



HUMAN LANDING SYSTEM

**Update on NASA's Human Landing System (HLS) Program:
Public-Private Partnership Advancing Artemis Sustainable
Lunar Exploration**

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Artemis Path to Sustainable Lunar Architecture



✓ Artemis I

Uncrewed Flight Test



SLS, Orion, EGS

New Artemis Assets

Artemis II

Crewed Flight Test



Now stacking
in the
VAB

SLS, Orion, EGS, **Crew**

Artemis III

First Human Landing



SLS, Orion, EGS,
Crew, **Starship HLS,**
EVA Suits

Artemis IV

*First Human
Gateway Mission*



SLS, Orion, EGS, Crew,
Starship HLS, EVA Suits,
Gateway (PPE & HALO)

Artemis V

*Mobile Surface
Assets for Crew*



SLS, Orion, EGS, Crew,
Blue Moon HLS,
Gateway (iHab), Lunar
Terrain Vehicle

HUMAN LANDING SYSTEM



- Invest with industry providers to buy lander services to test systems
- Leverage U.S. commercial capabilities toward human exploration
- Achieve sustainable, long-term lunar lander capability leading to more permanent human access to the surface of the Moon
- Safety is key and we will be creative in how we approach solutions.

NASA-Industry Partnership: Collaboration is Crucial



The Best of Government & Industry

- Speed & innovation from industry
- Expertise & safety posture from NASA
- Technical collaborations across seven NASA Centers providing expertise in areas such as:
 - Thermal engineering
 - Cryogenic fluid management
 - Plume-surface interaction
 - Cryogenic valve development



STARSHIP

Human Landing System (HLS)



NASA is working with SpaceX to develop the Starship Human Landing System for use on **Artemis III**, the mission that will put the next two Americans on the surface of the Moon, as well as **Artemis IV**.

- Height: 52m (171ft, 15 stories)
- Powered by 6 Raptor engines (3 sea level and 3 vacuum)
- Propellant: liquid methane/liquid oxygen
- Launches on: SpaceX Super Heavy
- 2-state dual launch campaign from: Starbase (Texas), Kennedy Space Center (Florida)
- Up to 90 days in Lunar Orbit Until Astronauts Arrive in Orion
- 2 astronauts ride HLS to the lunar surface
- ~7-day lunar stay with 4 planned moonwalks
- Uncrewed demonstration mission prior to Artemis III



Starship Human Landing System (HLS) Progress

Photo credits: SpaceX



Suited Crew-in-the-Loop Testing



Docking System
Qualification Testing



Integrated Flight Testing



Milestones to the Moon Landing

- SpaceX Starship Long-Duration On-Orbit Test + Large-Scale Propellant Orbital Transfer Test
- Uncrewed Demonstration Moon Landing
- **2027:** Artemis III Moon Landing





BLUE MOON

Human Landing System (HLS)

NASA is working with Blue Origin to develop the Blue Moon MK2 human landing system for use on **Artemis V**. It will meet an extended set of requirements for crew transfer and more mass to the surface.

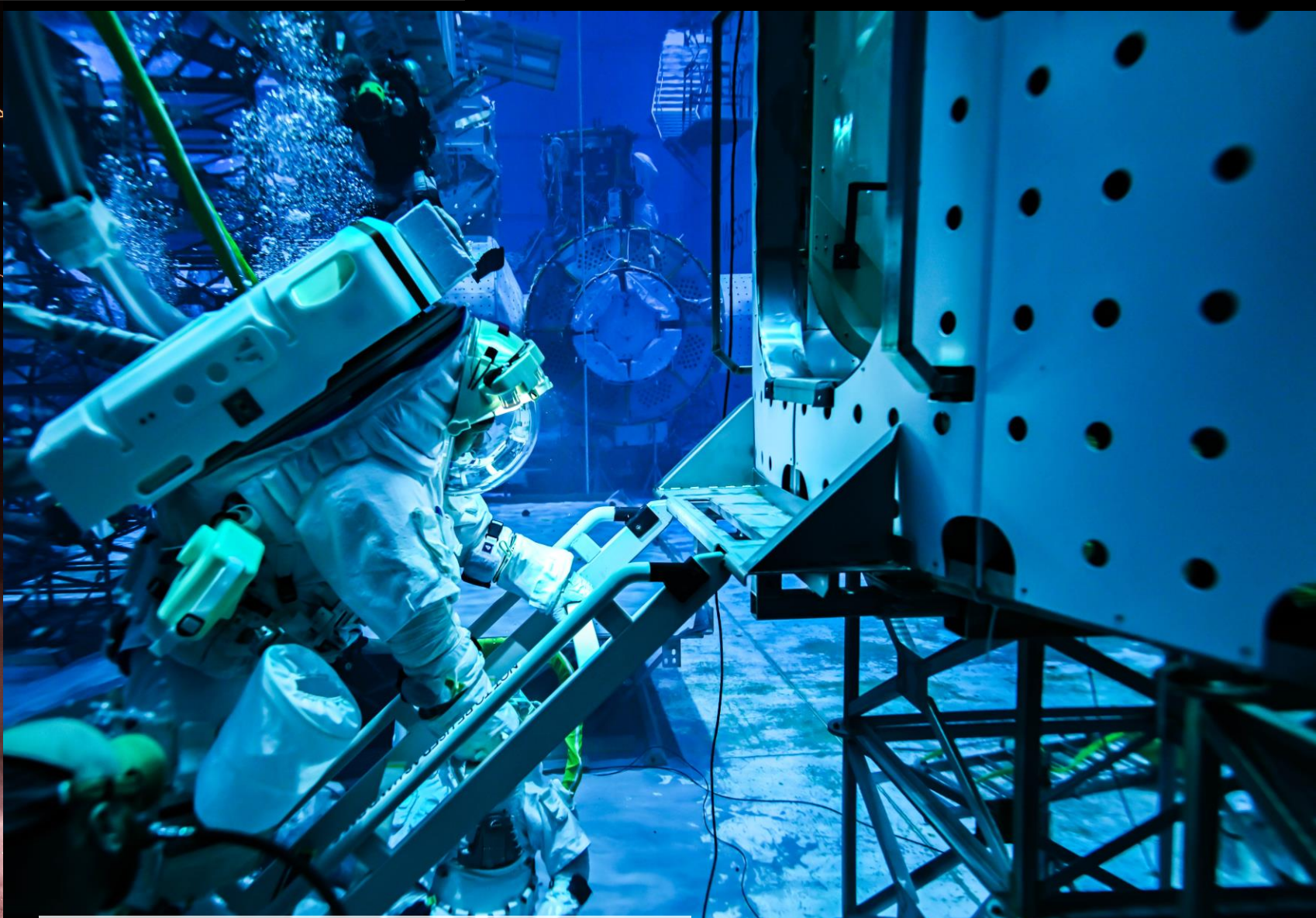
- Height: ~16m (91ft, 8 stories)
- Powered by 3 BE-7 engines
- Propellant: liquid hydrogen/liquid oxygen
- Launches on: Blue Origin New Glenn
- Launched from: Launch Complex 36 at Cape Canaveral, Florida
- 2 astronauts ride HLS to the lunar surface
- ~7-day lunar stay with moonwalks
- Uncrewed demonstration mission prior to Artemis V



ARTEMIS V



New Glenn First Flight Jan. 16, 2025



Blue Origin Testing in Neutral Buoyancy Lab

Photos: Blue Origin

Artemis vs. Apollo Lunar Landers



SpaceX Starship HLS
Artemis III, Artemis IV

Blue Origin Blue Moon MK2
Artemis V

Apollo Lunar Module (LM)

52 m

16 m

7 m

Habitable volume

614 m³
(estimated)

XX m³
(estimated)

4.5 m³

ARTEMIS

Future Landing Services



CARGO LANDERS



Image Credit:
SpaceX



The HLS program is working with SpaceX and Blue Origin to develop cargo variants of the companies' crewed landers to deliver large payloads – approximately 26,000-33,000 pounds (12-15 metric tons) – to the lunar surface for enhanced exploration no earlier than Artemis VII.

NASA intends to award SpaceX the mission to deliver a pressurized rover, currently in development by JAXA, to the lunar surface no earlier than 2032.

NASA intends to award Blue Origin the mission to deliver a lunar surface habitat to the Moon no earlier than 2033.

Image Credit:
Blue Origin



ARTEMIS



While maintaining American leadership in exploration, we will build a global alliance and explore deep space for the benefit of all.

Learn to Live & Work on Other Worlds for:

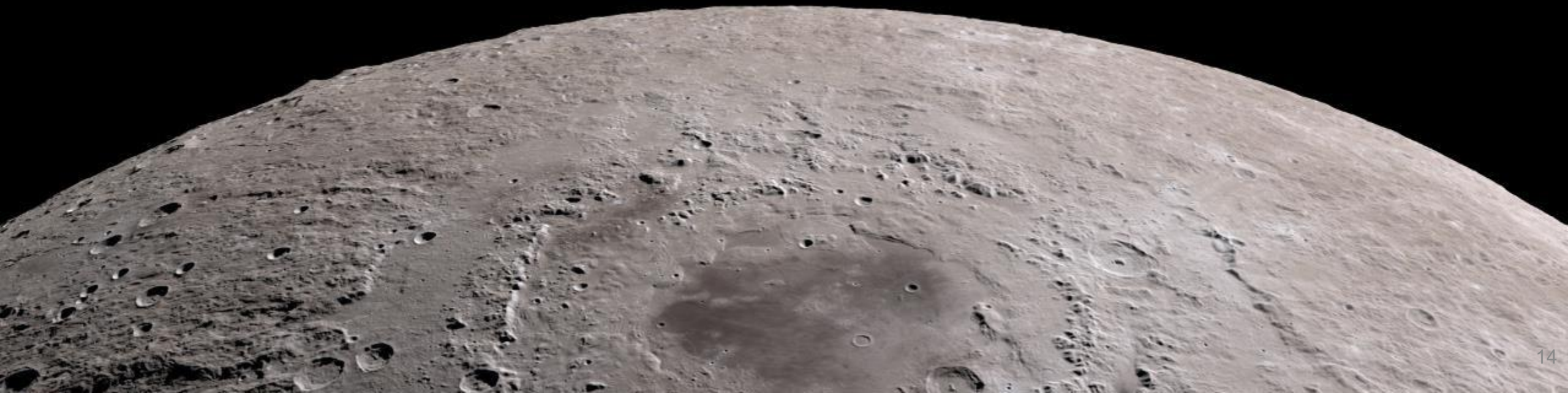
- Science & Discovery
- Economic Opportunity
- Inspiring a New Generation





Follow the missions

@NASAARTEMIS



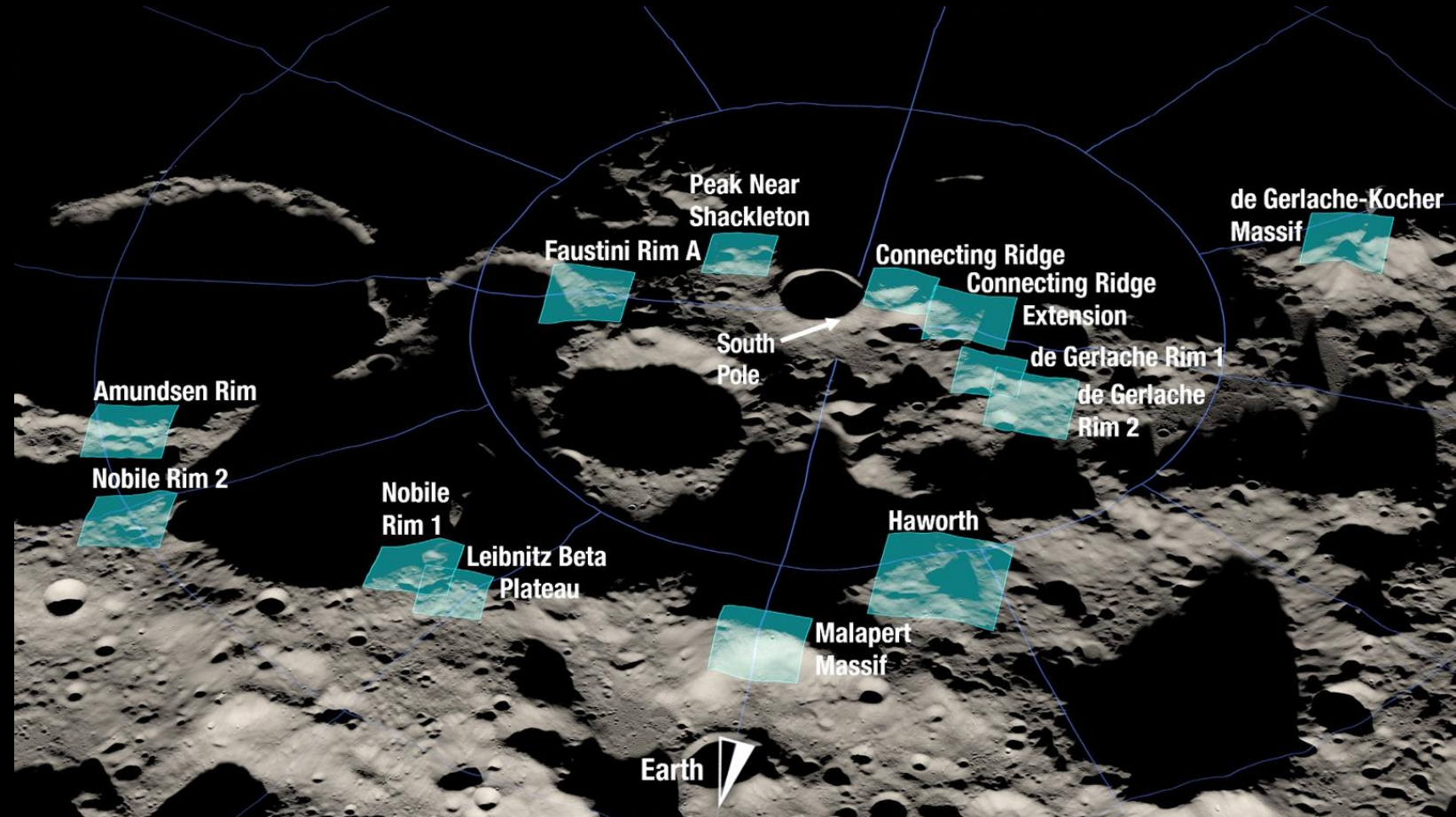
Backup



Candidate Landing Sites

Key Considerations:

- Proximity to the South Pole
- Gentle slope for landing and moonwalks
- Constant views to Earth for communications
- Continuous sunlight throughout the 6.5-day surface mission
- Landing accuracy
- Surface data resolution
- Combined mission vehicle capabilities: Space Launch System, Orion spacecraft, Starship HLS



A landing regions is approximately 15km². Each landing region includes multiple potential landing sites.

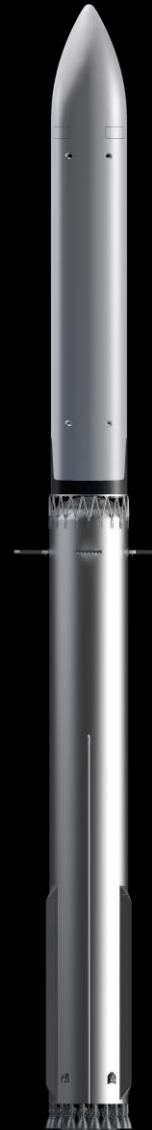
ARTEMIS III



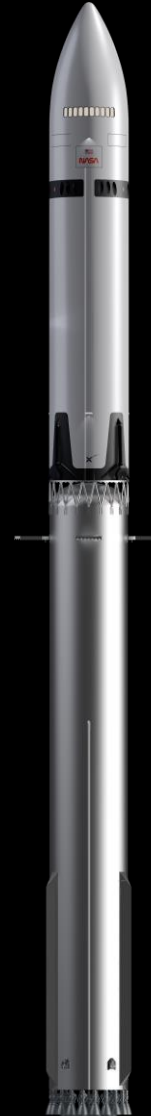
Concept of Operations Starship Human Landing System (HLS)



Tanker



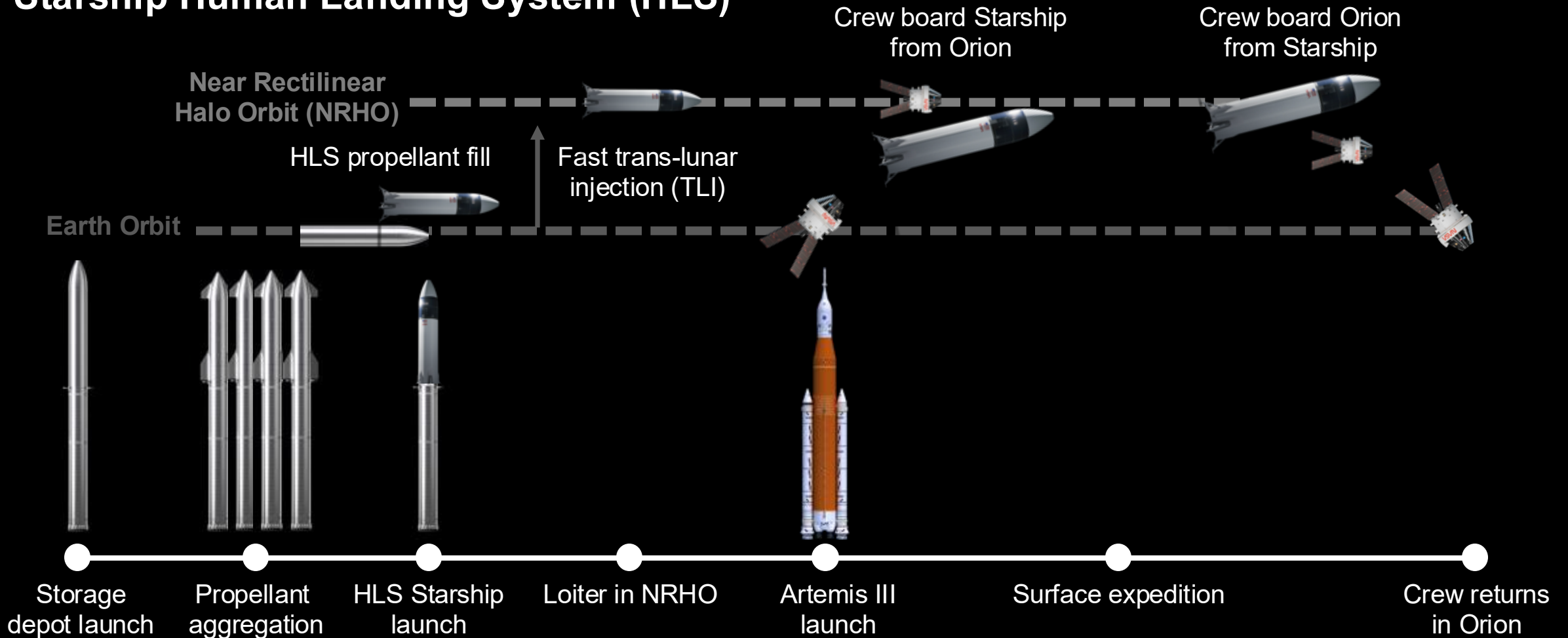
Depot



Lander

ARTEMIS III

Concept of Operations Starship Human Landing System (HLS)



Starship Human Landing System (HLS) Progress



Suited Crew-in-the-Loop Testing



Integrated Flight Testing





Objectives

- Deploy Transporter-2 and Crew Lander SN202
- 6.25 Lunar surface stay for 2 crew members with 4 + 1 Lunar surface EVAs
- Return of lunar sample (secondary)
- Safe disposal or reuse of elements

