



NASA's Lunar Surface Power Strategy

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Space Power Workshop - 2026

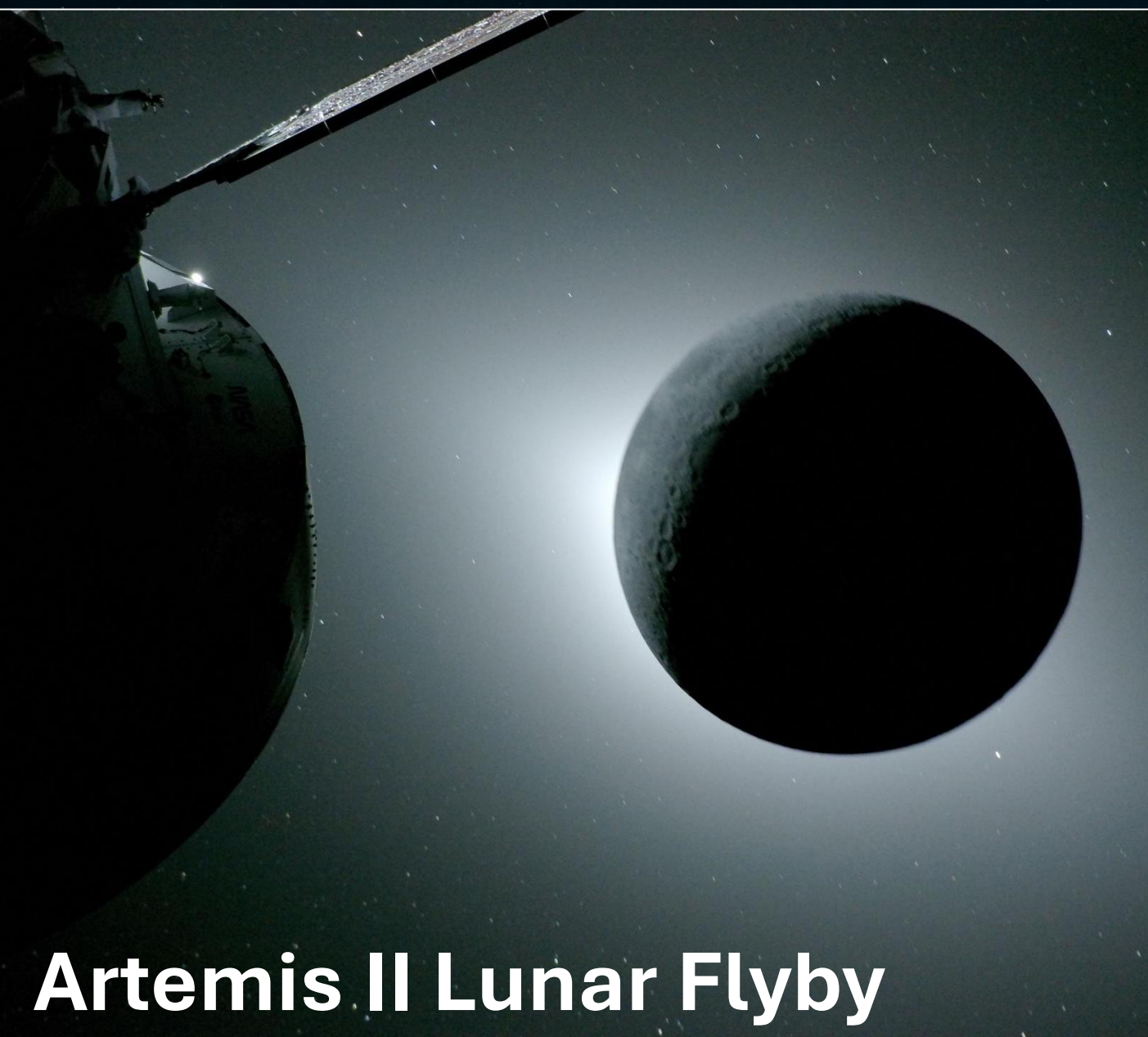


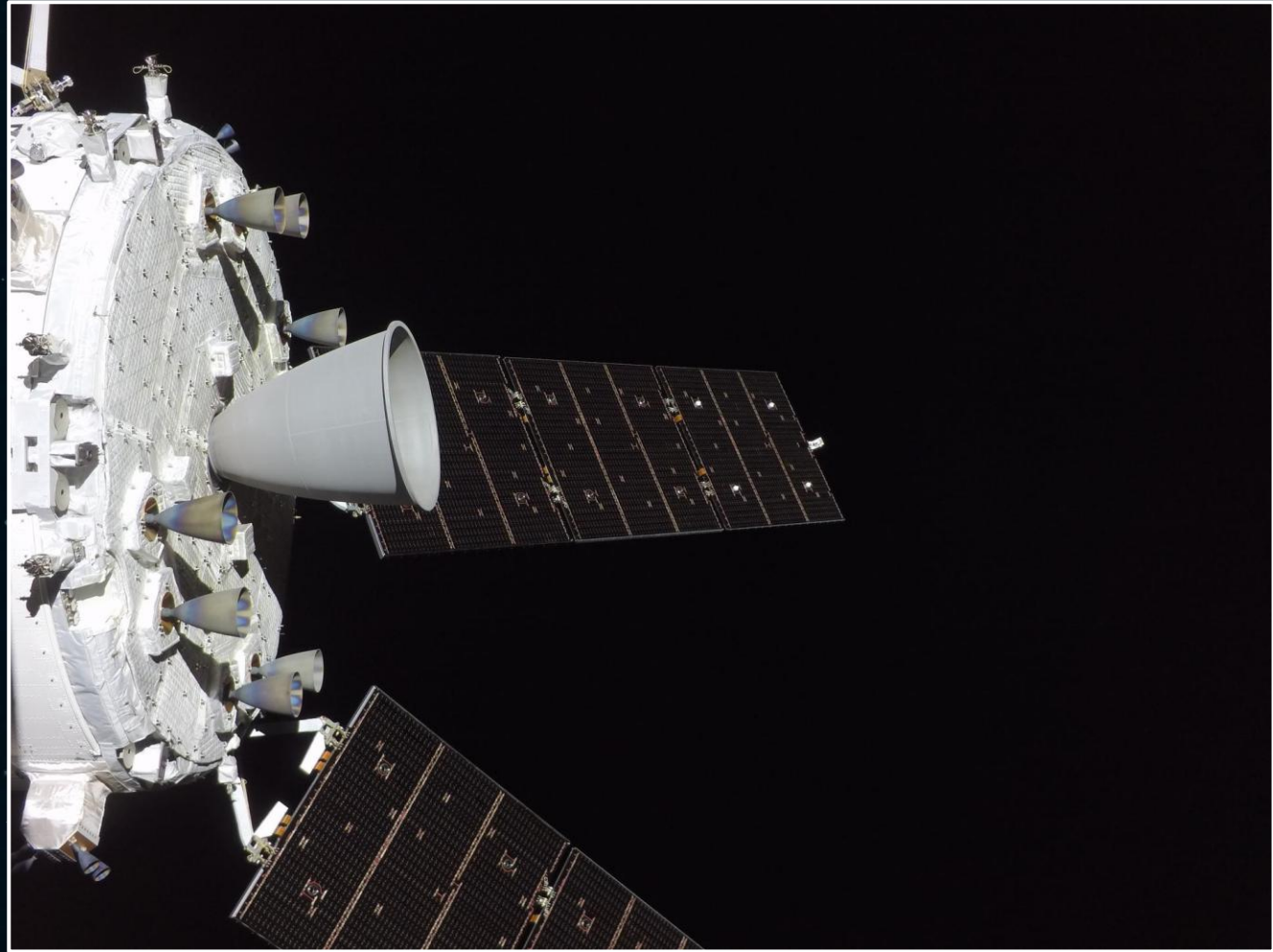
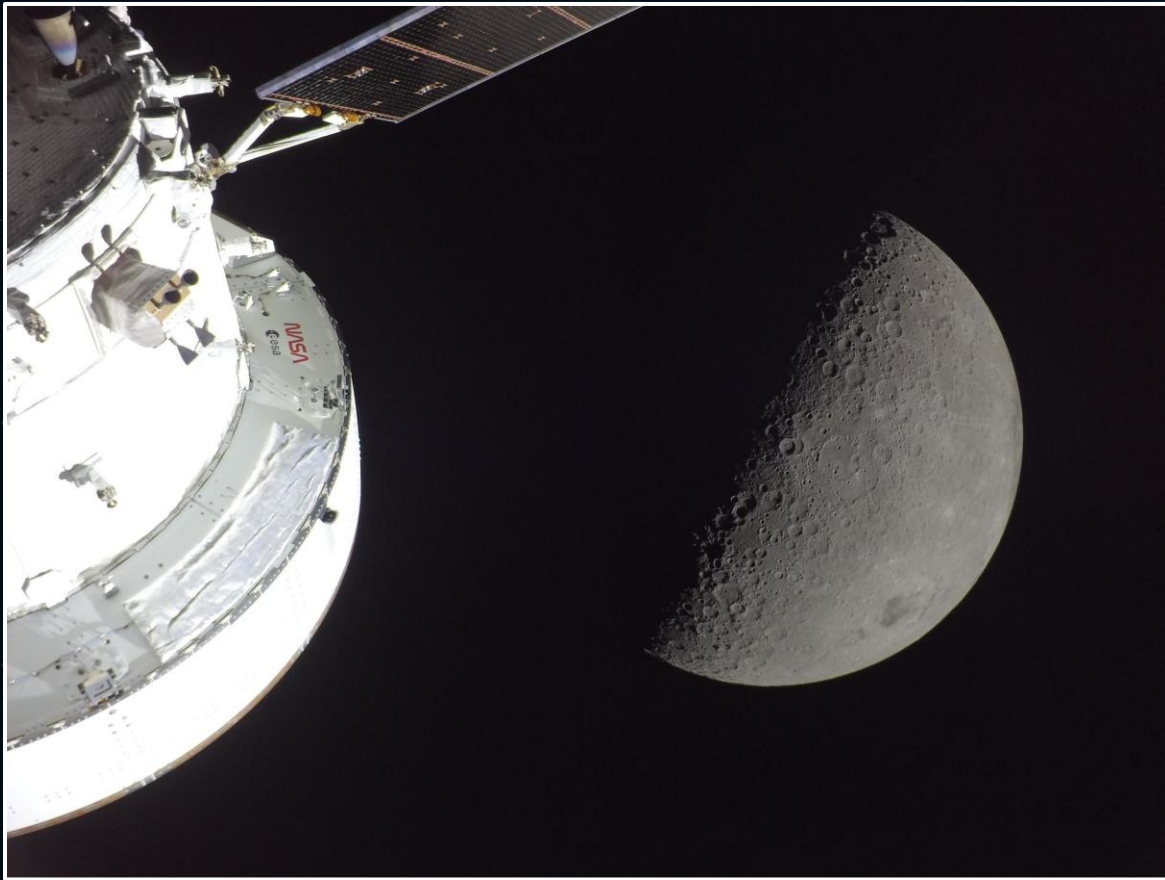
Artemis II Mission

NASA's Moon to Mars Architecture

Friday, April 17, 2026





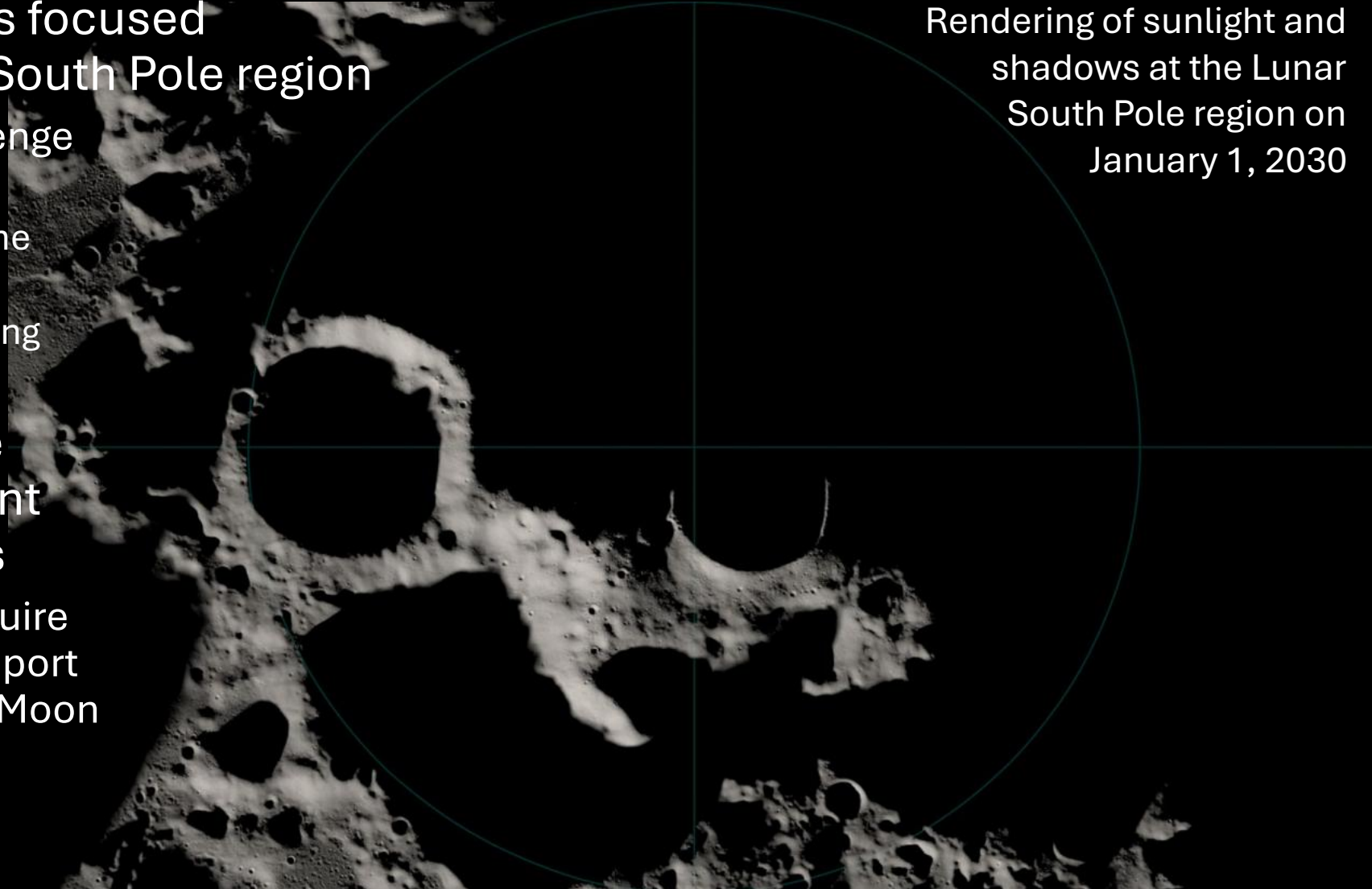


Artemis II Solar Arrays

Lunar Exploration Strategy



- NASA's Artemis campaign is focused on exploration of the lunar South Pole region
 - Unique environmental challenge for power systems
 - Abundant sunlight during the summer months
 - Long darkness periods during the winter months
- Early exploration assets are expected to be self-sufficient for power and energy needs
 - But future elements may require external power assets to support long-term exploration of the Moon



Rendering of sunlight and shadows at the Lunar South Pole region on January 1, 2030



South Pole Lighting and Terrain



NASA's Moon Base

National Aeronautics and
Space Administration

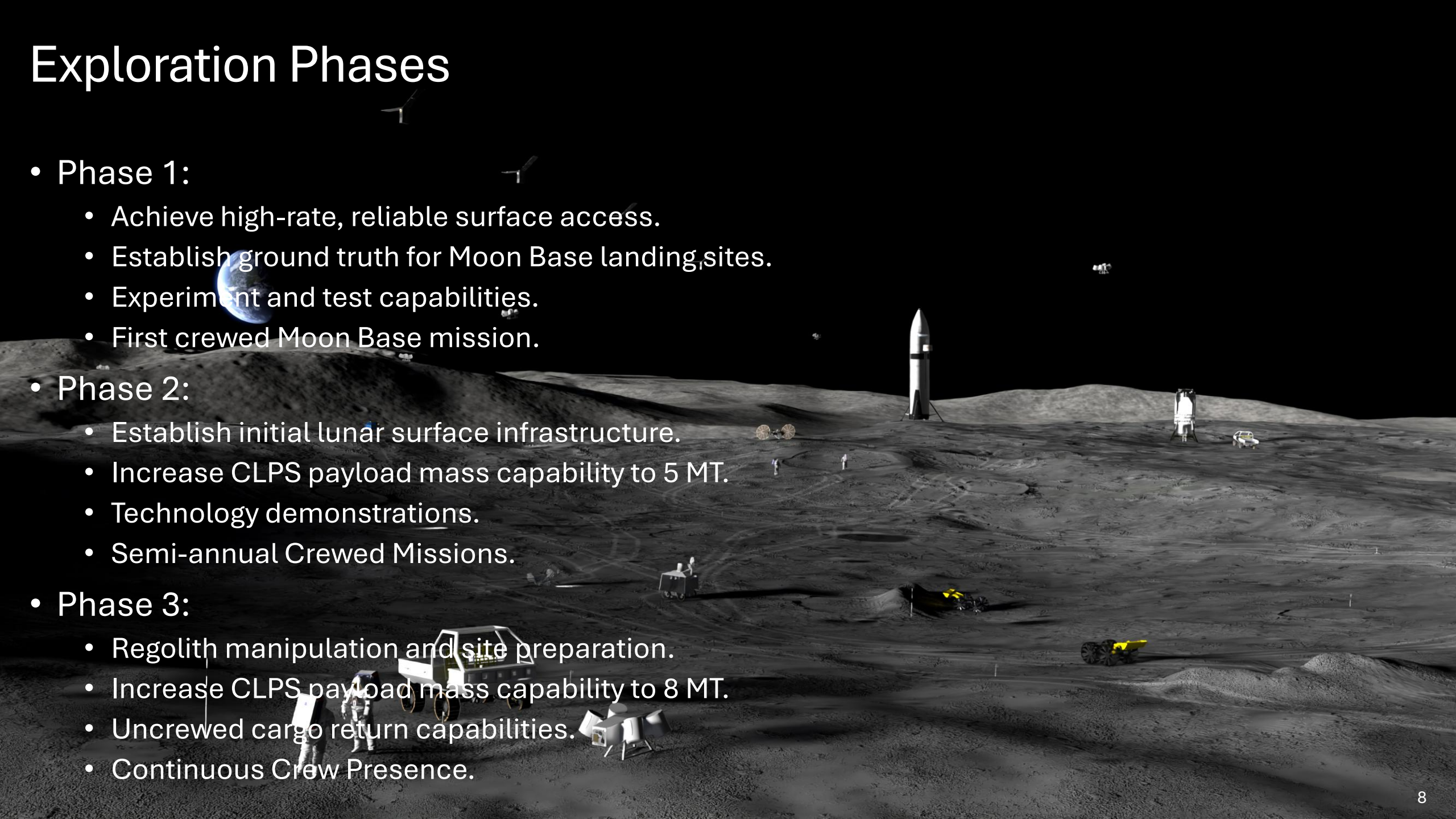


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NASA's Moon to Mars Architecture

Exploration Phases

- Phase 1:
 - Achieve high-rate, reliable surface access.
 - Establish ground truth for Moon Base landing sites.
 - Experiment and test capabilities.
 - First crewed Moon Base mission.
- Phase 2:
 - Establish initial lunar surface infrastructure.
 - Increase CLPS payload mass capability to 5 MT.
 - Technology demonstrations.
 - Semi-annual Crewed Missions.
- Phase 3:
 - Regolith manipulation and site preparation.
 - Increase CLPS payload mass capability to 8 MT.
 - Uncrewed cargo return capabilities.
 - Continuous Crew Presence.



Lunar Environment Considerations

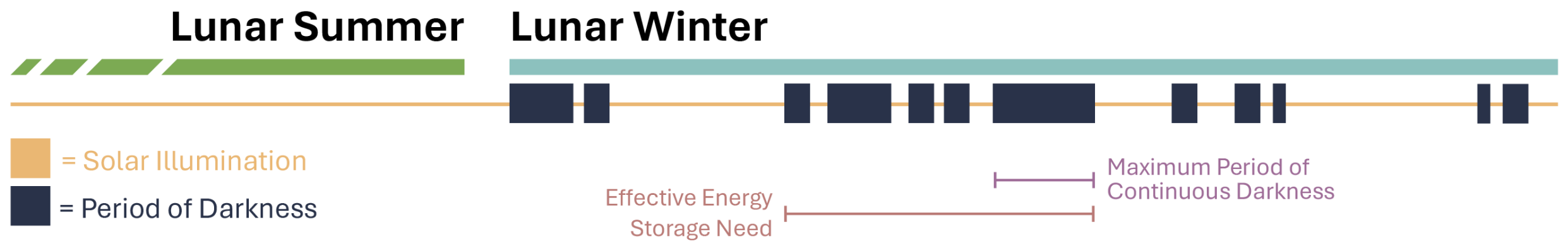
South Pole Lighting

National Aeronautics and
Space Administration



	Azimuth, Elevation	
Sun	335.15°	6.85°
Earth	300.80°	9.42°
01 Jan 2026 00:00 UT		

Surviving the Night



Effective
Energy
Storage
Duration

The number of hours of energy storage capacity needed to account for the annual worst-case recharge and discharge of solar-generated power (i.e., winter survival mode).



POWER SYSTEMS

Systems to generate, store, condition, and distribute electricity for the Moon Base, supporting infrastructure, and utilization systems.

ARCHITECTURAL VALUE

- Provides a critical shared resource for:
- Recharging mobility assets.
 - Crew habitation on the surface.
 - Science payloads in shadowed regions.
 - In-situ resource utilization (ISRU) processing.

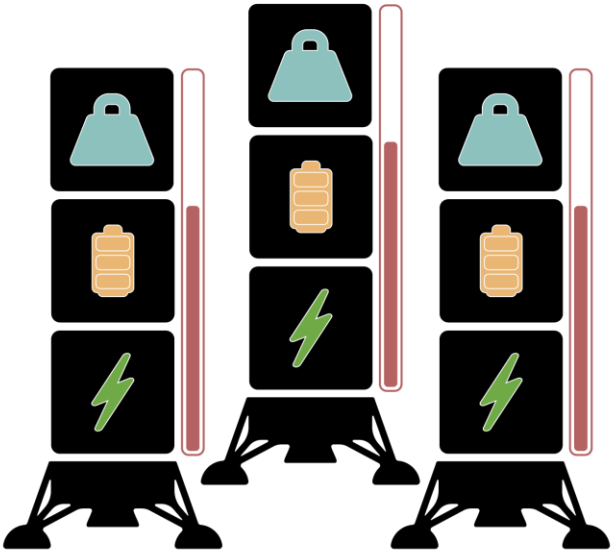
CAPABILITY TARGETS

- Demonstrate 5 kW power generation and storage, as well as survival through 120+ hours of darkness
- Demonstrate survive the night capability using radioisotope thermal generators

FUNCTIONAL GAPS	
FN-P-101 L	Generate power in the south pole region on the lunar surface.
FN-P-102 L	Store energy in the south pole region on the lunar surface.
FN-P-301L	Distribute power in the south pole region on the lunar.
FN-P-401L	Provide power for deployed surface utilization payloads/equipment.
FN-P-402 L	Provide power for deployed external surface utilization payload(s) and/or equipment for mid- (month+) to long-durations (year+).

Power Augmentation Benefits

SURVIVE



KEY

 Payload Mass

 Battery Mass

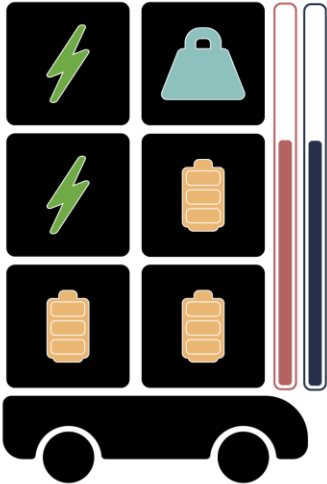
 Power System Mass

Power

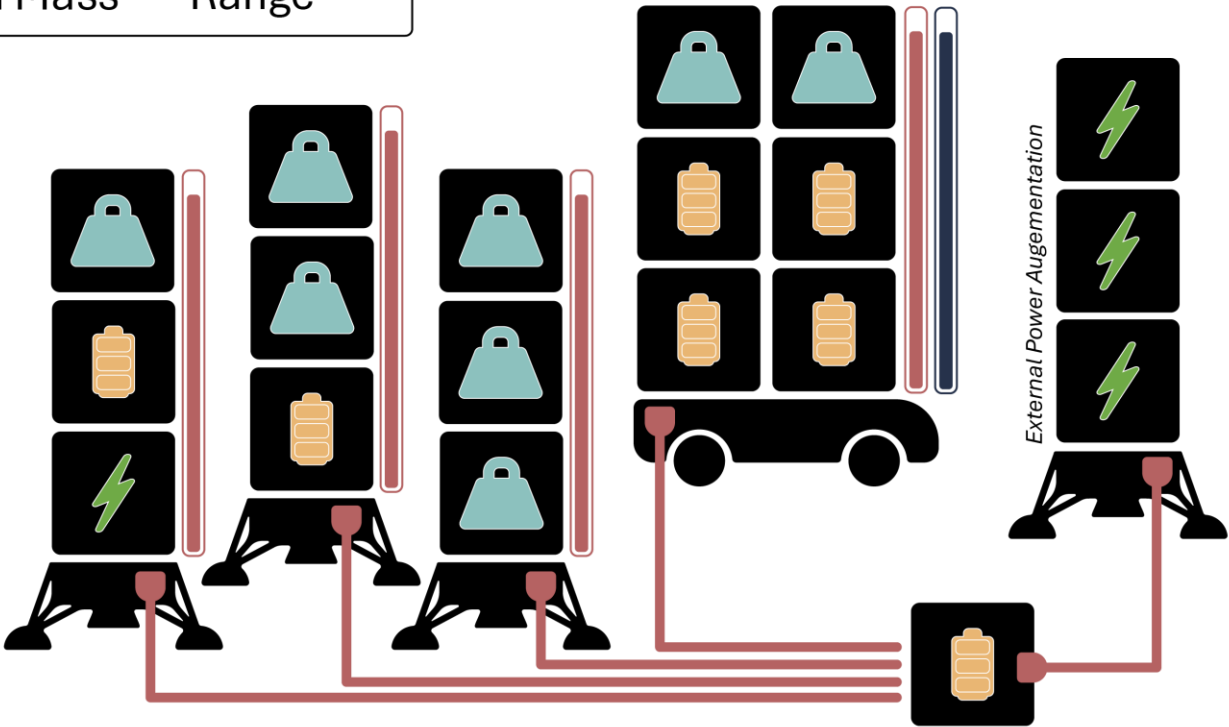


Range

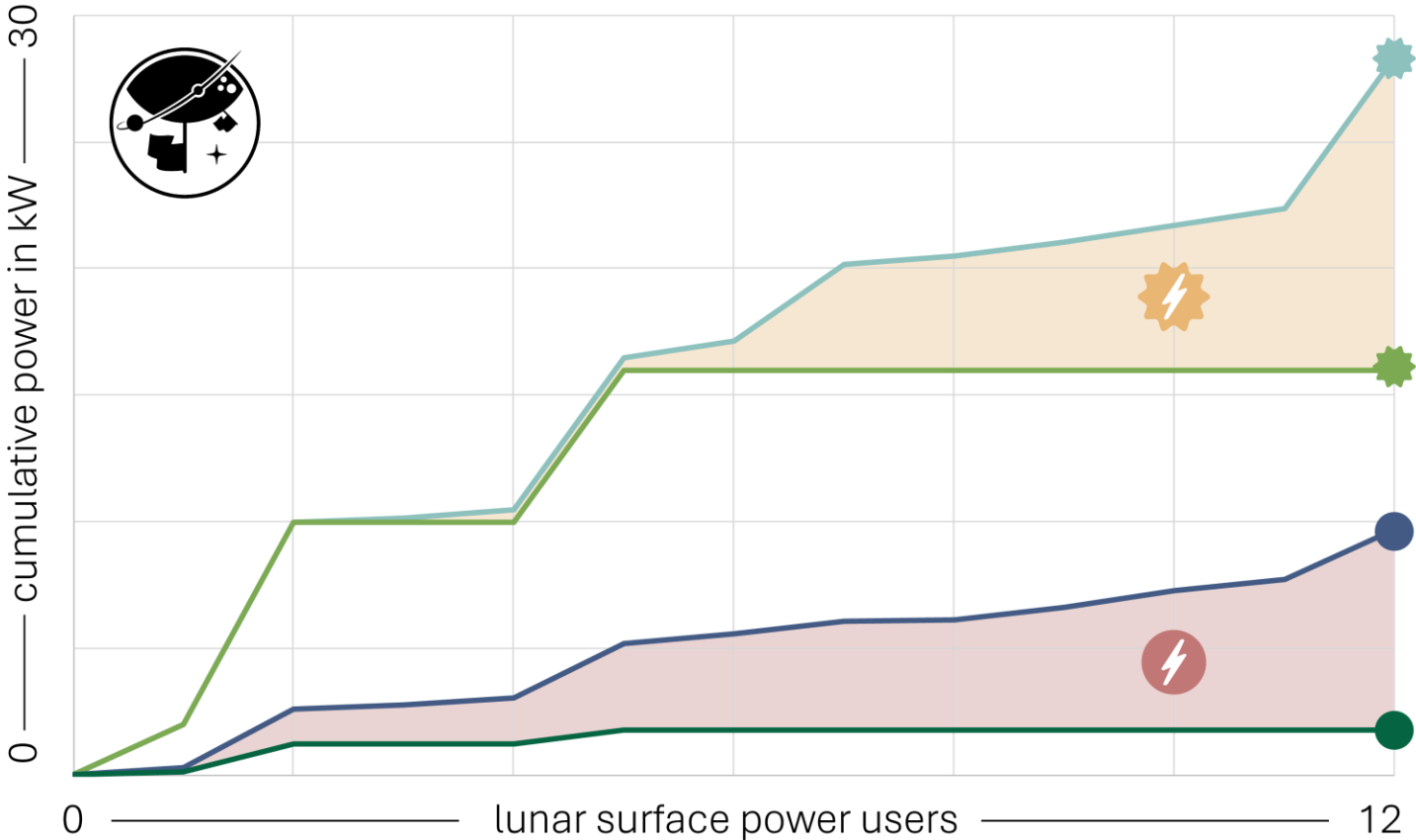




THRIVE



Representative Growth in User Need



Foundational Exploration Segment Power Profile

 **Day Power Needed**

 **Day Power Available**
(without augmentation)

 **Day Power Gap**

 **Night Power Needed**

 **Night Power Available**
(without augmentation)

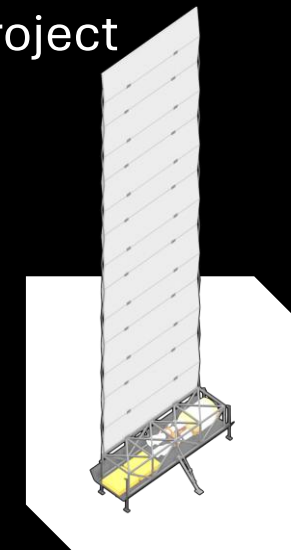
 **Night Power Gap**

Values Notional

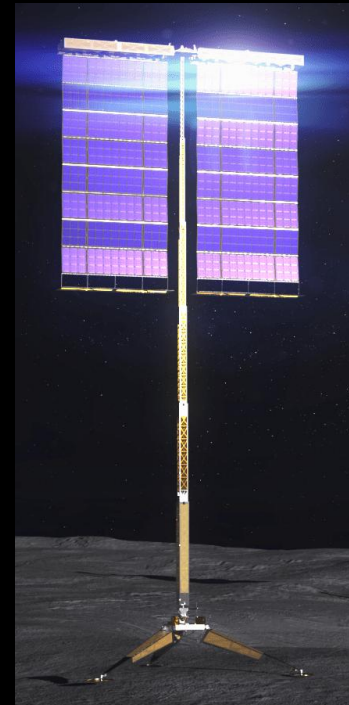
Power System Technologies



- The unique challenges of the lunar surface environment require multiple power technologies to enable NASA's exploration vision
- High TRL – Phase 1
 - Solar array technologies like the Vertical Solar Array Technology (VSAT) project
 - High energy density lithium-ion batteries
 - Radioisotope Power Systems (heat and power!)
- Low-Mid TRL – Phase 2 & 3
 - Nuclear Fission systems like Fission Surface Power (FSP) project
 - Regenerative Fuel Cells (RFC)
 - Power beaming
 - And other advanced power system technologies



Lunar Nuclear
Fission System



The unique lunar surface environment requires a wide range of power system capabilities to enable sustained lunar surface exploration.

2025 White Papers



Architecture White Papers

- 1 Why Moon and Mars? Building an Evolutionary Architecture
- 2 Integrated Lunar Power Considerations
- 3 Architecture-Driven Planetary Protection Considerations
- 4 Comms and Navigation Needs for Foundational Exploration
- 5 Architecture-Driven Data Gaps
- 6 Architecture Definition (*update to prev. papers*)



Questions?

Thank You!