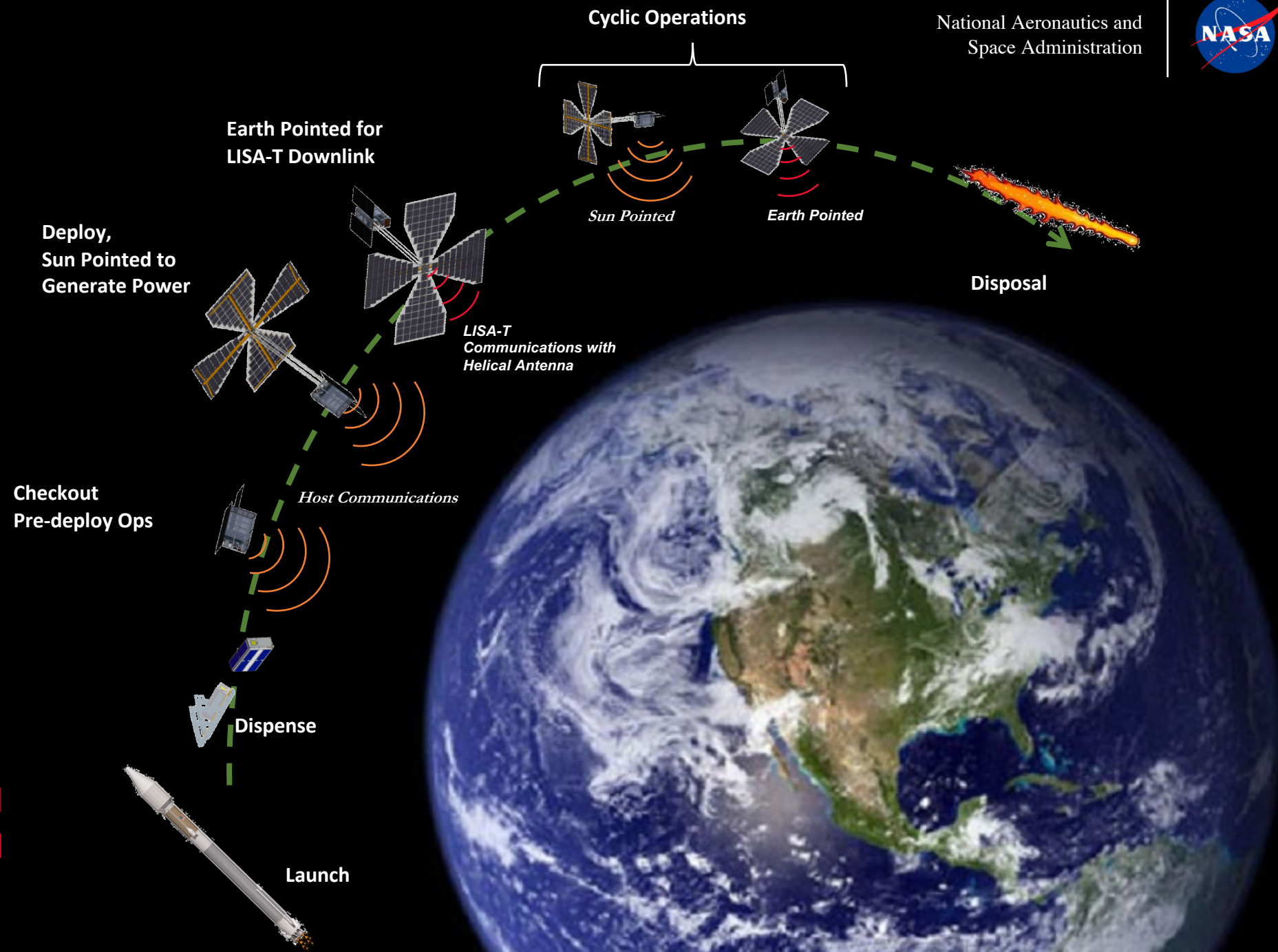


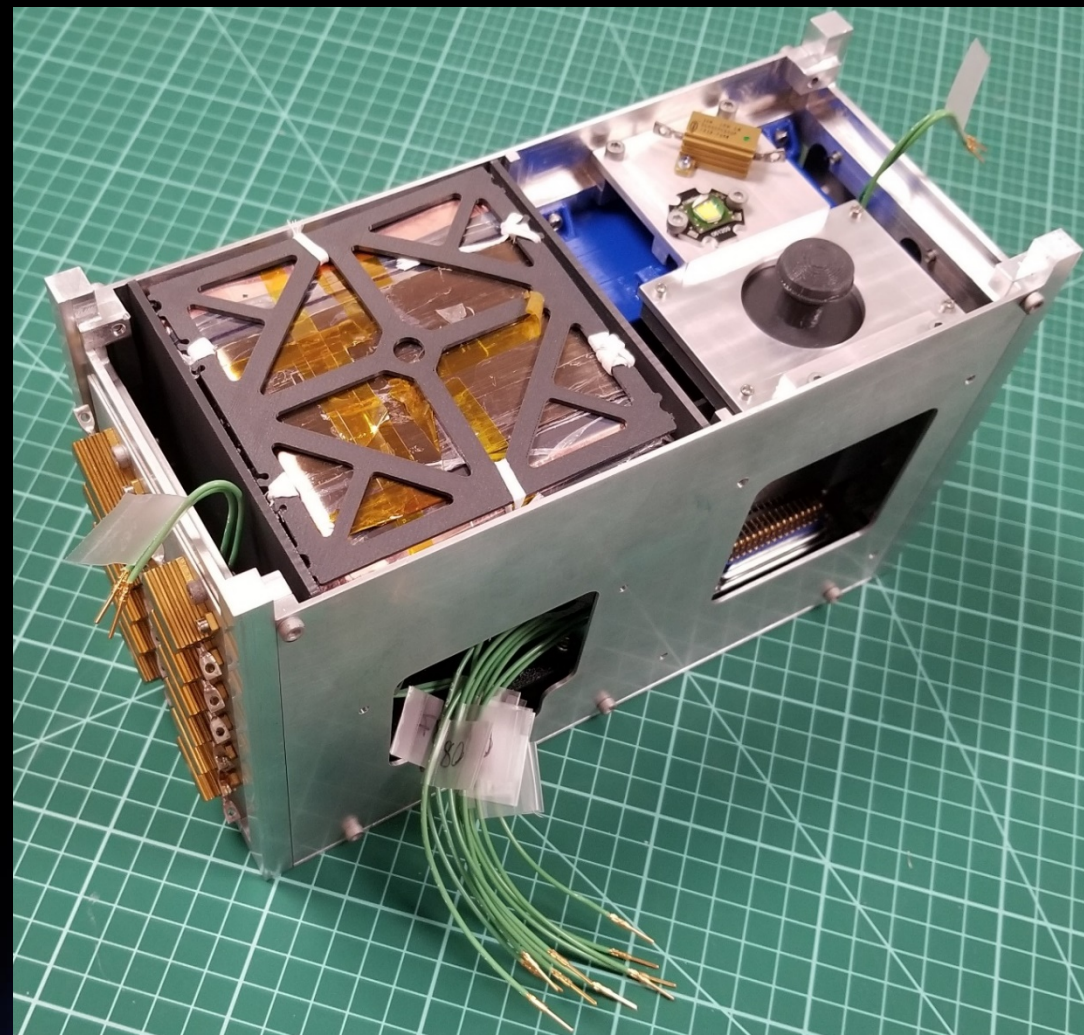
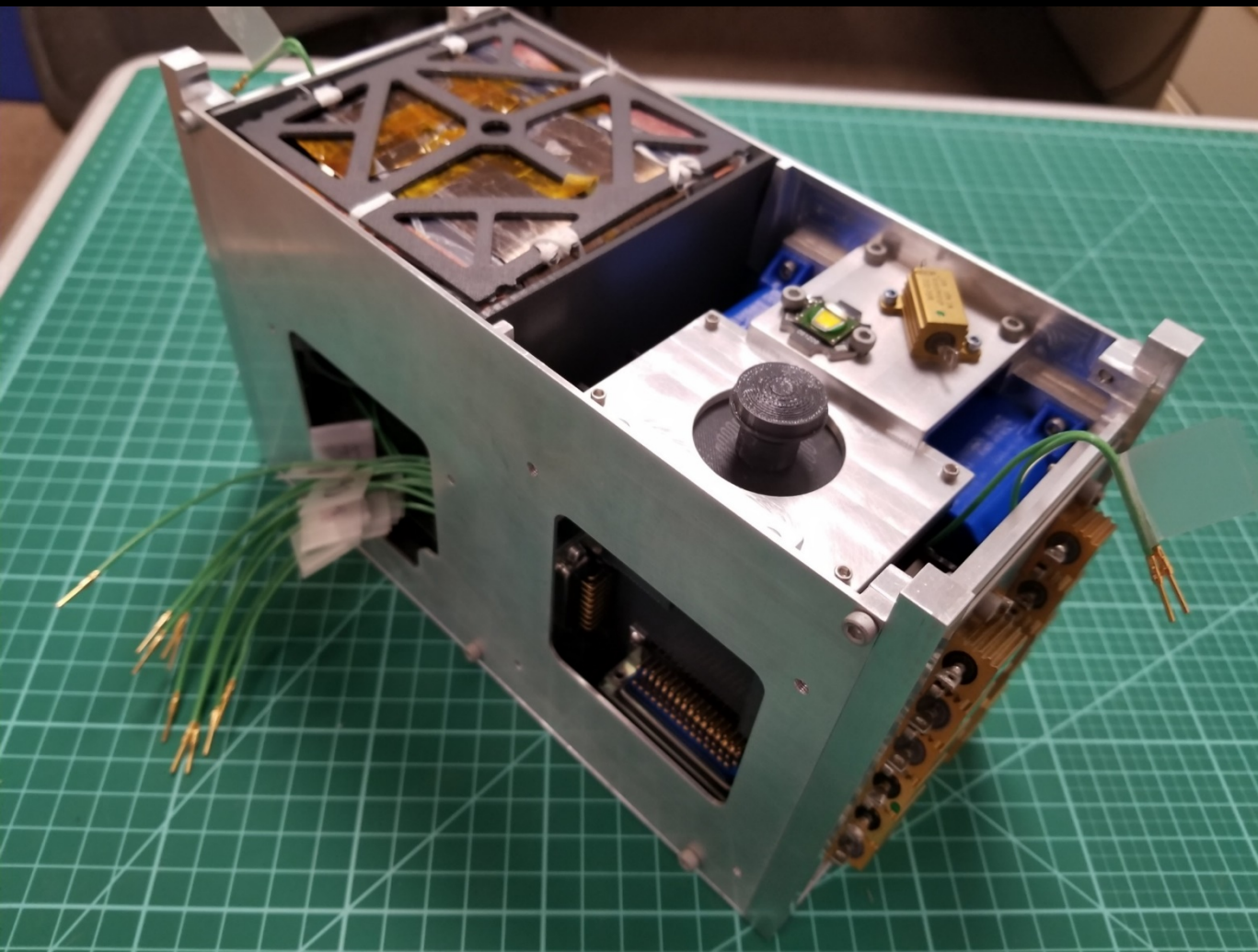
Tech demonstration to facilitate infusion?





Target Duration:
1 Months minimal
4 Months nominal
6+ Months desired







Large scale production for swarms or large single asset?





Print-Assisted Photovoltaic Assembly (PAPA)
NASA | 2018



Questions?



Thin-film solar arrays for small spacecraft

Sprat

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