

# 2024 GATEWAY PLANNING



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# Space Policy Directive 1: To The Moon, Then Mars



“Lead an innovative and sustainable program of exploration with commercial and international partners to enable human expansion across the solar system and to bring back to Earth new knowledge and opportunities. Beginning with missions beyond low-Earth orbit, the United States will lead the return of humans to the Moon for long-term exploration and utilization, followed by human missions to Mars and other destinations...”

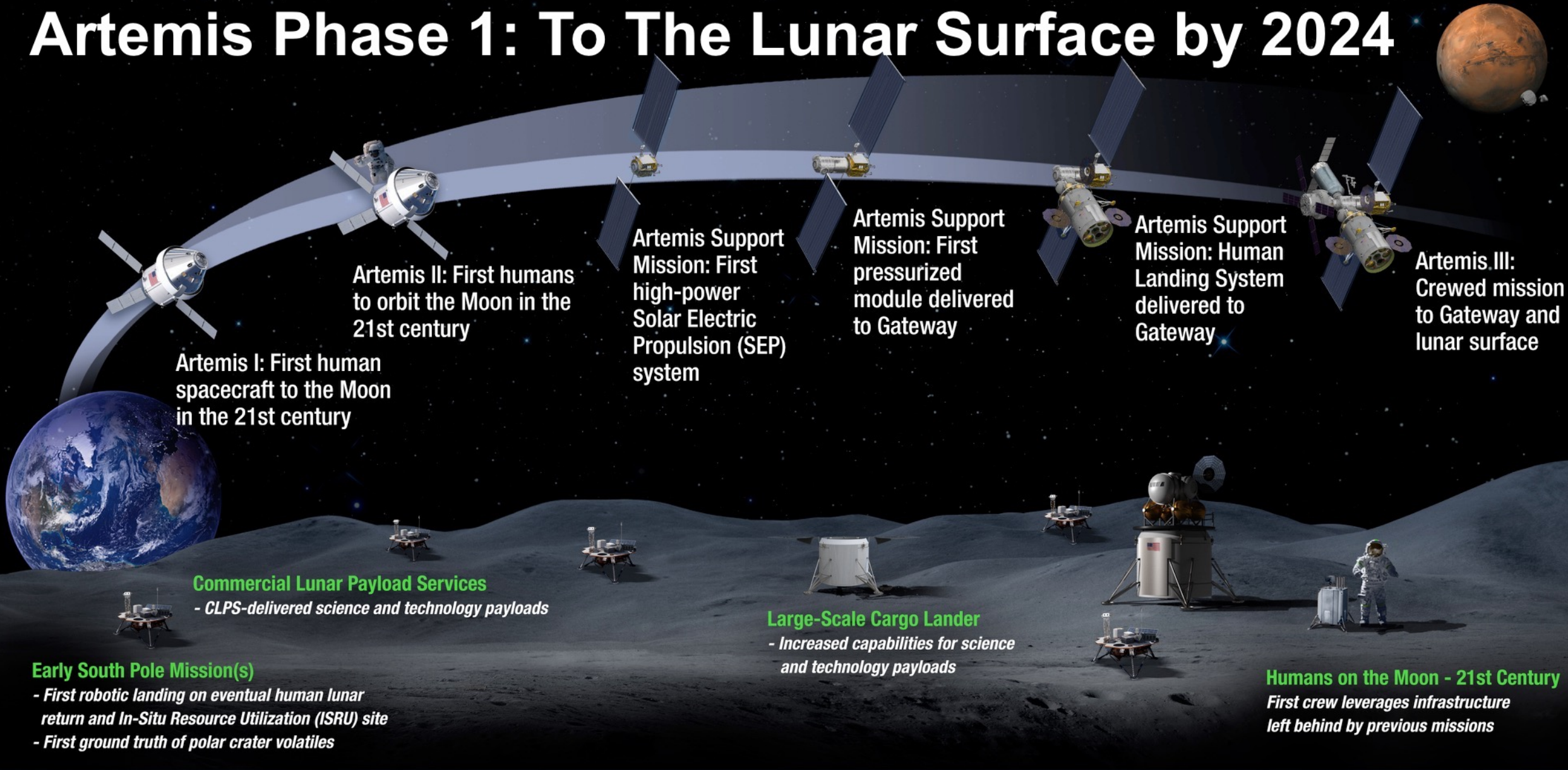


# FORWARD TO THE MOON

- Charged to get Americans to the Moon by 2024
- Going with commercial and international partners
  - Proving ground to test technologies for Mars
    - Sustainable, reusable architecture
  - Gateway is a key tenant in this mandate



# Artemis Phase 1: To The Lunar Surface by 2024



## LUNAR SOUTH POLE TARGET SITE

2020

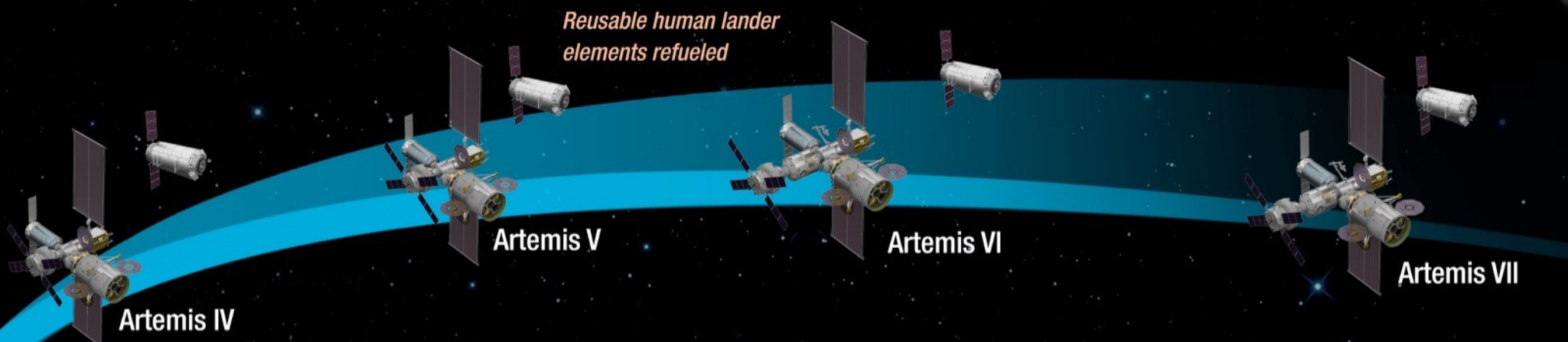
2024



# Artemis Phase 2: Building Capabilities For Mars Missions



*Reusable human lander elements refueled*



Artemis IV

Artemis V

Artemis VI

Artemis VII

**Artemis Support Mission**  
*Lunar surface asset deployment  
for longer surface expeditions*

CLPS opportunities

## **SUSTAINABLE LUNAR ORBIT STAGING CAPABILITY AND SURFACE EXPLORATION**

MULTIPLE SCIENCE AND CARGO PAYLOADS

INTERNATIONAL PARTNERSHIP OPPORTUNITES

TECHNOLOGY AND OPERATIONS DEMONSTRATIONS FOR MARS

2025

2029

# WHY GATEWAY?

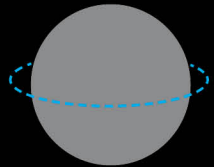
- Enables reusability and sustainability
- Provides access to the entire lunar surface
- Supports Lunar vehicle checkout
- Allows for deep space systems testing
- Enables international and commercial partnerships
- Is a stepping stone to Mars exploration



# GATEWAY ORBIT

Cislunar space offers innumerable orbits for consideration, each with merit for a variety of operations. The Gateway will support missions to the lunar surface and serve as a staging area for exploration farther into the solar system, including Mars.

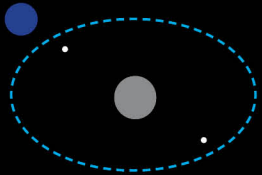
## ORBIT TYPES



### LOW LUNAR ORBITS

Circular or elliptical orbits close to the surface. Excellent for remote sensing, difficult to maintain in gravity well.

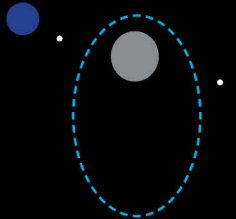
» Orbit period: 2 hours



### DISTANT RETROGRADE ORBITS

Very large, circular, stable orbits. Easy to reach from Earth, but far from lunar surface.

» Orbit period: 2 weeks



### HALO ORBITS

Fuel-efficient orbits revolving around Earth-Moon neutral-gravity points.

» Orbit period: 1-2 weeks

## NEAR-RECTILINEAR HALO ORBIT (NRHO)

1,500 km at its closest to the lunar surface, 70,000 km at its farthest.



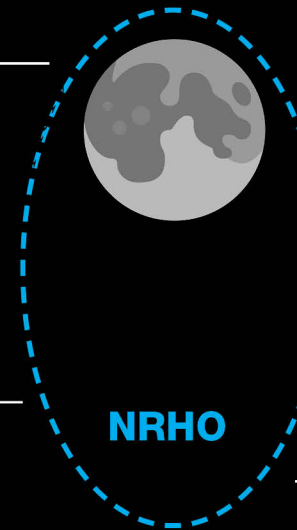
### ACCESS

Easy to access from Earth orbit with many current launch vehicles. Staging point for both lunar surface and deep space destinations.



### ENVIRONMENT

Deep space environment useful for radiation testing and experiments in preparation for missions to the lunar surface and Mars.



### SCIENCE

Favorable vantage point for Earth, sun and deep space observations.



### COMMUNICATIONS

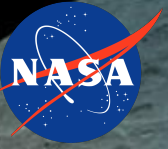
Provides continuous view of Earth and communication relay for lunar farside.



### SURFACE OPERATIONS

Supports surface telerobotics, including lunar farside. Provides a staging point for planetary sample return missions.

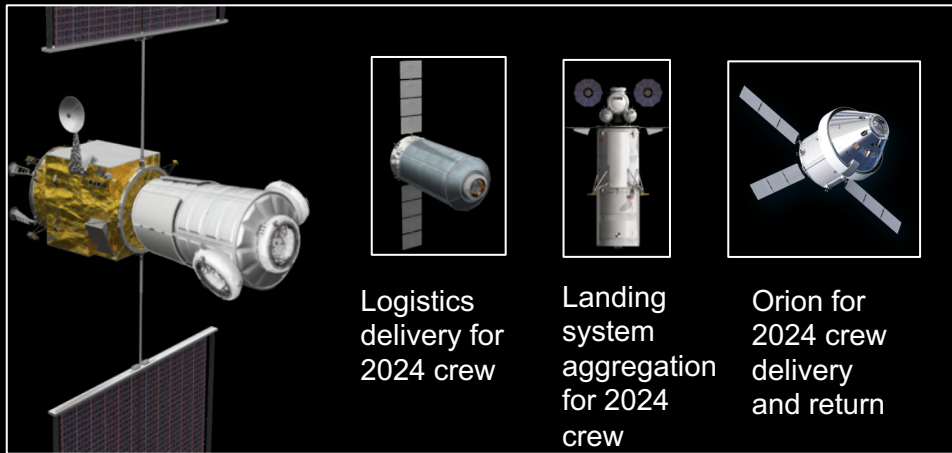




# Gateway Phase 1 and Phase 2

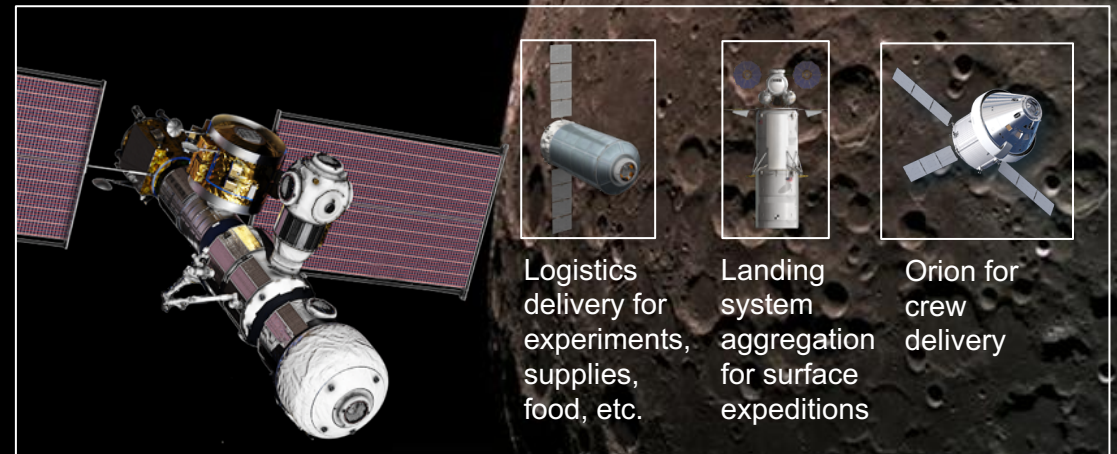
## Phase 1: Initial deep space vehicle by 2024

The essential hardware and systems required for a landing on the lunar South Pole in 2024 – power and propulsion, minimum habitation to support a 2024 human surface expedition, and docking ports for surface asset delivery, human landing system, and the Orion crewed vehicle.



## Phase 2: Sustainable deep space vehicle by 2028

Continued construction of the Gateway, with additional module living space, environmental control and life support systems, and more science capabilities. The Canadian Space Agency (CSA) has formally committed providing advanced external robotics, and agreements are in negotiation with other ISS International Partners.

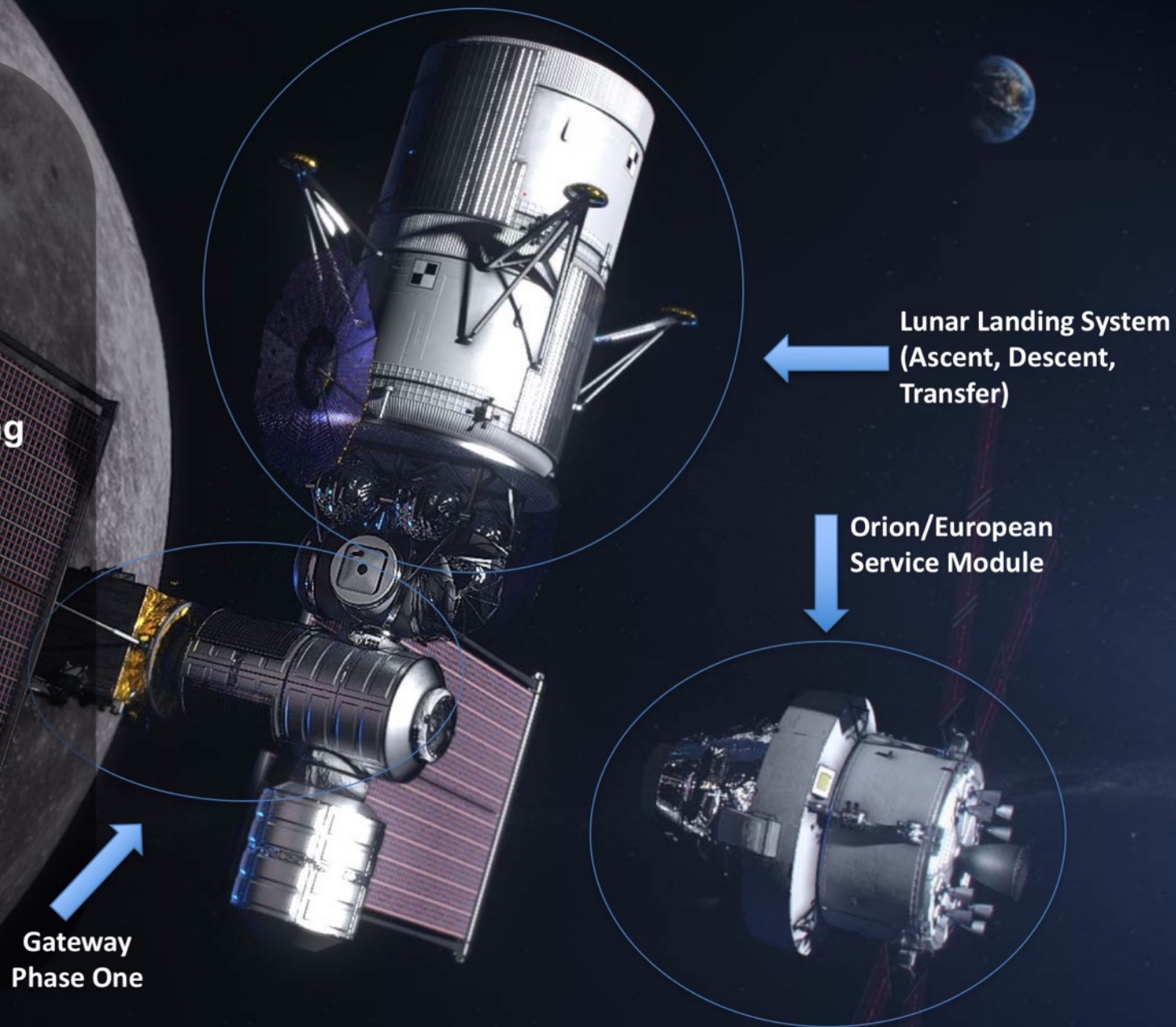


Phase 1 and Phase 2 will include options for internal and external science

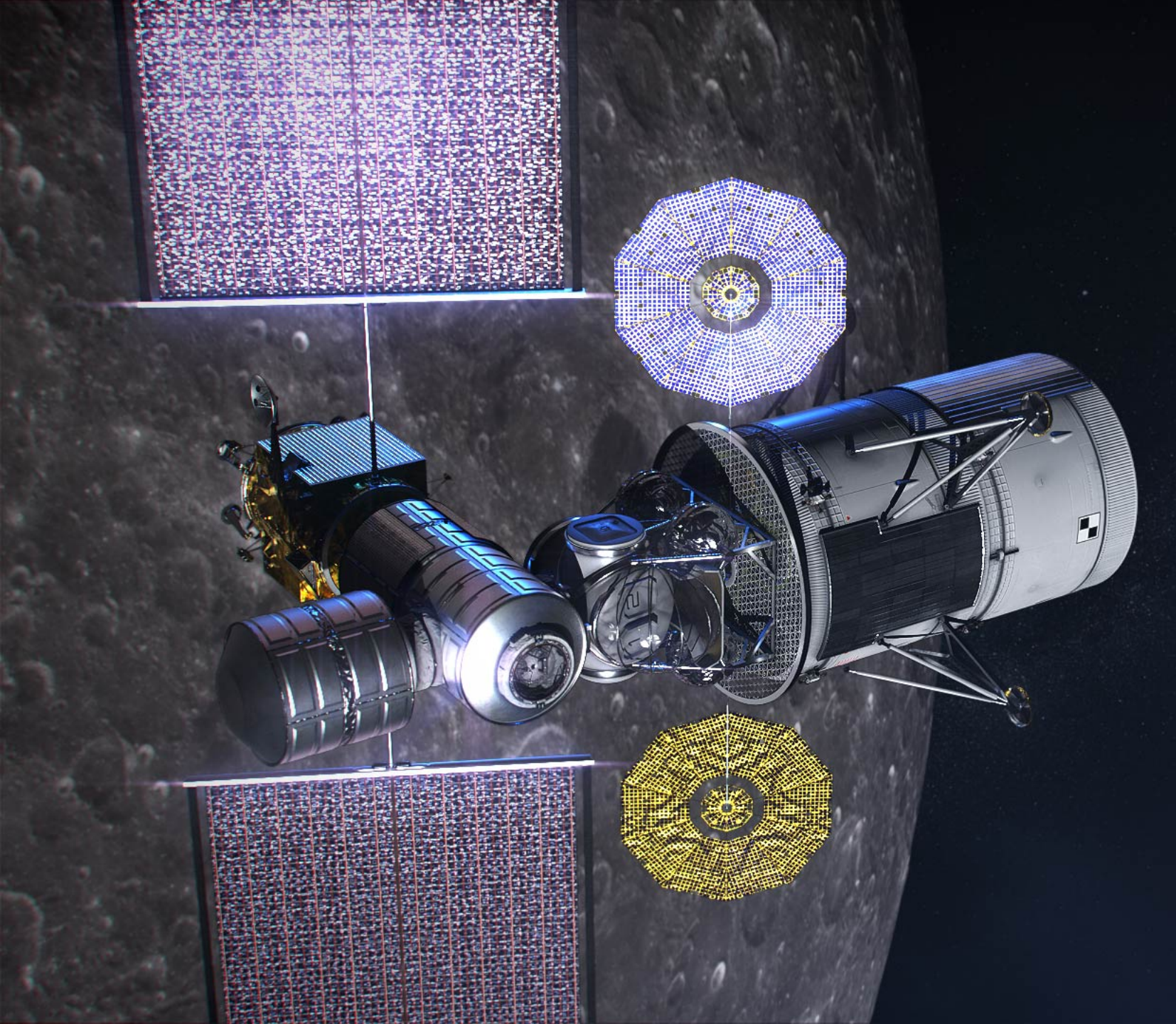


# Gateway is Essential for 2024 Landing

- 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







## Gateway Phase 1

- Supports the acceleration of landing Americans on the surface of the Moon in 2024, while preserving the ability to evolve for a longer-term human presence.
  - Provides power, propulsion, and communication for surface landing systems
  - Accessible for many rockets currently on the market
  - Port for landing system vehicle aggregation, checkout, and safe haven for crew
- Serves as a reusable command module and port for logistics delivery and landing system aggregation.
- Provides a temporary home for the crew who remain in orbit during the surface expedition.
- Early Utilization opportunities are being protected for simple payloads, with limited capability



# Gateway Phase I Status

- Power and Propulsion Element (PPE)
  - Based on a commercial satellite bus
  - Recently awarded to Maxar Technologies
  - Scheduled to launch in 2022
- Habitation and Logistics Outpost (HALO)
  - Significantly leverages Orion life support and human systems
  - Recently awarded to Northrop Grumman
  - Scheduled to launch in late 2023
- Logistics Element
  - Being modeled after ISS Commercial Resupply Services
  - Expected to be awarded by the end of the calendar year
  - Scheduled to launch in 2024, just ahead of Orion crewed flight, Artemis 3



# Potential Gateway Science Opportunities



## CREWS LIVING AND WORKING IN THE DEEP SPACE ENVIRONMENT

- » Human health and performance associated with living and working in deep space



## ELEMENTS WILL HAVE INTERNAL AND EXTERNAL PAYLOAD ACCOMMODATIONS

- » Earth science, heliophysics, astrophysics, lunar/planetary science, and fundamental physics
- » Technology and capability testing for future exploration destinations
- » Combined radiation effects and microgravity on biological organisms



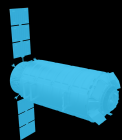
## LUNAR SURFACE OPPORTUNITIES

- » Crewed and robotic surface missions
- » Sample return
- » Lander and systems development



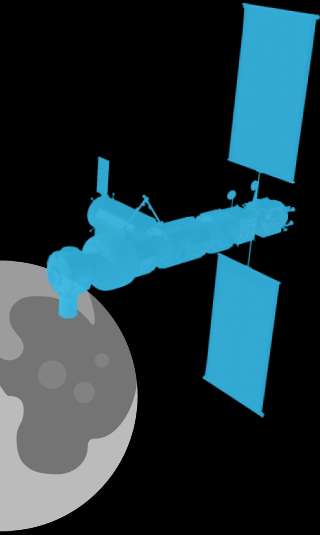
## OTHER CISLUNAR LOCATIONS ACCESSIBLE

- » Potential for use of logistics modules as science platforms post departure from Gateway, including heliocentric disposal orbit
- » Variations of NRHO, Low Lunar Orbit, Distant Retrograde Orbit, Earth-Moon Lagrange Points



## GATEWAY COMMUNICATIONS RELAY

- » Coverage of lunar poles, craters/valleys and lunar farside not possible from Earth
- » Teleoperations of surface assets by crew or Earth-based operators
- » In support of small satellite communications relay





# Questions?

