

Advancements in the Lunar Surface ROSA technology

Space Power Workshop 2023

Matt LaPointe

Advanced Programs Engineering Lead

Redwire Space Systems - Goleta

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Redwire Space Employs Over 750 Jobs in U.S. and Europe

Redwire Space Provides 50+ Years of Space Flight Heritage and Innovative Capabilities for Civil Space and National Security Missions!



COLORADO (Littleton and Longmont)

- 102,000 sq. ft total in CO
- Clean Rooms
- RF & Antenna Systems
- Deployable and Retractable Space Structures
- Solar Arrays, Batteries, Thermal Products
- Space Systems Engineering Services
- Camera Systems
- Flight Avionics
- Data Recovery Systems
- In-House Testing Capabilities
- Digital Engineering
- Modeling & Simulation

CALIFORNIA

- Collaborating with JPL
- 80,000 sq. ft. office & manufacturing area
- 3-Story High Bay
- Deployables IA&T
- ISS & PPE Large ROSA IA&T
- High Power Solar Array R&D

NEW MEXICO

- 14,000 sq. ft facility
- Operate and Maintain AFRL testing facility
- Design and Analysis Services
- Structural & Thermal Testing
- Launch Accommodation Hardware
- Thermal Control Hardware
- Deployable Technologies

Cleared Personnel

ALABAMA

- Strong partnerships with NASA MSFC

FLORIDA

- **Redwire Corporate Headquarters in Jacksonville**
- 37,247 sq. ft facility
- Clean rooms
- Advanced In-Space Manufacturing Technology
- Large In-Space Manufacturing Project – OSAM-2/Archinaut One
- ISS Payload Development

INDIANA

- 22,000 sq. ft facility
- In-space Research
- ISS Payload Development
- Advanced Space Manufacturing Technology
- Biotechnology, bioprinting, on-orbit manufacturing
- ISS/CASIS

MASSACHUSETTS

- 18,000 sq. ft. facility
- Clean Rooms
- Sun Sensors & Star Trackers
- Integrated Camera Systems
- ADACS Systems
- Satellite Systems

DC/VA/MD

- Engaging NASA GSFC in MD
- 8,000 sq. ft. facility under construction (2/3 SCIF)
- SCIF, Classified Systems Access
- Digital Engineering Lab

Merritt Island, FL (near KSC)

- 2,377 sq. ft. facility
- Strong partnership with NASA KSC
- Prelaunch processing laboratory and support
- Commercial partnership with Tupperware Brands
- In-space plant biology research
- ISS and lunar Payload Development



LUXEMBOURG

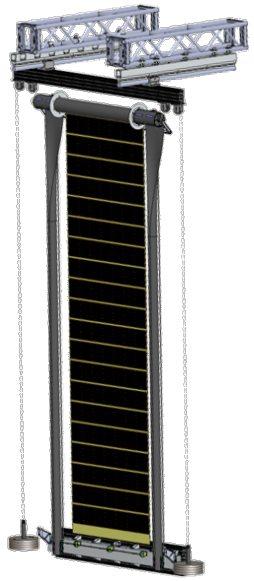
- Redwire Engineering & Sales Center in Europe
- 2,500 sq. ft facility
- Robotic Systems
- Avionics

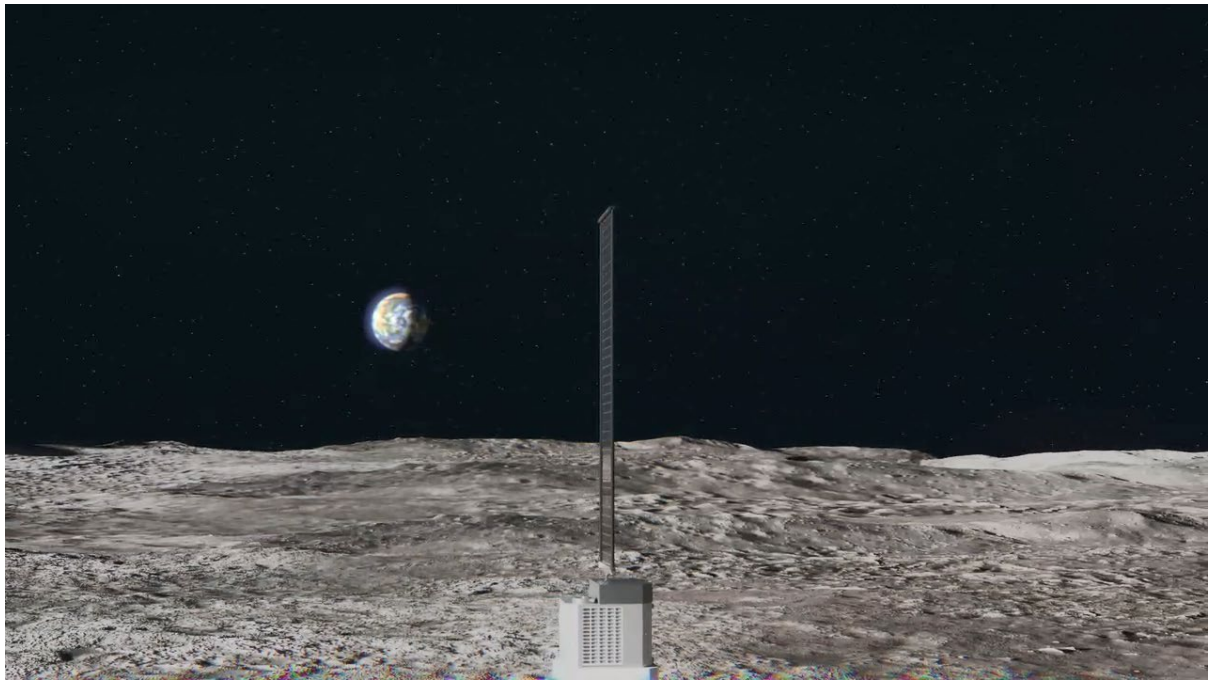
BELGIUM

- QinetiQ Space NV
- 19,000 sq. ft. facility
- Hi-Ref SmallSats, Berthing & Docking Mechanisms, Avionics

Presentation Outline

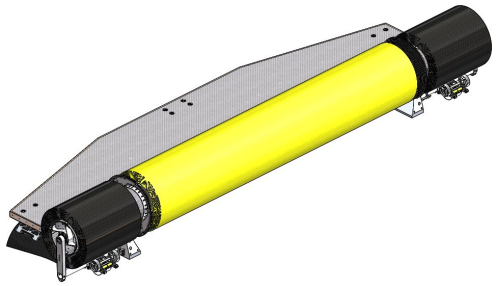
- ROSA Retraction Capabilities
- Lunar Lander ROSA SBIR Review
- Astrobotic VSAT Program
- Dynetics HLS Program
- Lunar Transport Vehicles
- Lunar Gateway Update

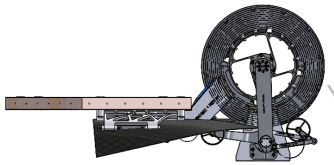




Roll-Out Solar Array (ROSA) Nomenclature

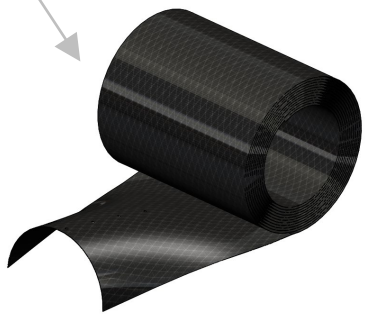
Stowed Wing | **Deployed Wing**





Spacecraft Root or SADA Interface

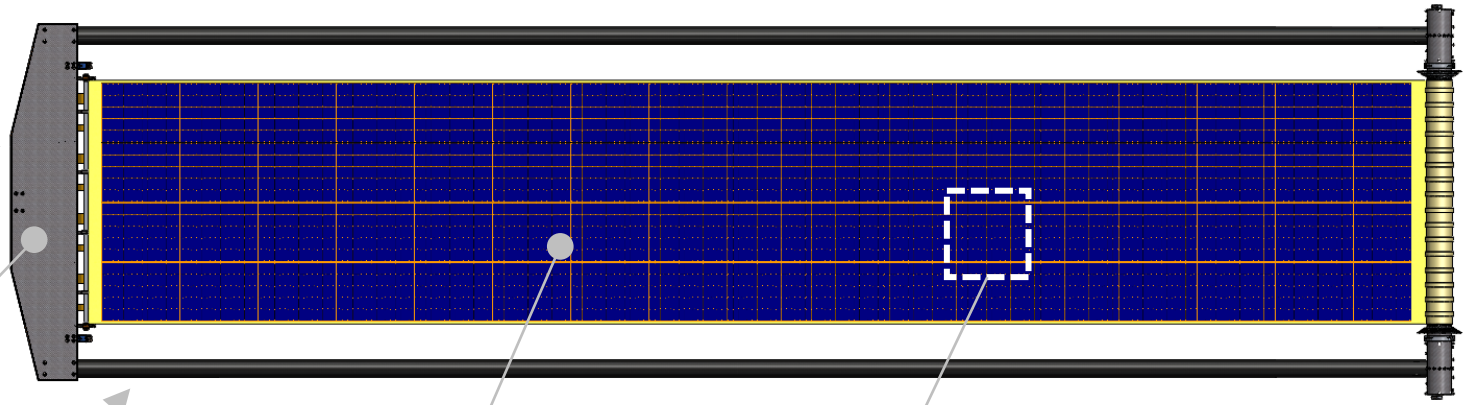
Spacecraft Tie-down Interface



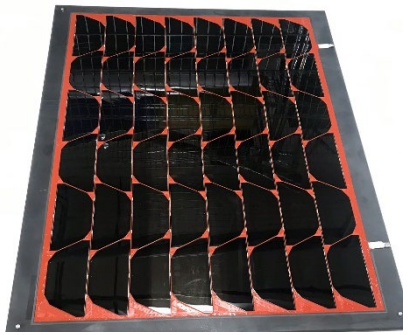
Composite Boom (Stowed)

Offset or Yoke Structure

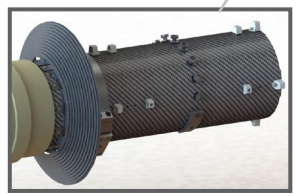
Diode Boards (backside)



Integrated Modular Blanket Assembly (IMBA)



Standard Power Module (SPM)



Mandrel Tube Assembly

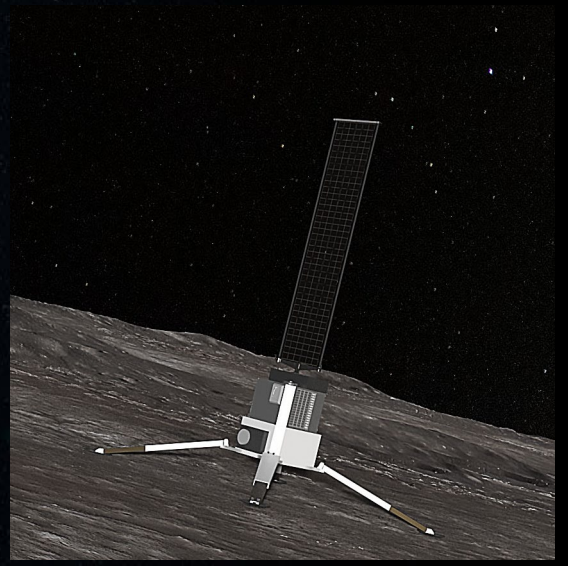
ROSA Retraction Capability

- **ROSA can be seamlessly adapted for retraction functionality**
  - Swap rate control dampers with motorized components
- **Retraction capability showcased in 2017 on the ISS Flight Demonstration mission**
  - Successful performance of three retractions and re-deployments
- **Additional ROSA models have completed over 100 cycles without any degradation in performance**



Lunar Lander ROSA SBIR Program Overview

- **Redwire recently completed NASA GRC Phase II SBIR for Lunar Surface array**
  - Title: Deployable and Retractable Solar Array for Lunar Surface/Lander Mobility Operations
- **Objective: Develop, build and test TRL 5/6 Lunar Surface ROSA hardware**
- **Requirements & Objective:**
  - 3 kW wing power
  - 50+ deployment and retraction at 15° in 1/6 G lunar gravity
  - Hot & cold functional testing (-40 to +60°C)
  - Random vibration testing (> 11.2 Grms)



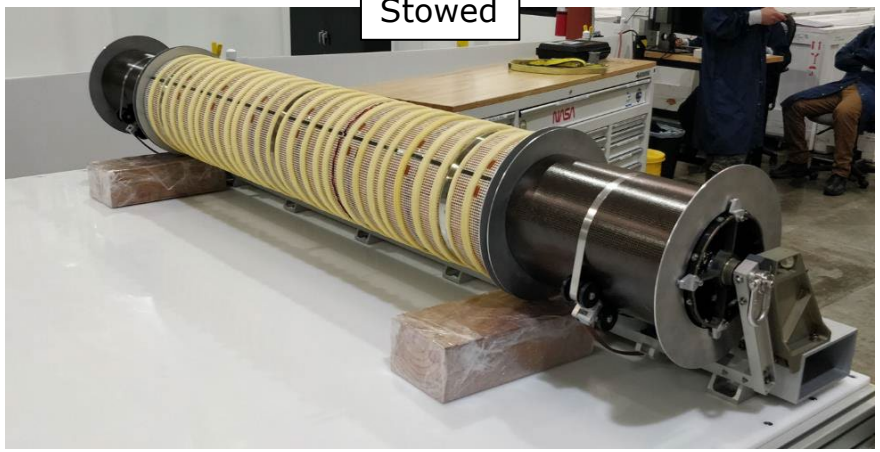
Lunar Lander SBIR ROSA

Program Overview

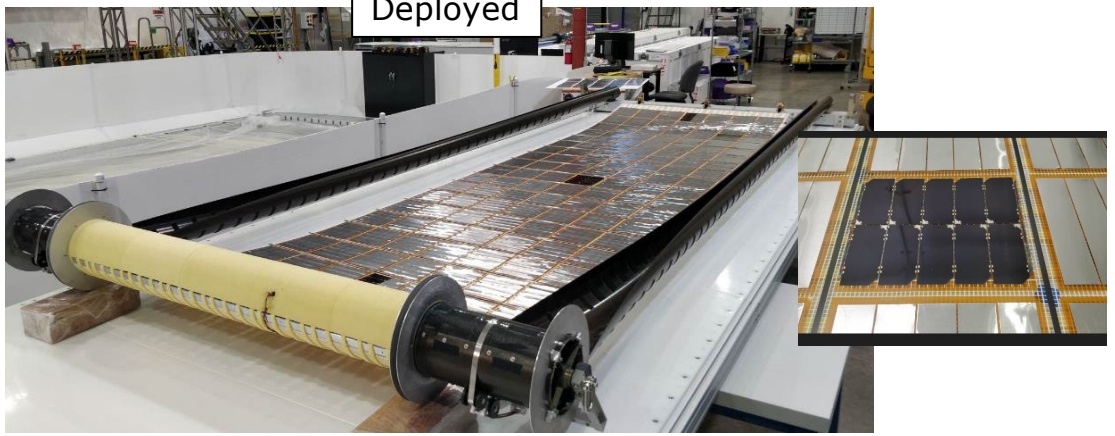
- Full-scale 3-kW Vertical ROSA EDU hardware built
- Forward-rolled 4” slit-tube boom design with motor driven deployment and retraction mechanism
- Blanket assemblies – 0.2 G mass simulators with three SPMs located at the middle and each end
  - Additional 1 G mass simulators added for vibration testing



Stowed

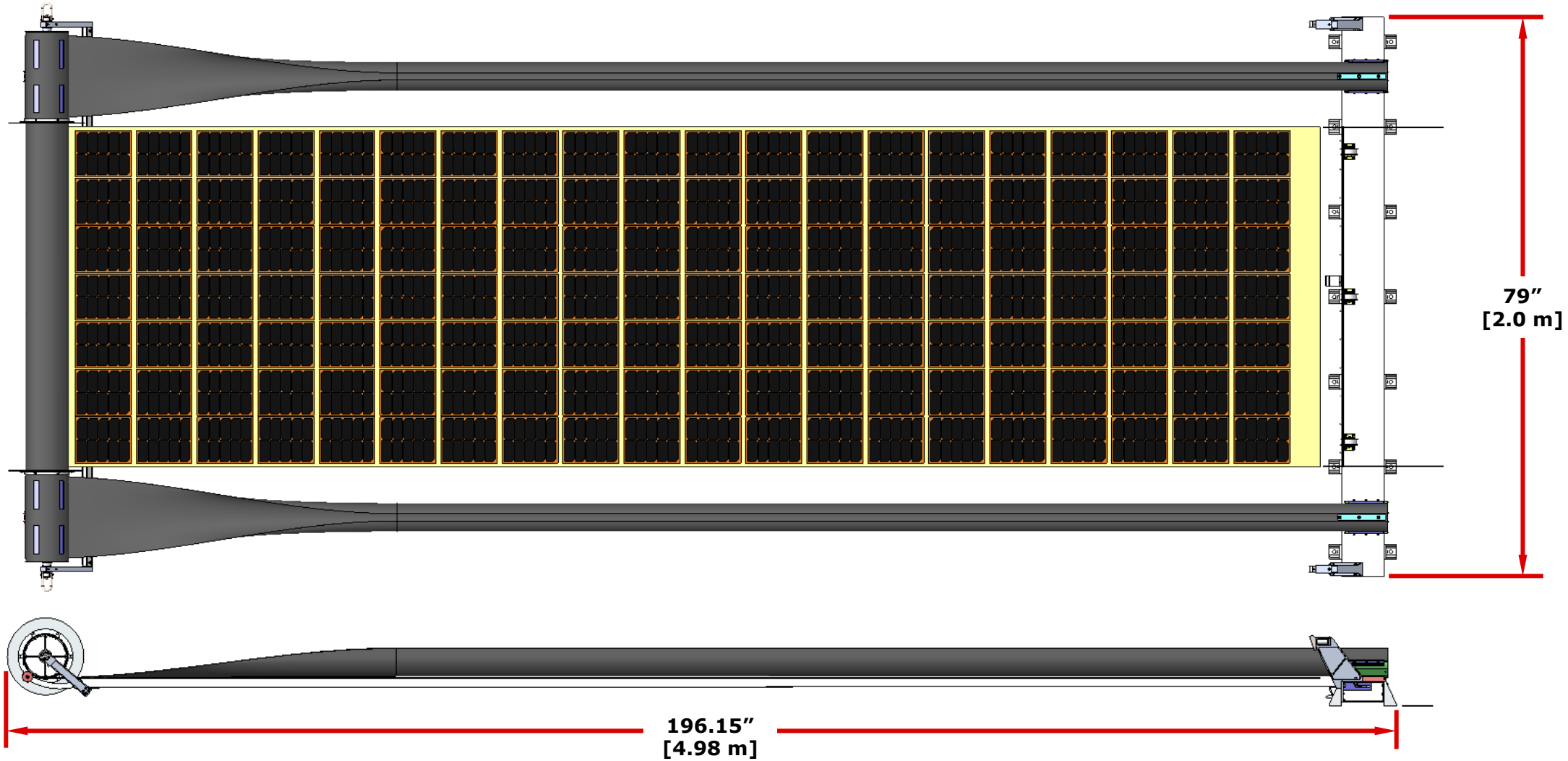


Deployed



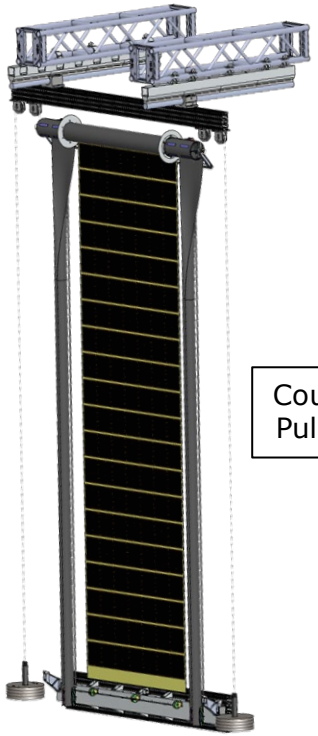
Lunar Lander SBIR ROSA

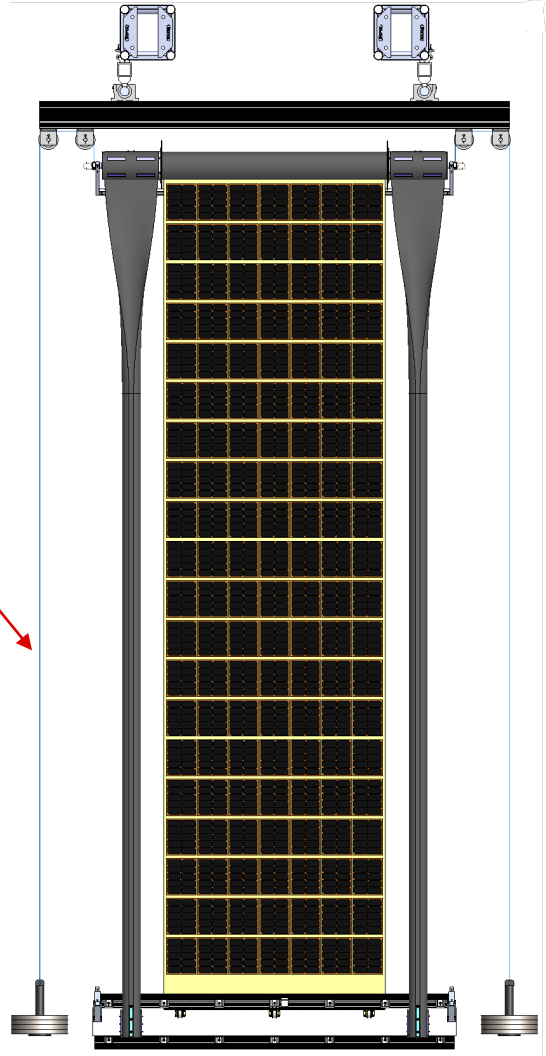
Wing Size

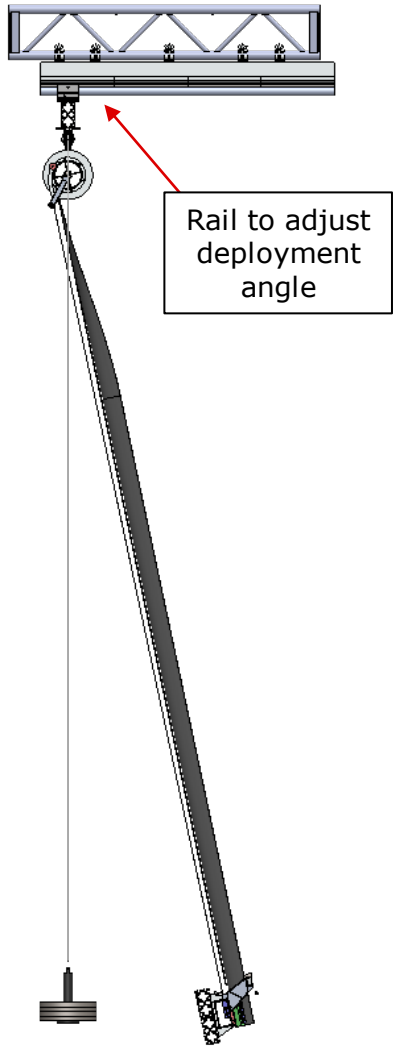


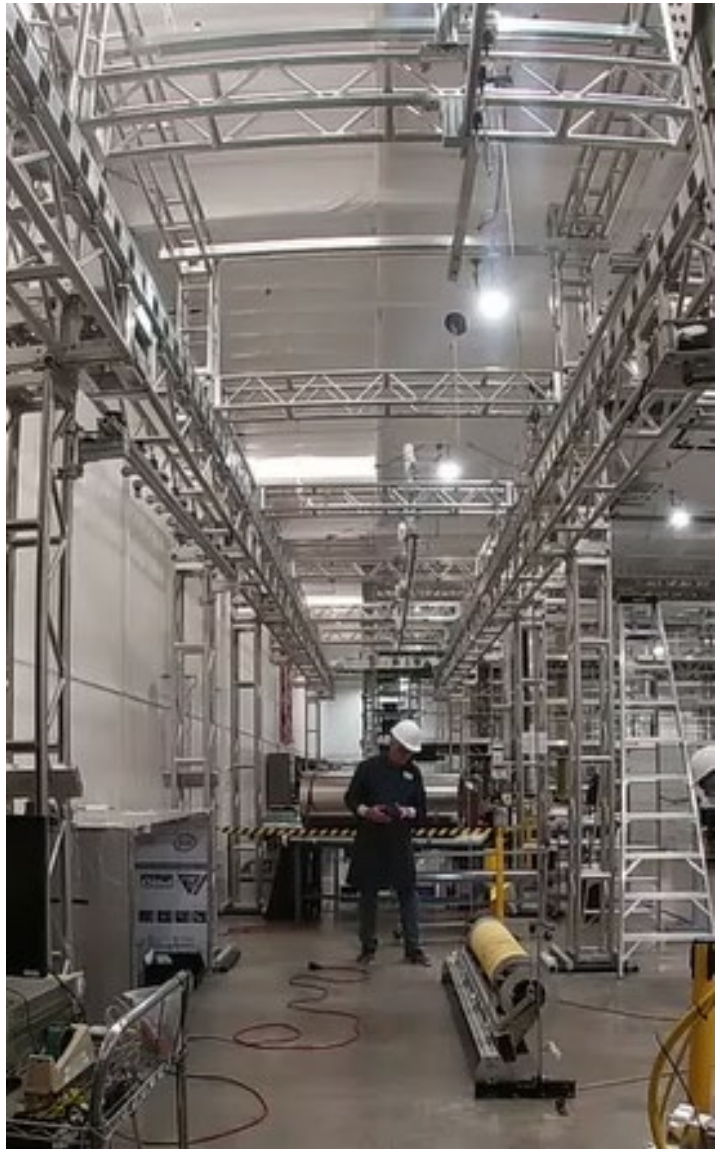
Lunar Lander SBIR ROSA

Vertical Deployment



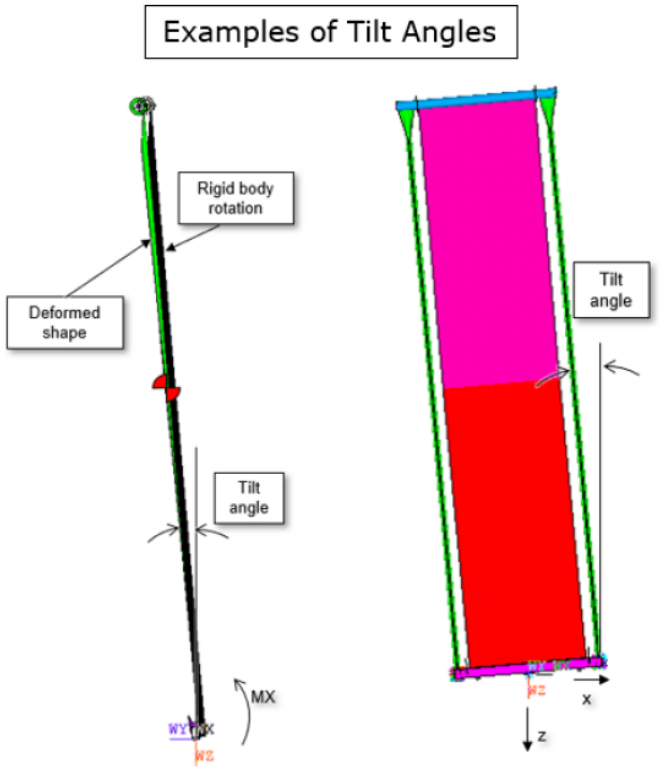


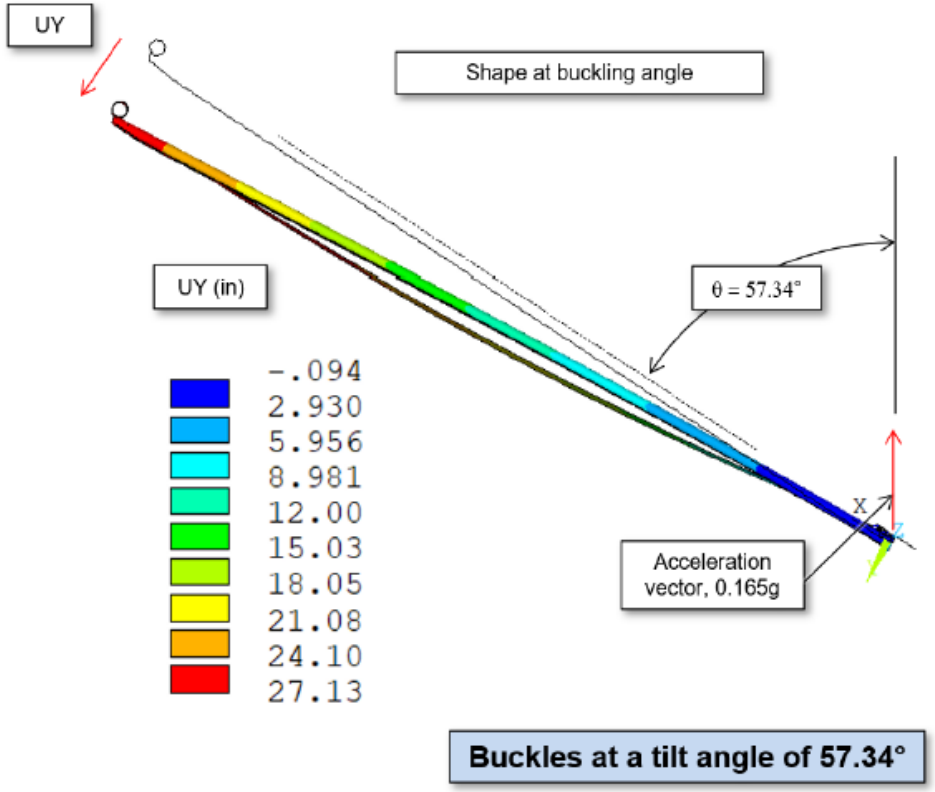




Lunar Lander SBIR ROSA Tilt Capabilities

Tilt Angle Analysis

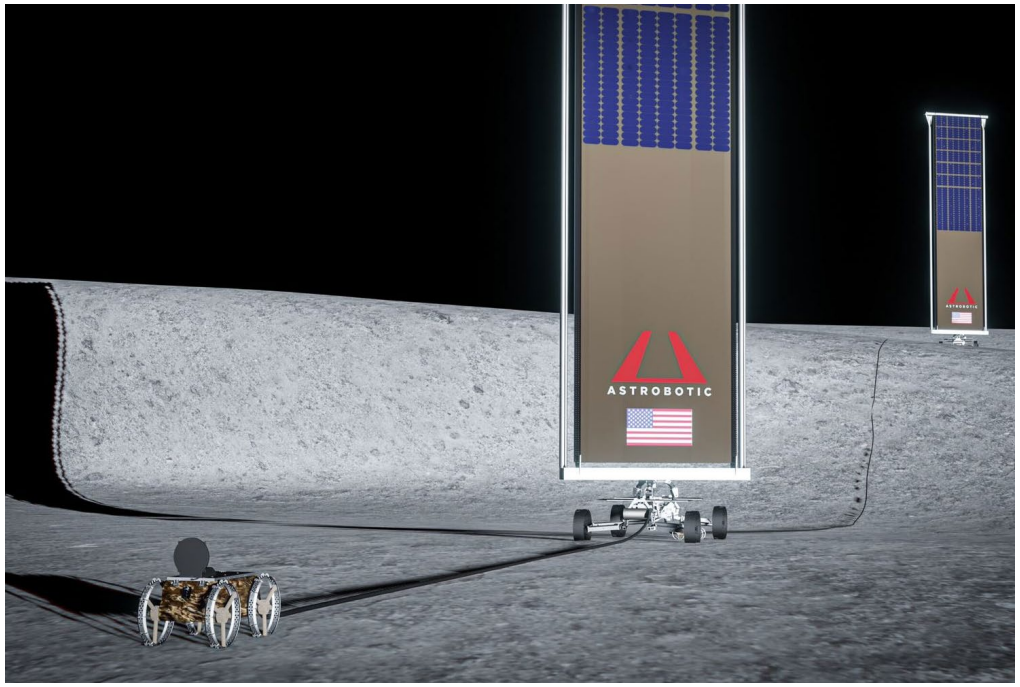


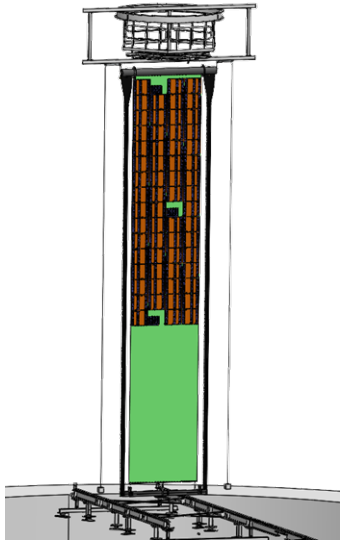


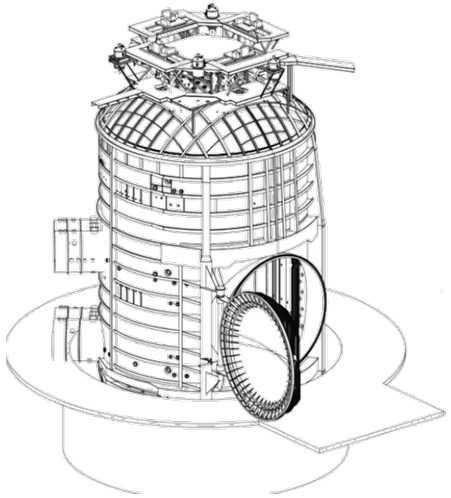
3-kW Lander ROSA design capable of > 57° tilt vs. 15° requirement

Astrobotic VSAT ROSA

- Redwire partnered with Astrobotic to provide ROSAs for NASA's Vertical Solar Array Technology (VSAT) program
- ROSA part of Astrobotic's LunaGrid system, which will power lunar lander which can provide wireless charging
- Program Goals:
  - Build full-size 10 kW ROSA EDU
  - Demonstrate 15° tilt capability
  - Offset 10 m from lunar surface (approx. 19 m long wing)
  - Perform thermal vacuum testing at JSC chamber
  - SPM Thermal Cycle Qualification

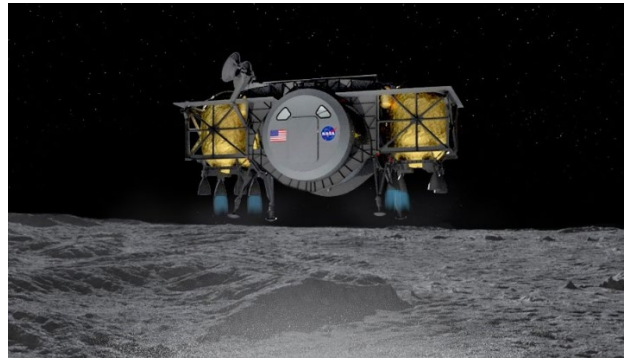


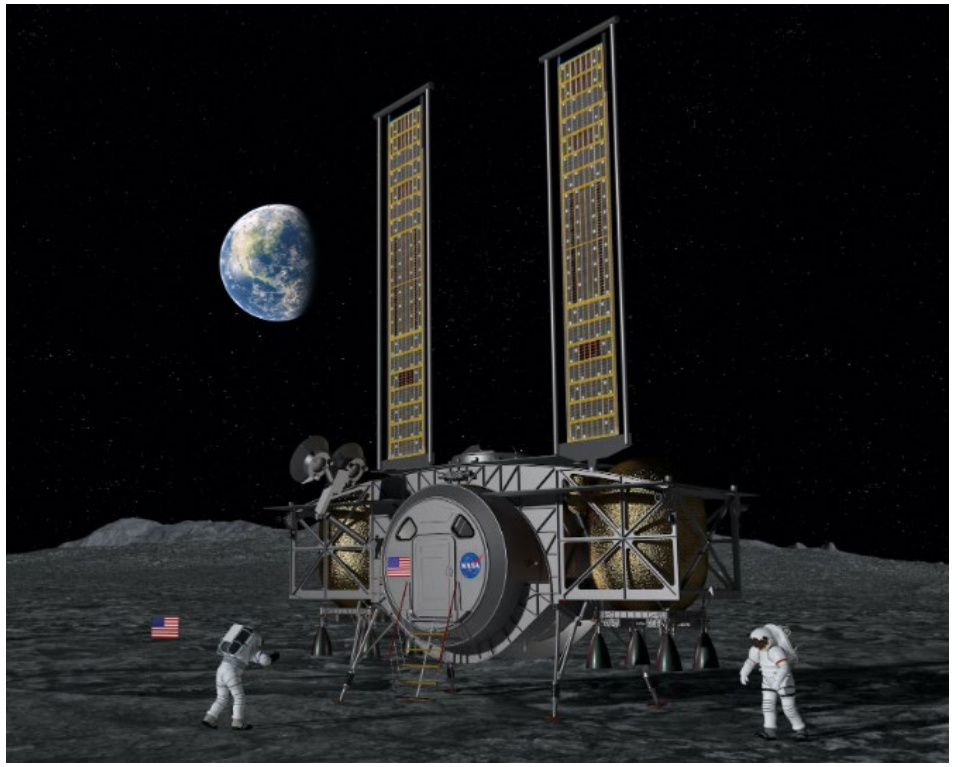




Dynetics HLS ROSA

- Pair of ROSA wing baselined for Dynetics' Human Landing System
  - ALPACA - Autonomous Logistics Platform for All-Moon Cargo Access
- Wing sizing comparable to DART ROSA
- Capable of retracting and re-launching from lunar surface







LTV Applications

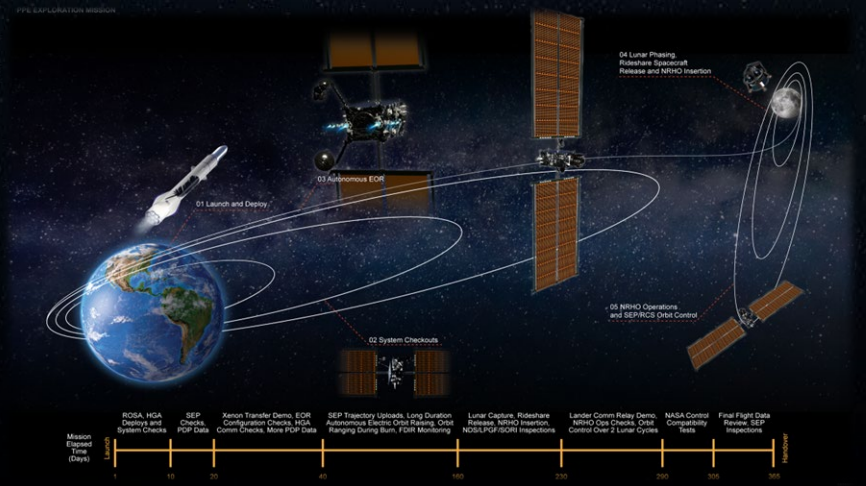
- ROSA considered for several Lunar Transport Vehicle (LTV) mission concepts
- Arrays would deploy to recharge batteries while parked, and retract into storage container

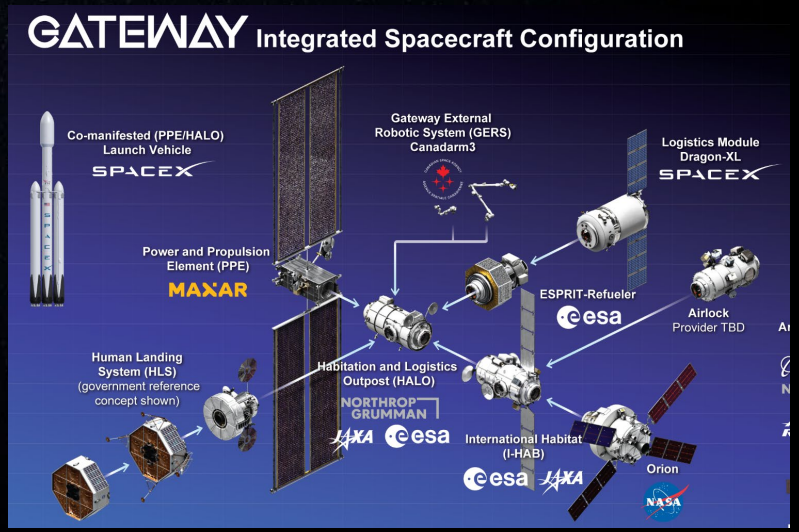


Lunar Gateway PPE ROSA Program

- Redwire providing Maxar two 33-kW ROSA wings for the Artemis Lunar Gateway Power Propulsion Element (PPE)
  - PPE based on Maxar's 1300-series bus platform
- Gateway will be launching point for lunar surface vehicles

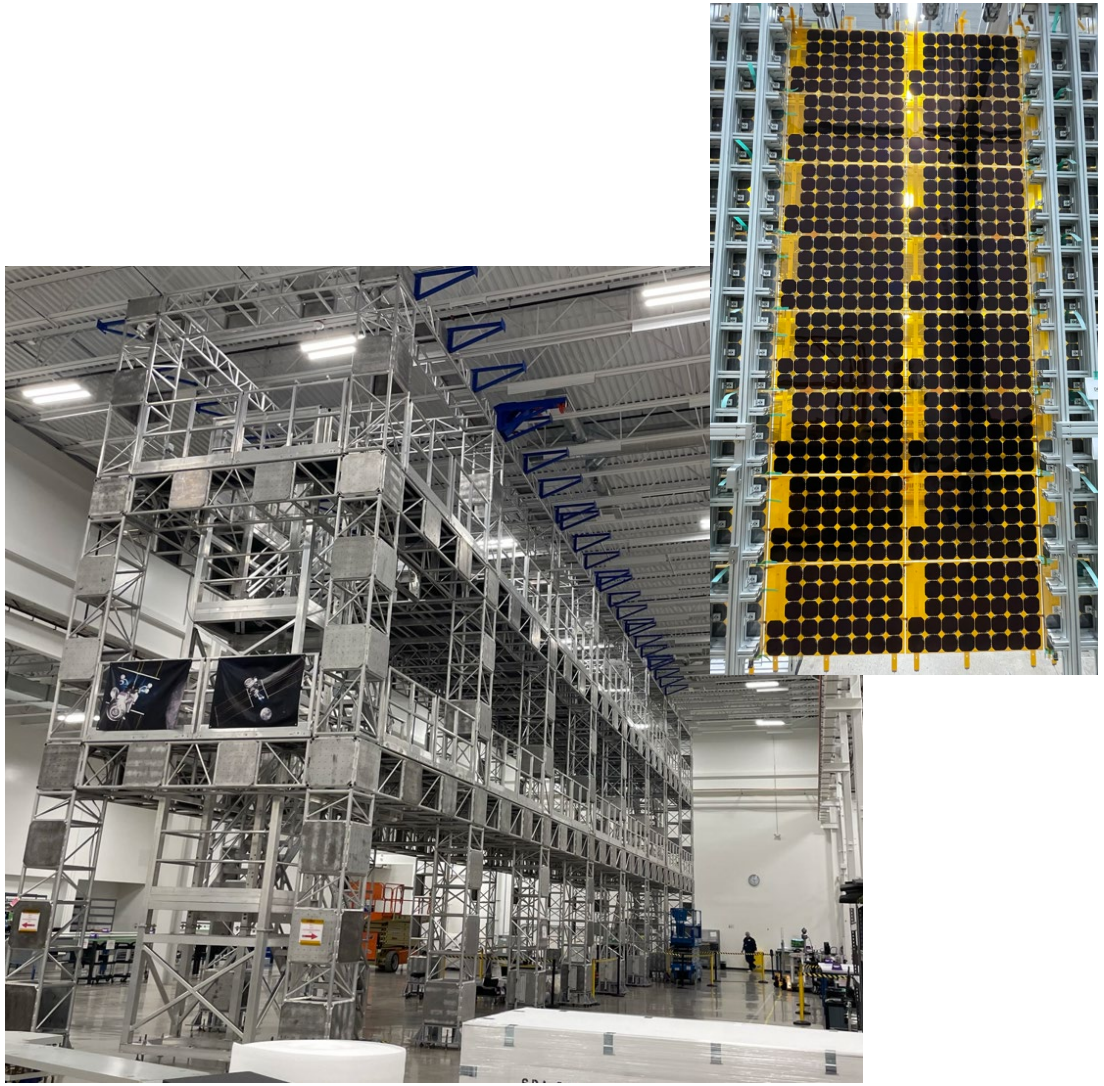




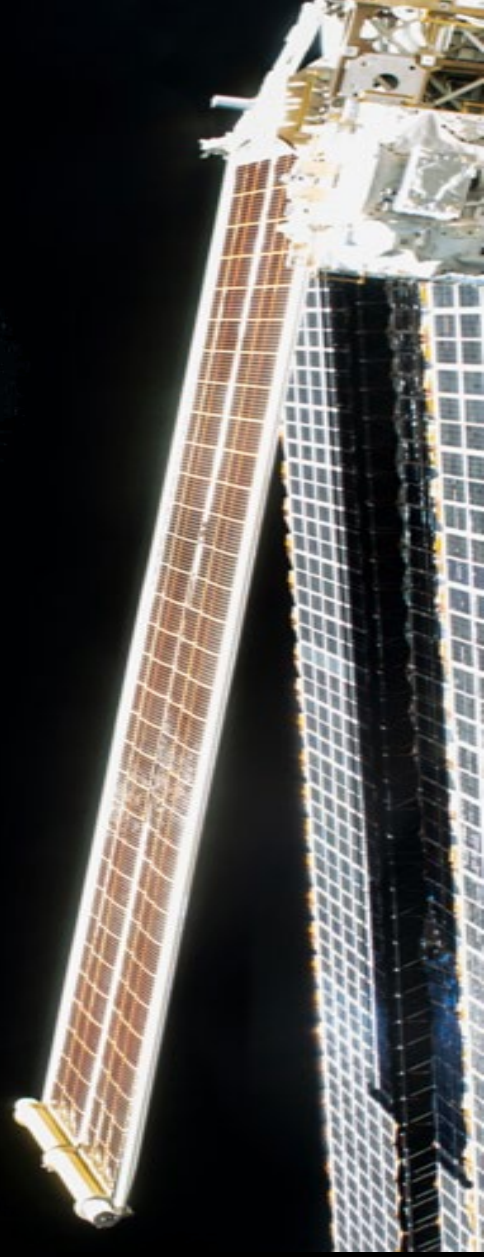


Lunar Gateway PPE ROSA Status

- PPE ROSA production underway for at Redwire's new 23,000-ft² high-bay cleanroom in Goleta, California
- Program is through CDR
- 3-story tall Vertical Deployment Offloader recently completed
- Integrated Modular Blanket Assembly (IMBA) constructions in process using SolAero Z4J cells
- 9" Slit Tube booms and other composites fabricated



Questions



Thank you for your time and consideration!

Questions or More Info: matt.lapointe@redwirespace.com