



Human Landing System Program Overview

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Human Landing System Program

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The NASA Charge to the Moon

In keeping with SPD-1, NASA is charged with landing the first American woman and next American man at the South Pole of the Moon by 2024, followed by a sustained presence on and around the Moon by 2028.

NASA will “use all means necessary” to ensure mission success in moving us forward to the Moon.



APOLLO
NEXT GIANT LEAP

U.S. Space &
Rocket

Vice President Mike Pence speaks about NASA's mandate to return American astronauts to the Moon and on to Mars at the U.S. Space & Rocket Center in Huntsville, Alabama.

The Artemis Program

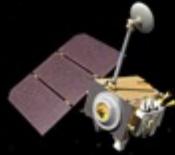
Artemis is the twin sister of Apollo and goddess of the Moon in Greek mythology. Now, she personifies our path to the Moon as the name of NASA's program to return astronauts to the lunar surface by 2024.

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.



ARTEMIS : Landing Humans On the Moon in 2024



LRO: Continued surface and landing site investigation



Artemis I: First human spacecraft to the Moon in the 21st century



Artemis II: First humans to orbit the Moon and rendezvous in deep space in the 21st Century



Gateway begins science operations in lunar orbit with launch of PPE and HALO



Initial human landing system delivered to lunar orbit



Artemis III: Orion and crew dock to human landing system for crew expedition to the surface



Early South Pole Robotic Landings

Science and technology payloads delivered by Commercial Lunar Payload Services providers

Volatiles Investigating Polar Exploration Rover

First mobility-enhanced lunar volatiles survey

Humans on the Moon - 21st Century

First crew leverages infrastructure left behind by previous missions

LUNAR SOUTH POLE TARGET SITE

Human Landing System

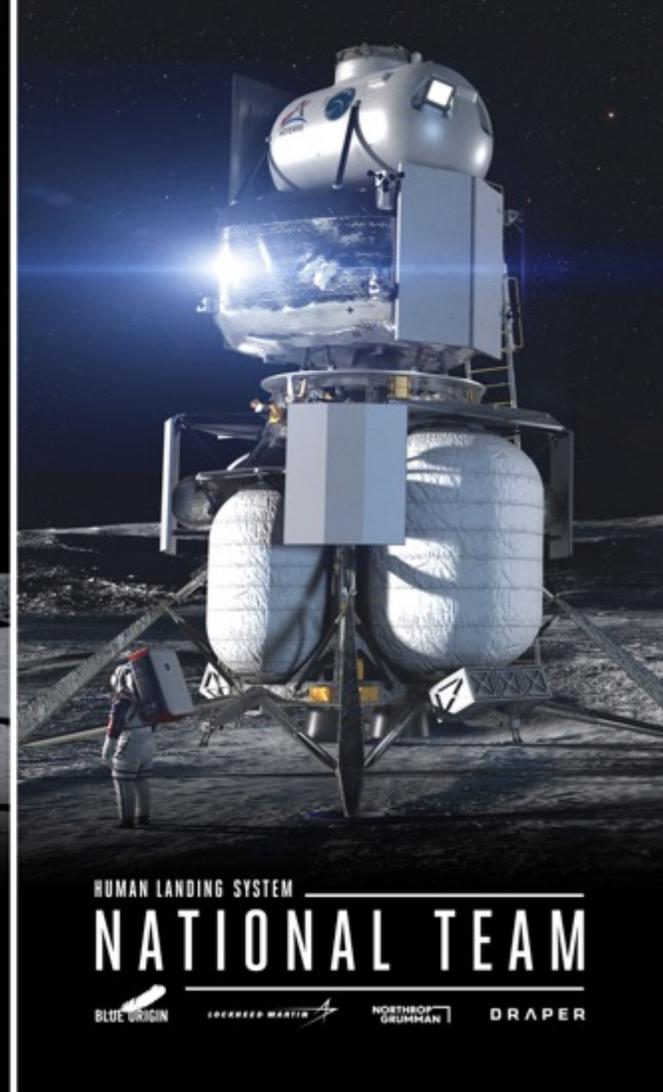
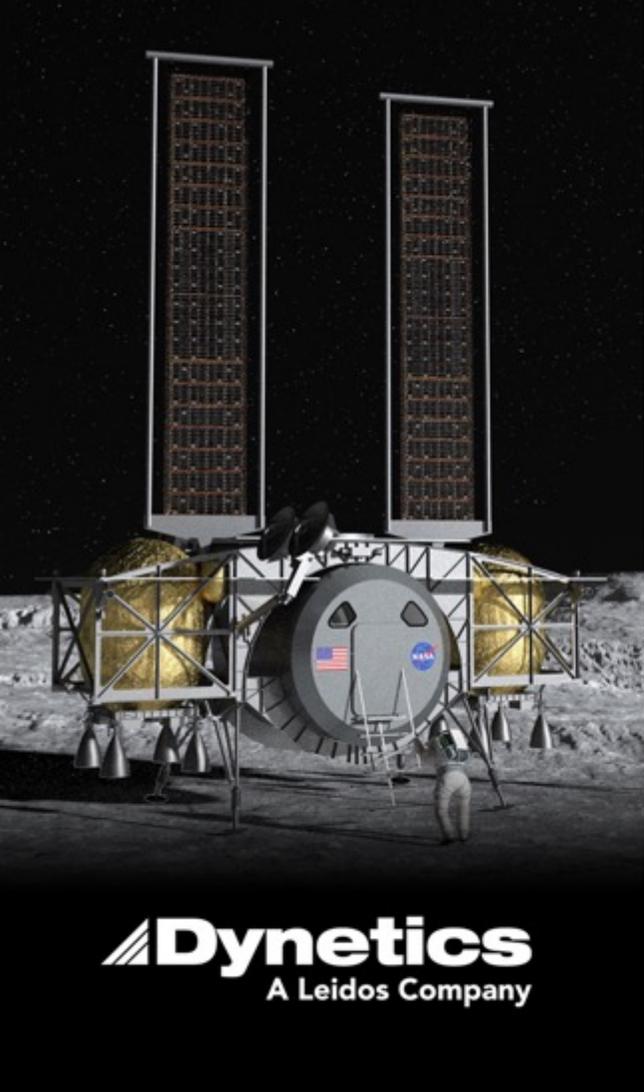
- Firm Fixed Price Broad Agency Announcement for rapid development and crewed demonstration to return humans to the lunar surface by 2024
- Leveraging commercial capabilities to the maximum extent possible; may tailor the traditional NASA program management and systems engineering processes to expedite the schedule
- NASA will not take ownership of the HLS hardware/software
- HLS will launch as commercial cargo; checkout and testing will occur on orbit prior to any crew launch and egress
- NASA provides certification and technical expertise

The HLS plan is to leverage the speed and operating models of the commercial space industry while applying NASA expertise to ensure safety and mission success

Human Landing System – NextSTEP-2 Appendix H



- Final solicitation issued September 30
 - Drafts issued July 19 and August 30; +1,150 comments from industry
- Proposals submitted November 5, 2019
- Selections announcement April 30, 2020
- Base Period ends February 2021



3 HLS contracts awarded April 30, 2020

Complete lander systems were proposed including launch vehicles for an end to end solution for 2024 and sustaining

Base Period:
May 2020 –
February 2021

The Broad Agency Announcement achieved the innovation from US Industry it was designed to do.



HUMAN LANDING SYSTEM

NATIONAL TEAM



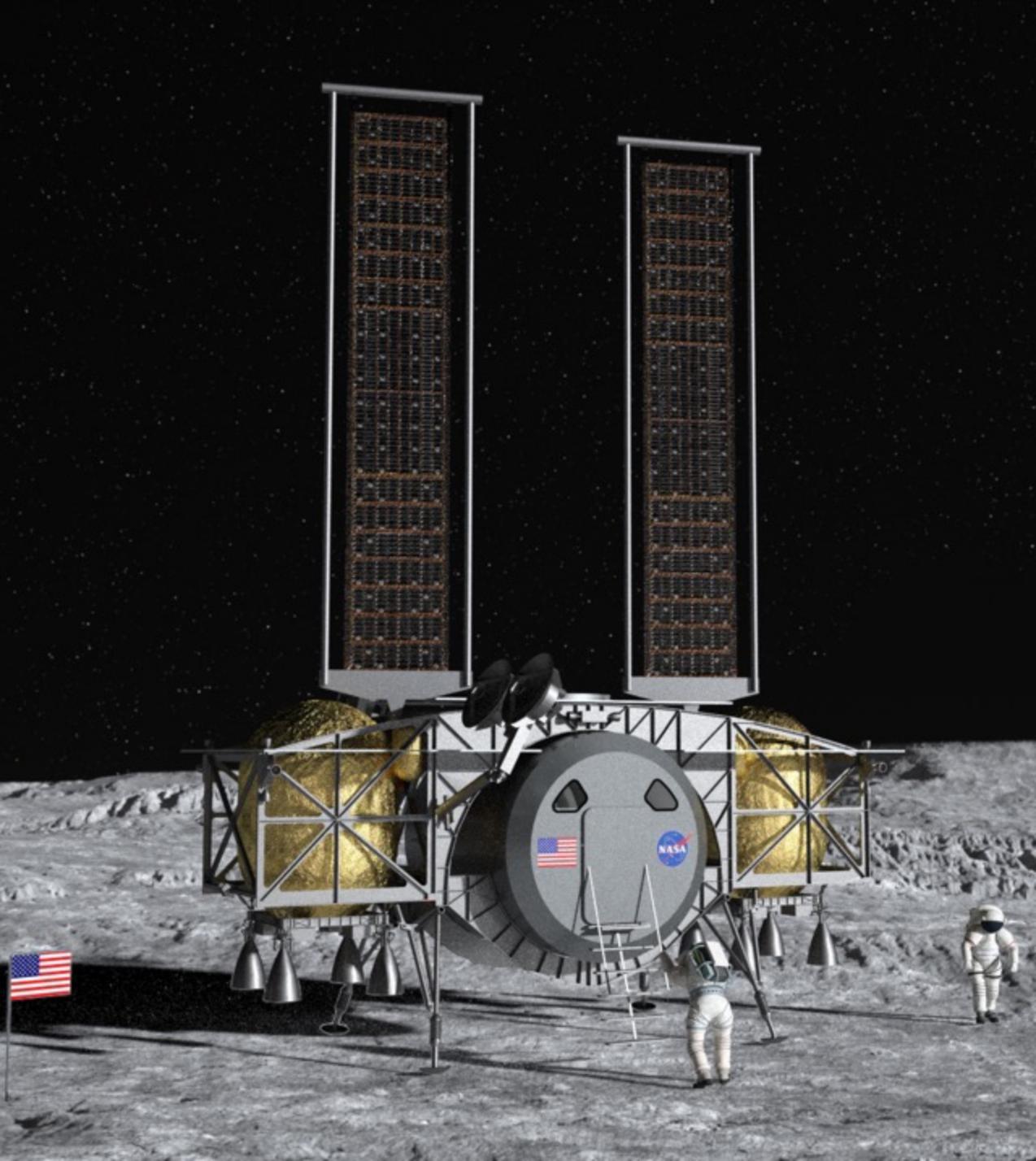
DRAPER

“INTEGRATED LANDER VEHICLE” (ILV)

- Three-stage landing system
 - Ascent – Lockheed Martin
 - Descent – Blue Origin
 - Transfer – Northrop Grumman (future refueler)
 - GN&C, Avionics, Software – Draper
- Rockets: New Glenn & ULA Vulcan

KEY ATTRIBUTES

- Significant proven spaceflight heritage
- Orion and Gateway compatible



Dynetics

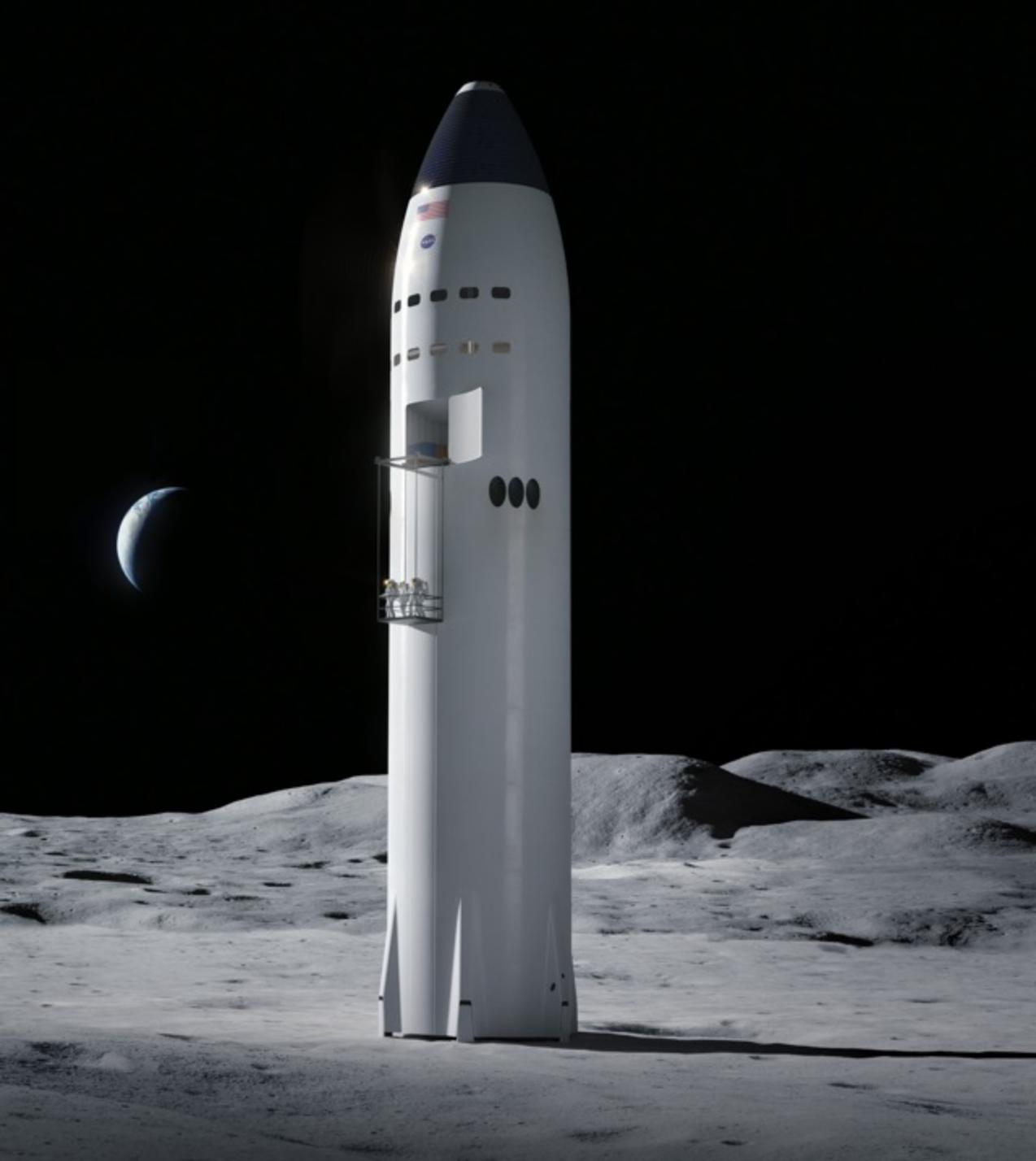
A Leidos Company

“DYNETICS HUMAN LANDING SYSTEM”

- Single element providing the ascent and descent capabilities
- Multiple modular propellant vehicles (MPVs) prepositioned to fuel the engines
- Large subcontractor team
- Rockets: ULA Vulcan

KEY ATTRIBUTES

- “Mass produced” MPVs
- Crew cabin sits low to the surface
- Double-androgynous docking system
- Orion and Gateway compatible



SPACEX

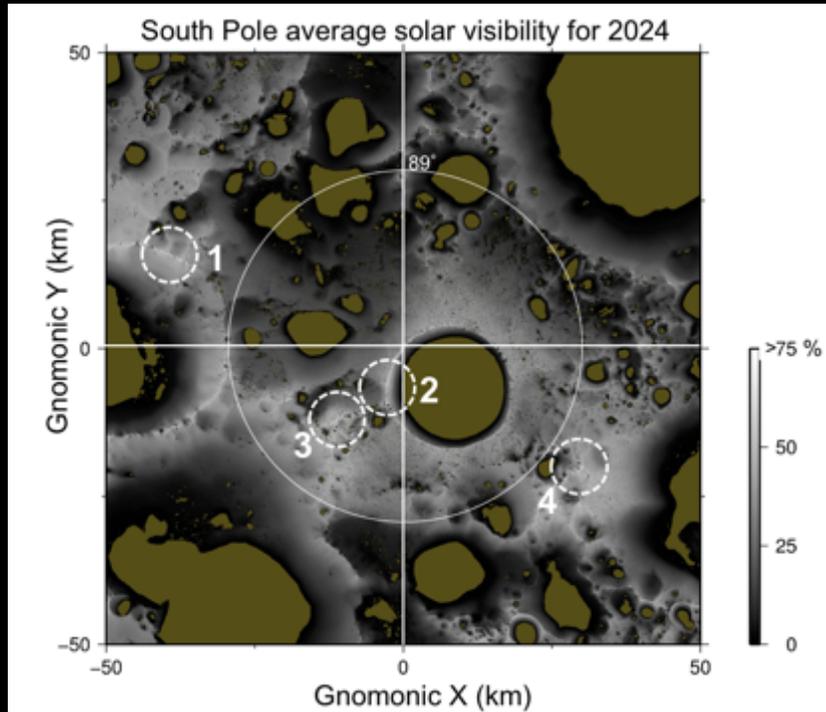
“STARSHIP”

- Integrated lander
- Fully reusable launch and landing system
- Fueling in low-Earth orbit with Starship storage and Starship Tanker variants
- Rocket: SpaceX Super Heavy

KEY ATTRIBUTES

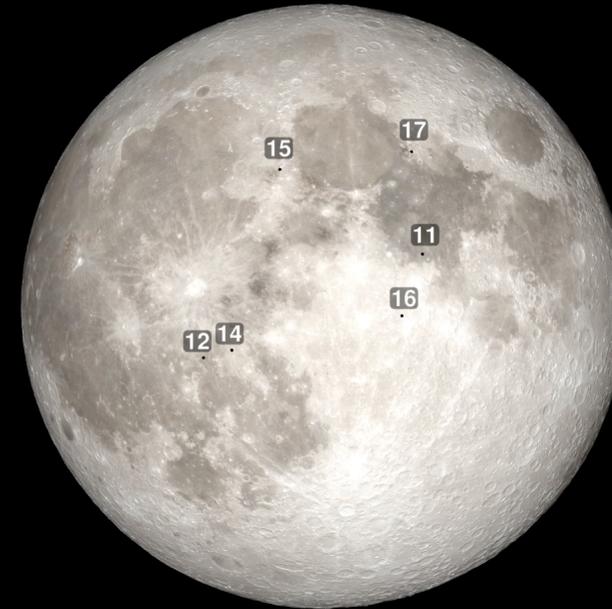
- Spacious cabin
- Two airlocks
- Orion and Gateway compatible; Orion for first demo

American Strategic Presence on the Moon – High solar illumination areas within 2 degrees (<50 km) of the lunar south pole.



Four highly illuminated areas shown above:

1. De Gerlache Rim,
2. Shackleton Rim
3. Shackleton – De Gerlache Ridge
4. Plateau near Shackleton



High Priorities for Sustained Surface Activities

- **Long duration access to sunlight:** A confirmed resource providing power and minimal temperature variations
- **Surface roughness and slope:** Finding the safest locations for multiple landing systems, robotic and astronaut mobility
- **Direct to Earth communication:** Repeatable Earth line-of-sight communication for mission support
- **Permanently Shadowed Regions and Volatiles:** Learning to find and access water ice and other resources for sustainability



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.



**Let's go.
*The time is now.***

We have the capability

We have the purpose

We have the charge

We have the responsibility

ARTEMIS

