FORWARD TO THE MOON:

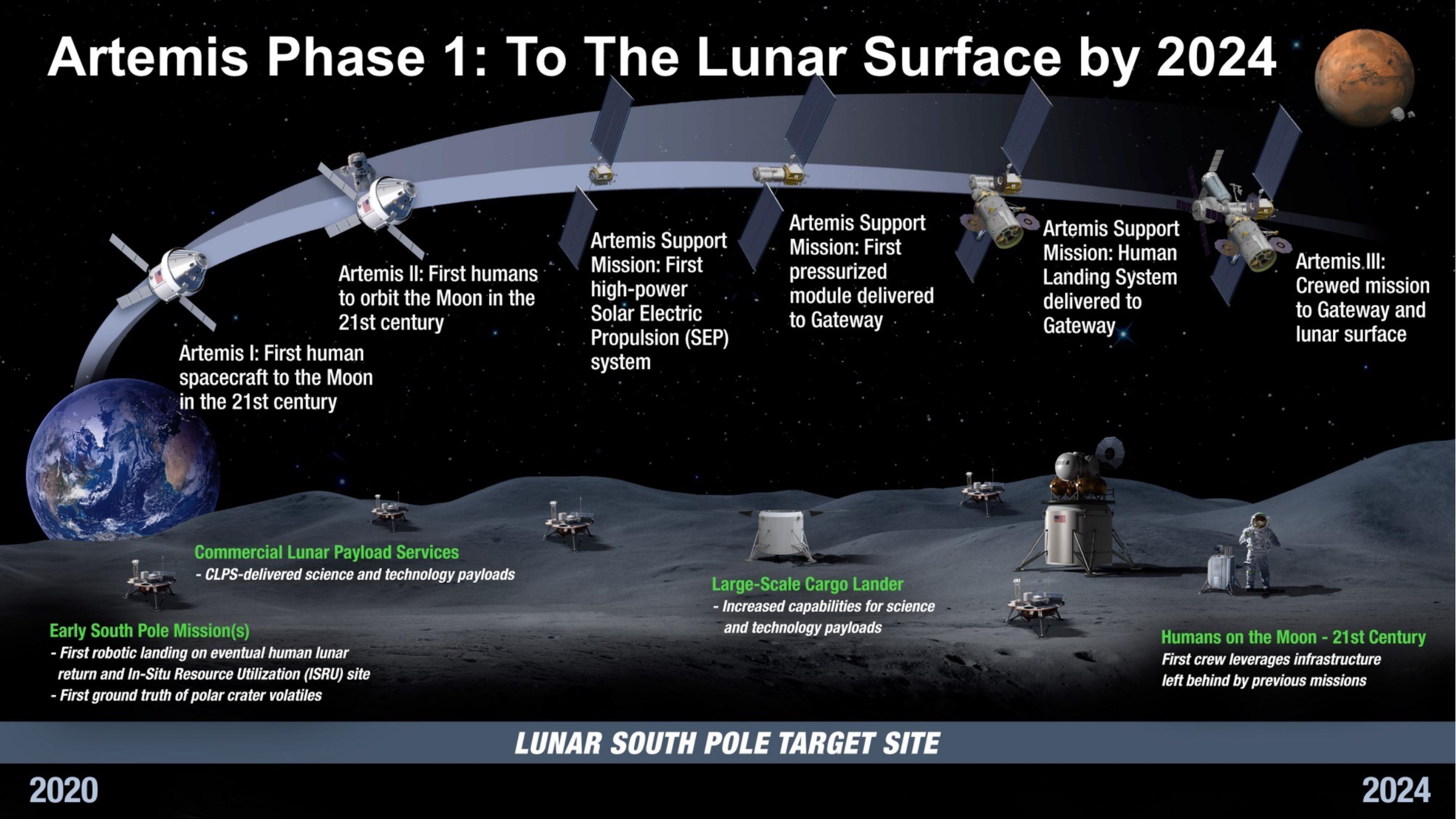
NASA's Strategic Plan for Human Exploration

Updated 09/04/2019

PLENARY ROUND TABLE: The Upcoming Exploration of the Moon
International Conference on Flight Vehicles, Aerothermodynamics and Re-entry Missions & Engineering
FAR 2019
3 October 2019, Monopoli, Italy


NASA
ARTEMIS
PHASE ONE:
Lunar South Pole by 2024

Artemis Phase 1: To The Lunar Surface by 2024



Achieving 2024 – A Parallel Path to Success

Artemis will see government and commercial systems moving in parallel to complete the architecture and deliver crew

CREW

NASA Programs SLS and Orion

Artemis I

First flight test of SLS and Orion as an integrated system

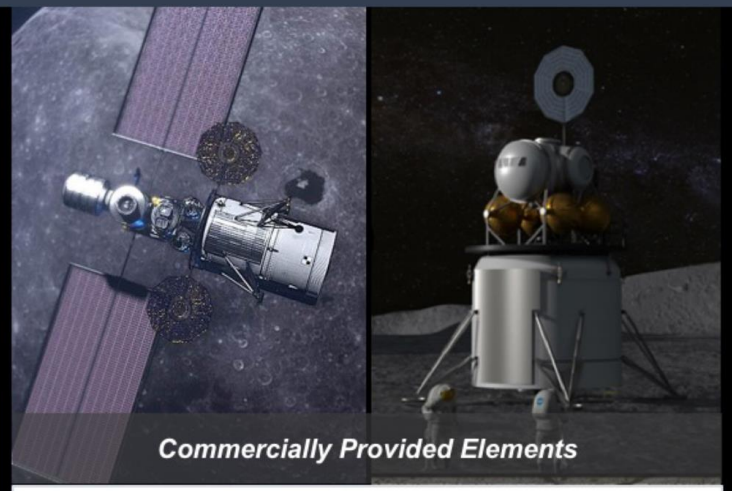
Artemis II

First flight of crew to the Moon aboard SLS and Orion

Artemis III

First crew to the lunar surface; Logistics delivered for 2024 surface mission

Between now and 2024, U.S. industry delivers the launches and human landing system necessary for a faster return to the Moon and sustainability through Gateway.



Commercially Provided Elements

CARGO

PPE

Power and Propulsion Element arrives at NRHO via commercial rocket

Pressurized Module

Small area for crew to check out systems prior to lunar transfer and decent

Human Landing System

Transfer

Transfers lander from Gateway to low lunar orbit

Descent

Descends from Transfer Vehicle to lunar surface

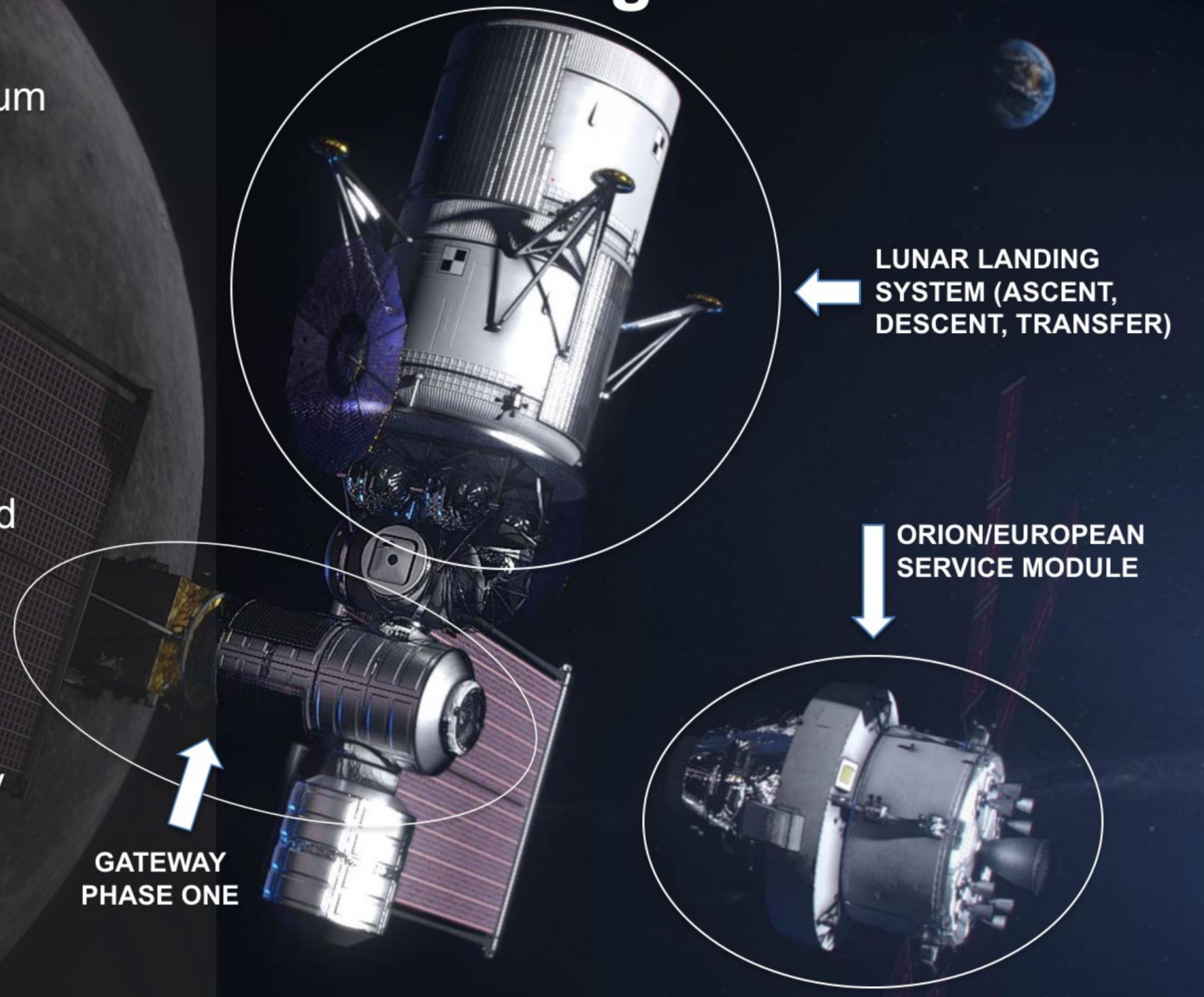
Ascent

Ascends from lunar surface to Gateway

Up to three commercial rocket launches, depending on distribution of the Transfer, Descent, and Ascent functions

Gateway is Essential for 2024 Landing

- Initial Gateway focuses on the minimum systems required to support a 2024 human lunar landing while also supporting Phase 2
- Provides command center and aggregation point for 2024 human landing
- Establishes strategic presence around the Moon – US in the leadership role
- Creates resilience and robustness in the lunar architecture
- Open architecture and interoperability standards provides building blocks for partnerships and future expansion



Lunar Science by 2024

POLAR LANDERS AND ROVERS

- First direct measurement of polar volatiles, improving understanding of lateral and vertical distribution, physical state, and chemical composition
- Provide geology of the South-Pole Aitken basin, largest impact in the solar system

NON-POLAR LANDERS AND ROVERS

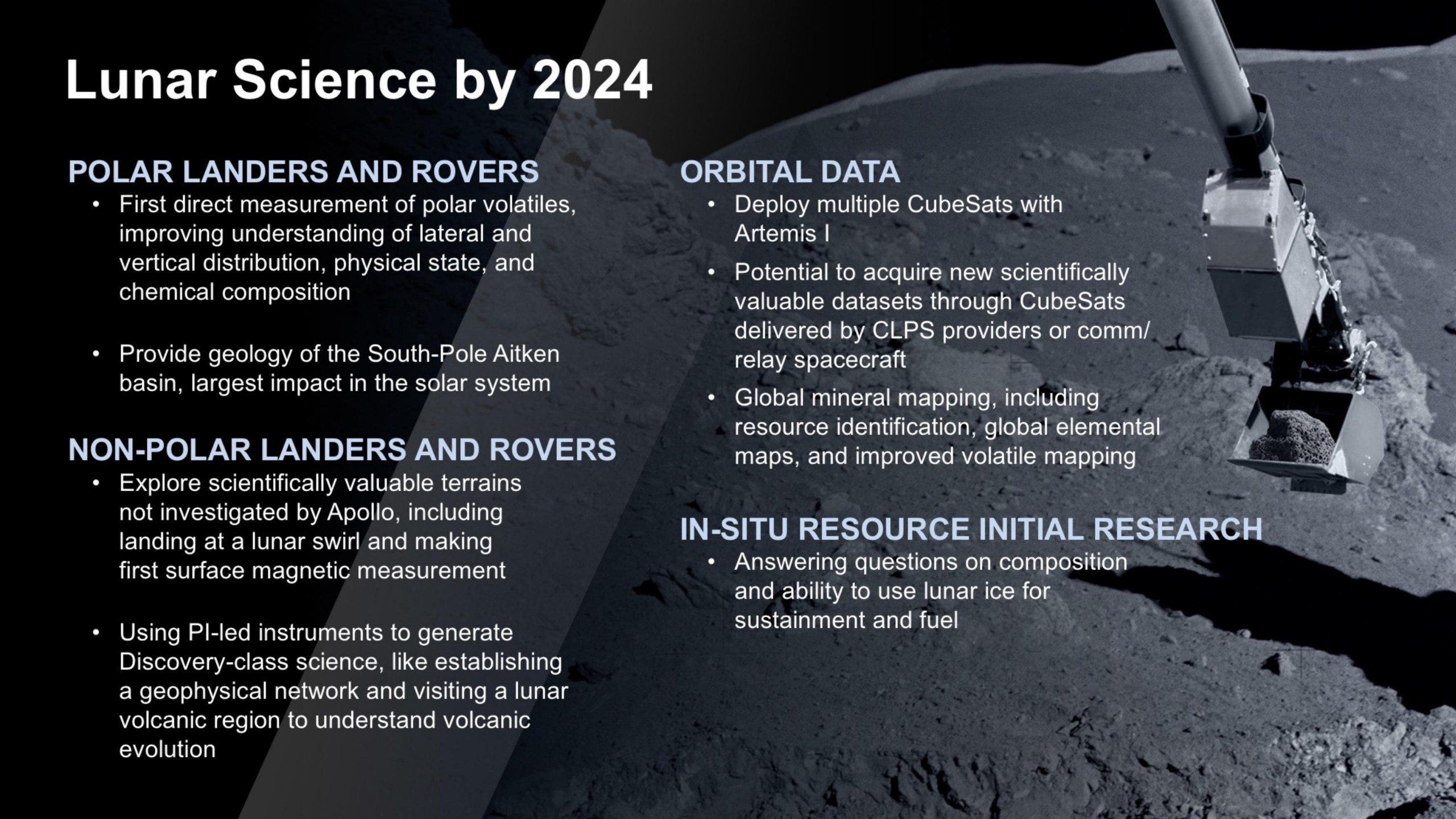
- Explore scientifically valuable terrains not investigated by Apollo, including landing at a lunar swirl and making first surface magnetic measurement
- Using PI-led instruments to generate Discovery-class science, like establishing a geophysical network and visiting a lunar volcanic region to understand volcanic evolution

ORBITAL DATA

- Deploy multiple CubeSats with Artemis I
- Potential to acquire new scientifically valuable datasets through CubeSats delivered by CLPS providers or comm/ relay spacecraft
- Global mineral mapping, including resource identification, global elemental maps, and improved volatile mapping

IN-SITU RESOURCE INITIAL RESEARCH

- Answering questions on composition and ability to use lunar ice for sustainment and fuel

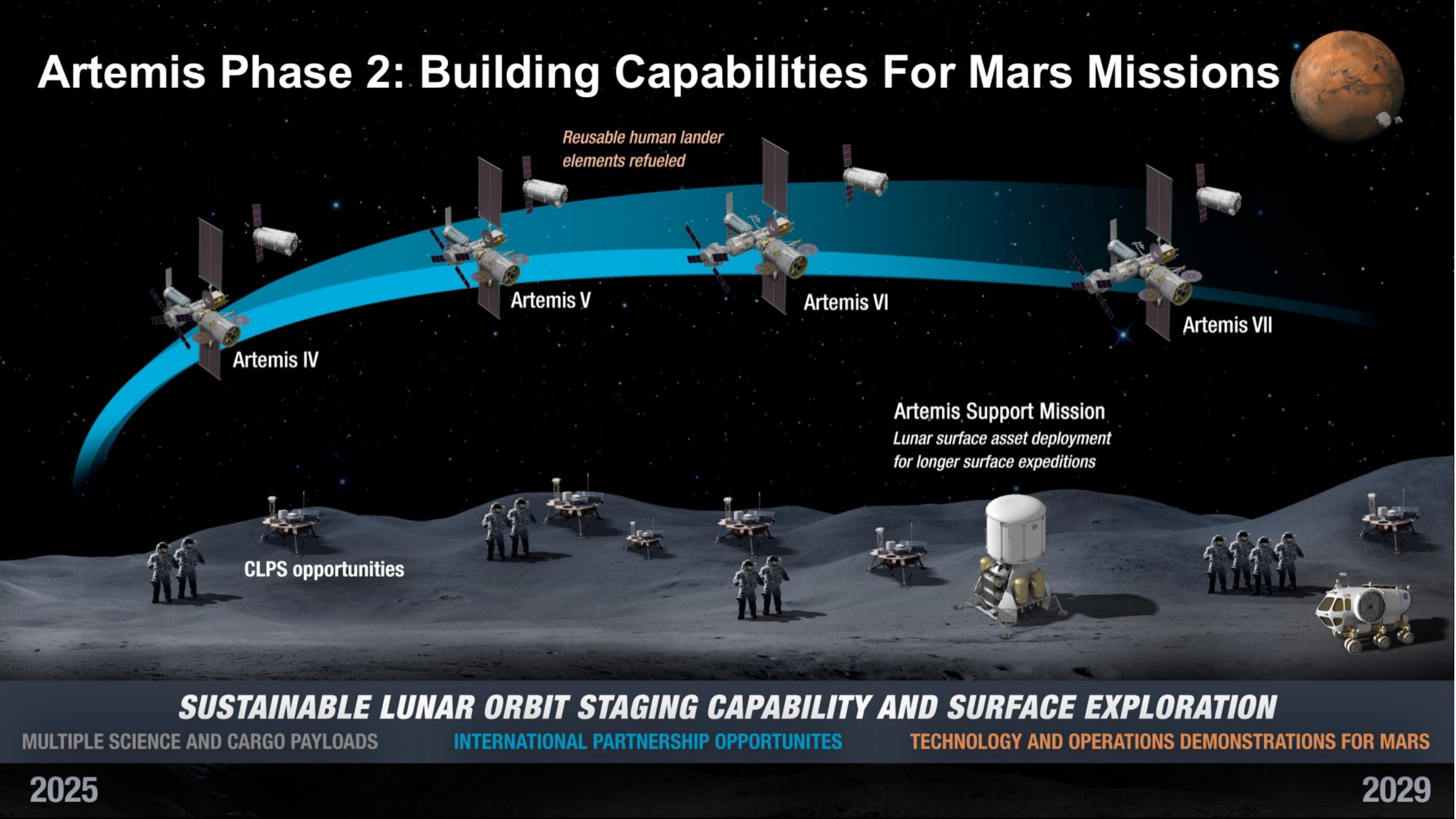


ARTEMIS

PHASE TWO:

Mars Forward Capabilities, Sustainable Lunar Presence

Artemis Phase 2: Building Capabilities For Mars Missions



SUSTAINABLE LUNAR ORBIT STAGING CAPABILITY AND SURFACE EXPLORATION

MULTIPLE SCIENCE AND CARGO PAYLOADS | INTERNATIONAL PARTNERSHIP OPPORTUNITES | TECHNOLOGY AND OPERATIONS DEMONSTRATIONS FOR MARS

2025 — 2029

Science After 2024

Human and Robotic Missions Provide Unique Science Opportunities

ON GATEWAY

- Deep space testing of Mars-forward systems
- Hosts groundbreaking science study and observation
- Mars transit testbed for reducing risk to humans

SURFACE EXPLORATION

- Understanding how to use in-situ resources for fuel and life
- Revolutionizing the understanding of the origin and evolution of the Moon
- Studying lunar impact craters to understand impact cratering
- Setting up complex surface science instrumentation
- Informing and supporting sustained human presence

SURFACE TELEROBOTICS TO PROVIDE CONSTANT SCIENCE

- Sending rovers into areas too difficult for humans to explore

BACK-UP CHARTS

The Artemis Program

Artemis is the twin sister of Apollo and goddess of the Moon in Greek mythology. Now, she personifies our path to the Moon as the name of NASA's program to return astronauts to the lunar surface by 2024.

When they land, Artemis astronauts will step foot where no human has ever been before: the Moon's South Pole.

With the horizon goal of sending humans to Mars, Artemis begins the next era of exploration.

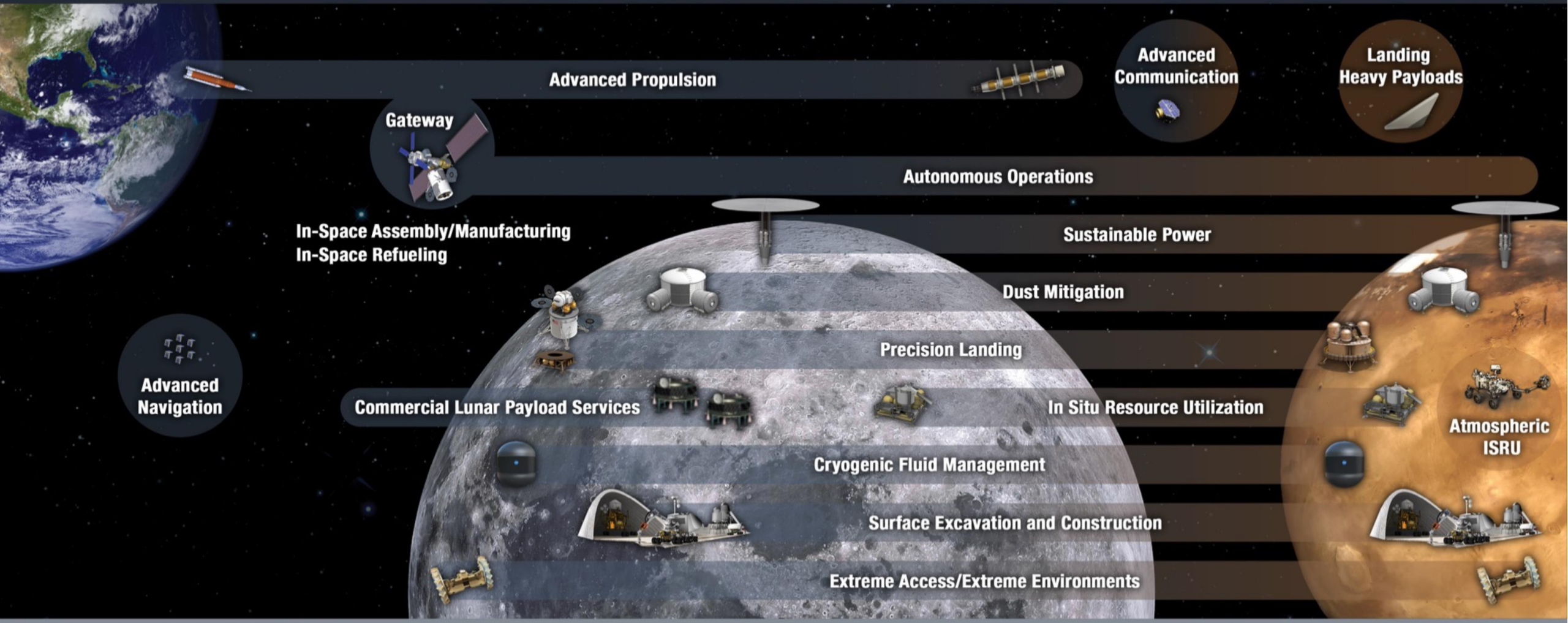
Moon Before Mars

On the Moon, we can take reasonable risks while astronauts are just three days away from home.

There we will prove technologies and mature systems necessary to live and work on another world before embarking on what could be a 2-3 year mission to Mars.

Reaching The Moon And Mars Faster With NASA Technology

Rapid, Safe, and Efficient Space Transportation | **Expanded Access to Diverse Surface Destinations** | **Sustainable Living and Working Farther from Earth** | **Transformative Missions and Discoveries**



2020 **GO | LAND | LIVE | EXPLORE** 203X