Solar Simulation of NASA's Huge Artemis PPE Solar Arrays

ÅNGSTROM DESIGNS

Sizing Up Advanced Testing To Meet Human-Rated Space Power Resiliency, Capability and Scale

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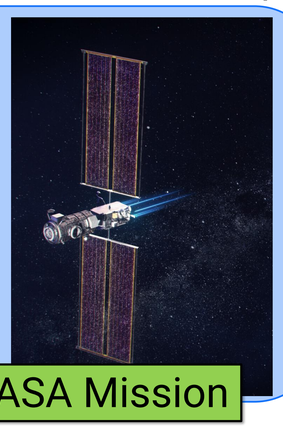
1. Power for Artemis Gateway

Gateway is a Martian and Lunar Space Station:

- High Power Needs for Long-Term Missions
  - Advanced 4-Junction Solar Cells
- Highest Reliability Human-Rated Mission
  - Maximum Test Accuracy Needed



A Critical, Flagship NASA Mission

2. Testing Advanced 4-Junction Solar Cells

4-Junction Cells Enable:

- Greater Power
- Lower Mass per Watt
- Mission Enabling Capability

Requiring Better Solar Simulation:

- Greater Spectral Control
  - 4 Current Matched Junctions
- <2% Large-Area Spatial Nonuniformity
- High Temporal Stability

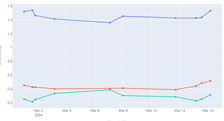
With Great Power Comes Great Testing Requirements

3. Programmable LED Solar Simulator (pLEDss) For Best Performance

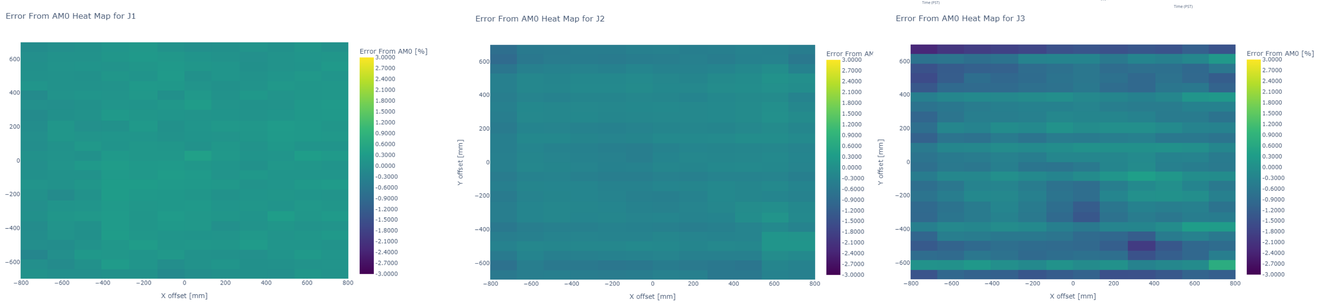
Better than Industry Standard Large Area Performance:

Isotype	Average AM0 I_{sc} Error	Spatial Nonuniformity	Temporal Stability
Top	0.1%	0.3%	0.7%
Middle	-0.3%	0.5%	0.7%
Bottom	-0.6%	1.5%	0.9%

Real measurement results using triple junction isotypes on 1.8 x 1.5 m system.
Temporal stability data taken over 2 weeks.
AIAA Isc Match = <1%. Class A Spatial Nonuniformity = <2%. Class A Temporal Stability = <2%



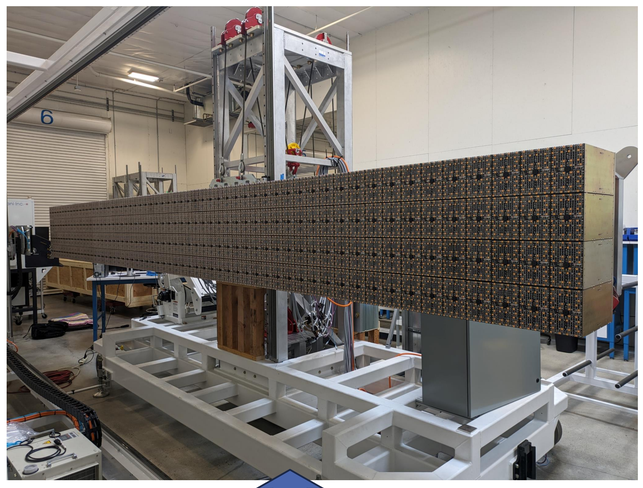
Error From AM0 Heat Map for J3

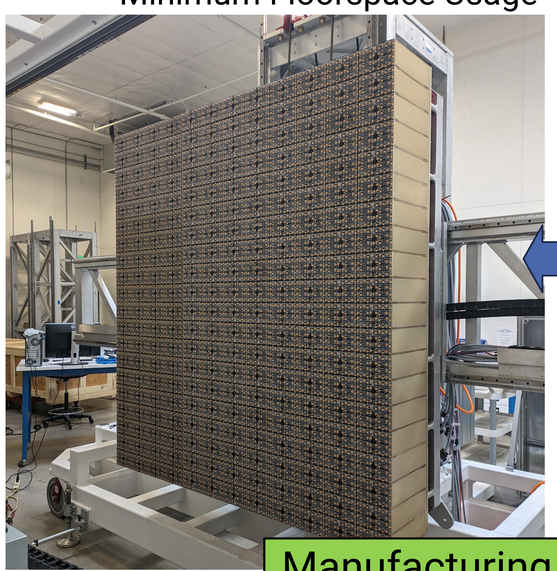


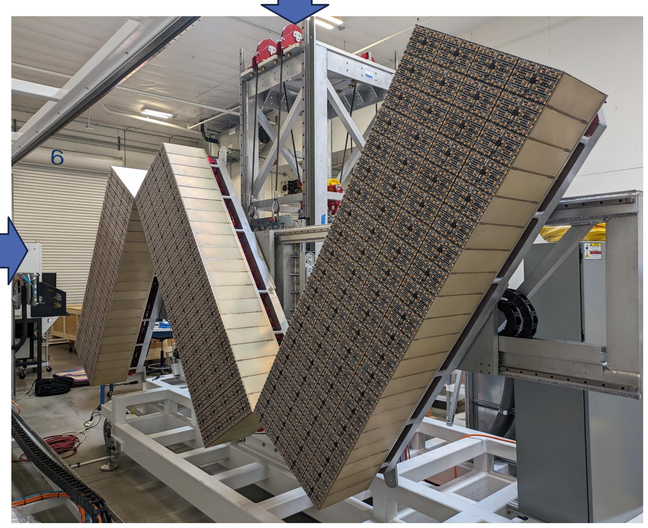
Better Than Industry Standard At Very Large Area

4. Mechanization Saves Cost

- Morphing Mechanism Allows For Aspect Ratio Change
  - Matches PPE wing circuits with an efficient use of pLEDss heads
- Mobile Frame Allows for Testing Anywhere on the Wing
  - Minimum Floorspace Usage



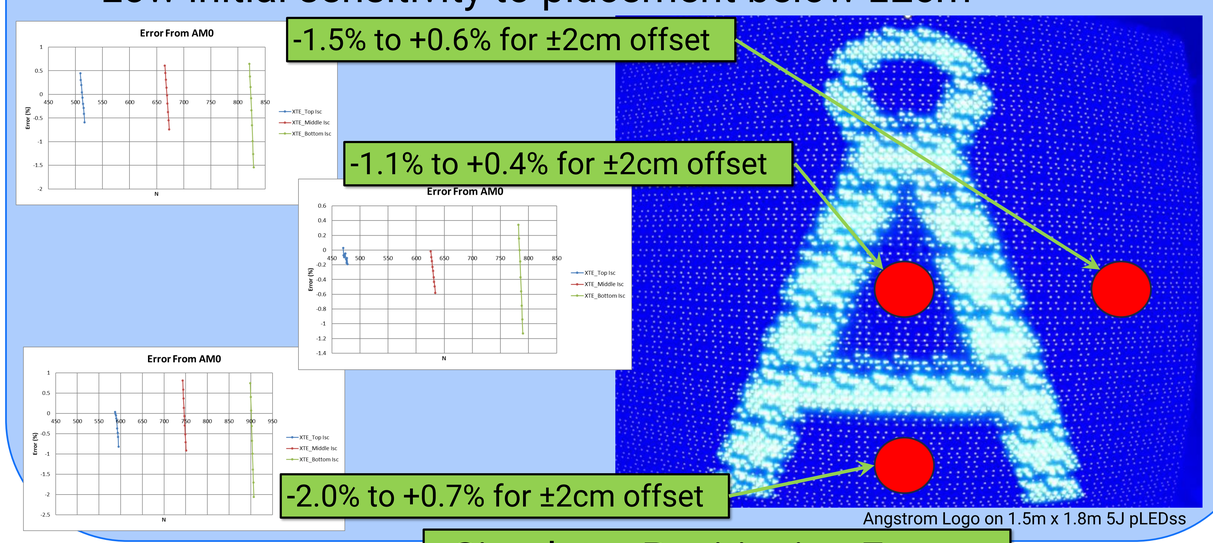




Manufacturing Optimized Frame

5. pLEDss Placement Effects

- Frame placement possible in X, Y and Z to within ±1cm
- Low initial sensitivity to placement below ±2cm



-1.5% to +0.6% for ±2cm offset

-1.1% to +0.4% for ±2cm offset

-2.0% to +0.7% for ±2cm offset

Angstrom Logo on 1.5m x 1.8m 5J pLEDss

Simulator Positioning Errors: Low, Measurable & Repeatable

6. PPE Test Data Coming Soon

- 4 Junction Calibration Data by June 2024
- PPE Wing Testing in Late Summer 2024
- PPE Launch for Artemis-3 to Follow

Best In Class Testing for NASA's Flagship Program

Designed and manufactured in the United States

4/23/2024

For More Information: www.AngstromDesigns.com
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