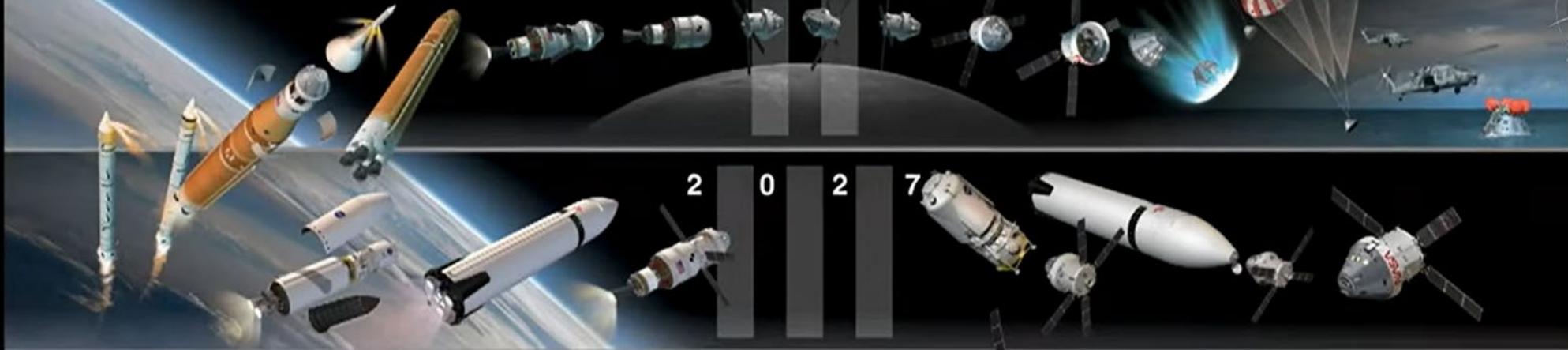
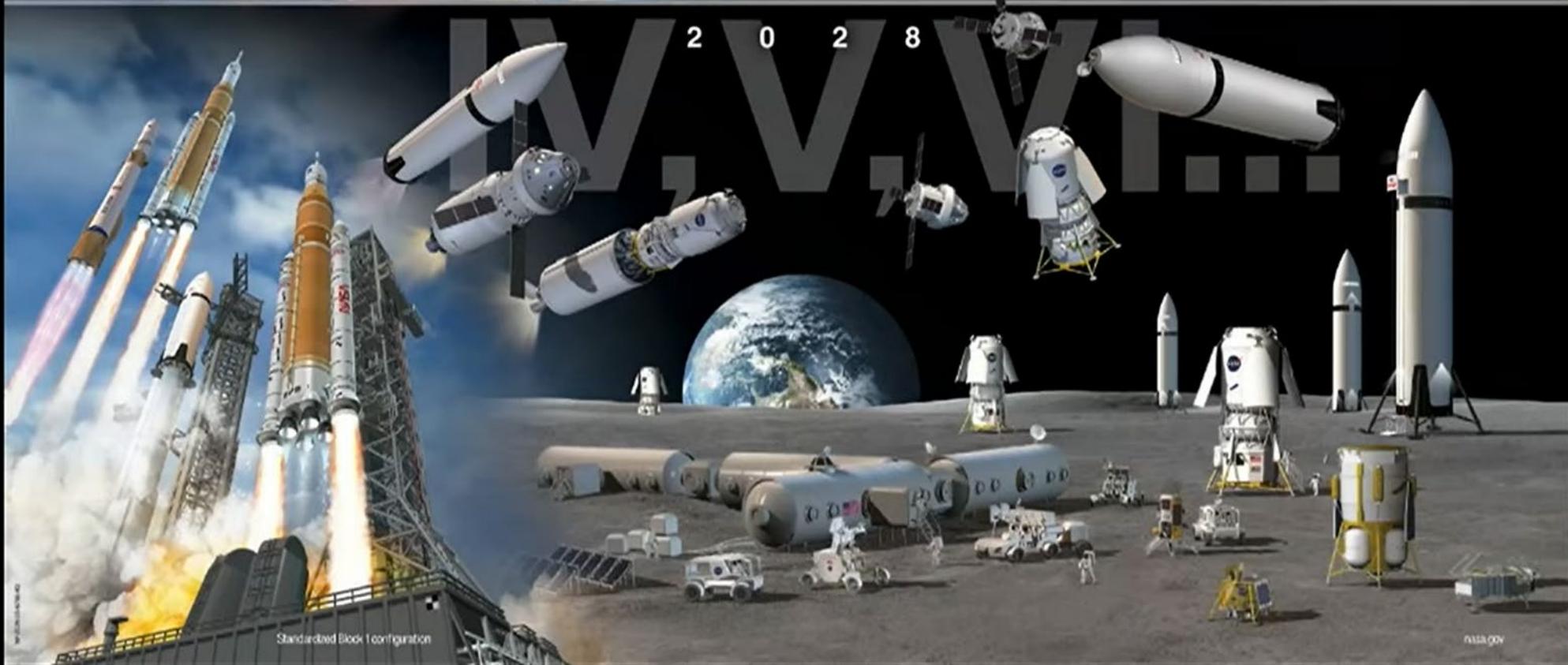


# ARTEMIS

2 0 2 6



2 0 2 7



2 0 2 8

Standardised Block 1 configuration

AS13-09-03

# Incremental Capability Development

- Framework used by Apollo to incrementally reduce risk and increase mission success

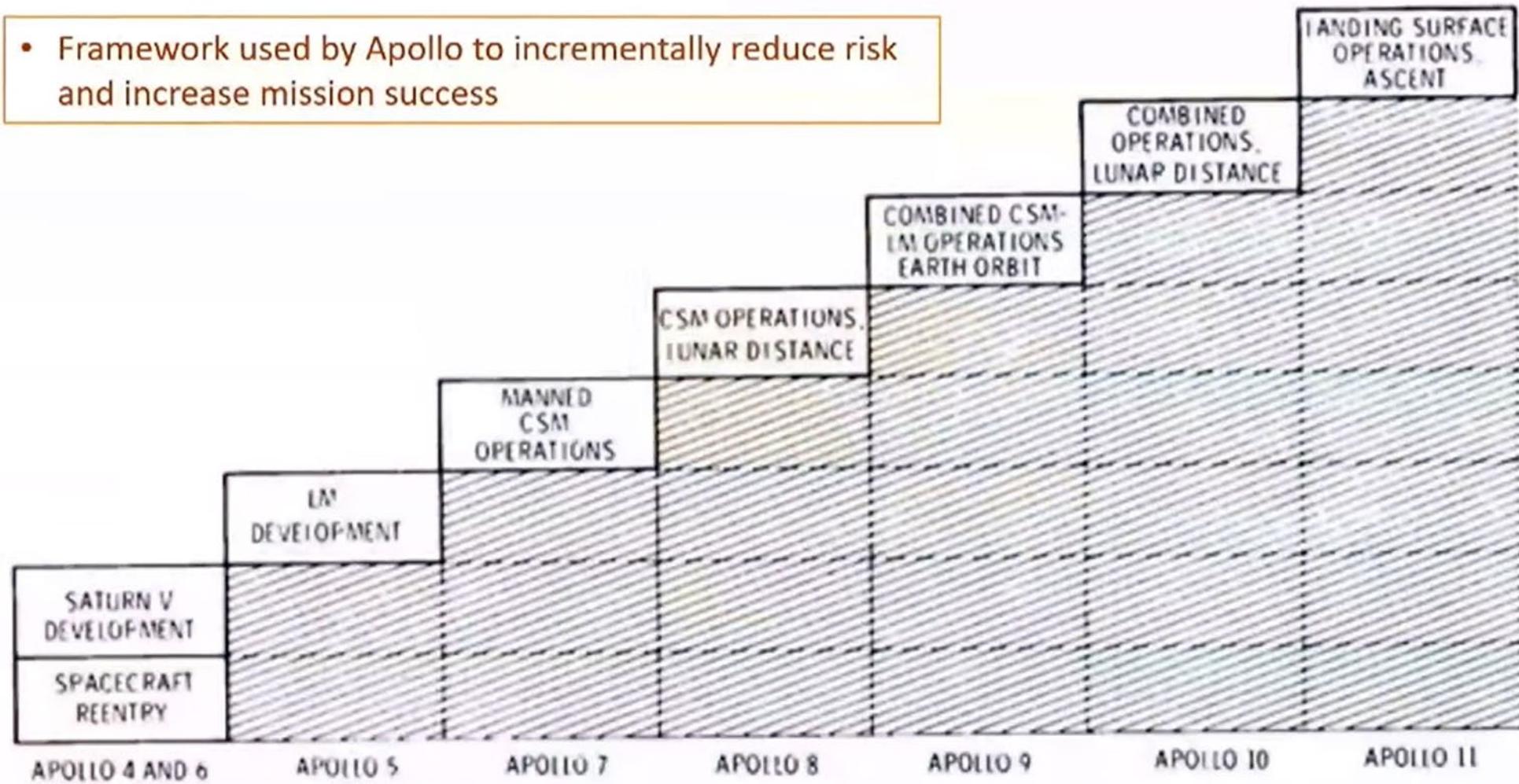
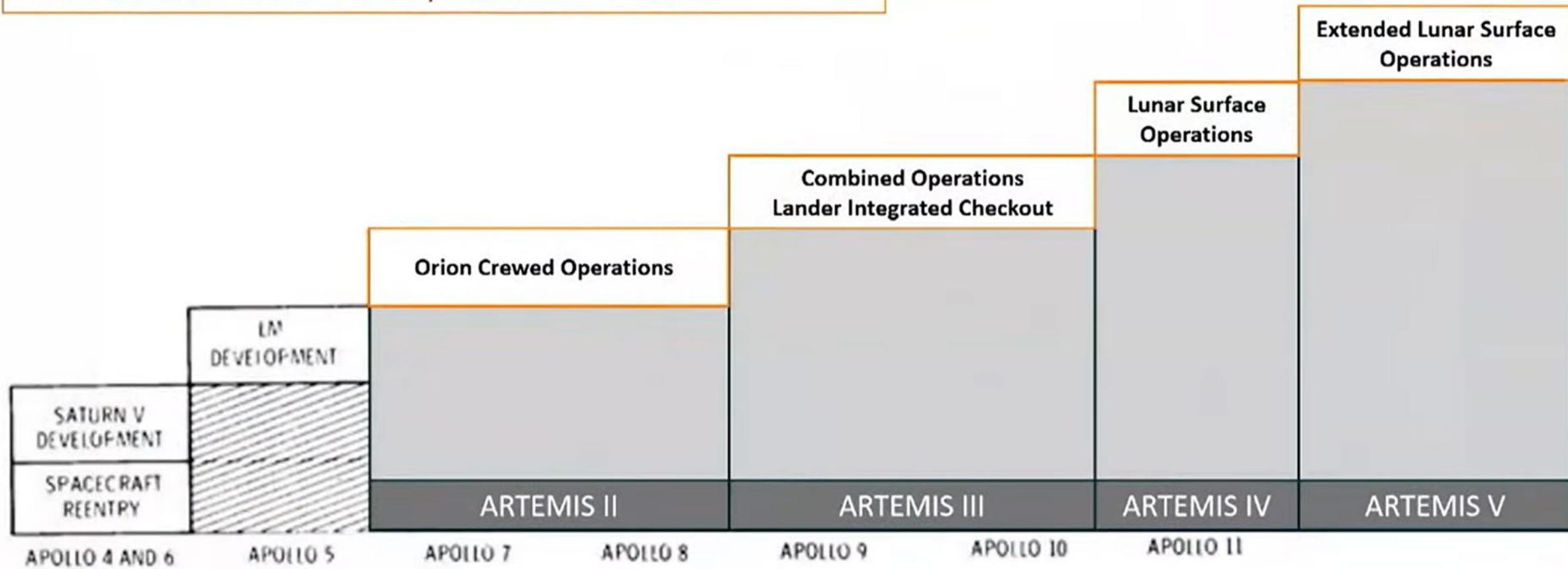


Figure 1-7. - Buildup of Apollo mission capability.

# Incremental Capability Development



- Same philosophy is applied to the Artemis mission manifest to increase overall Artemis safety and mission success





# Milestones & Progress - Artemis II



# Artemis II Vehicle



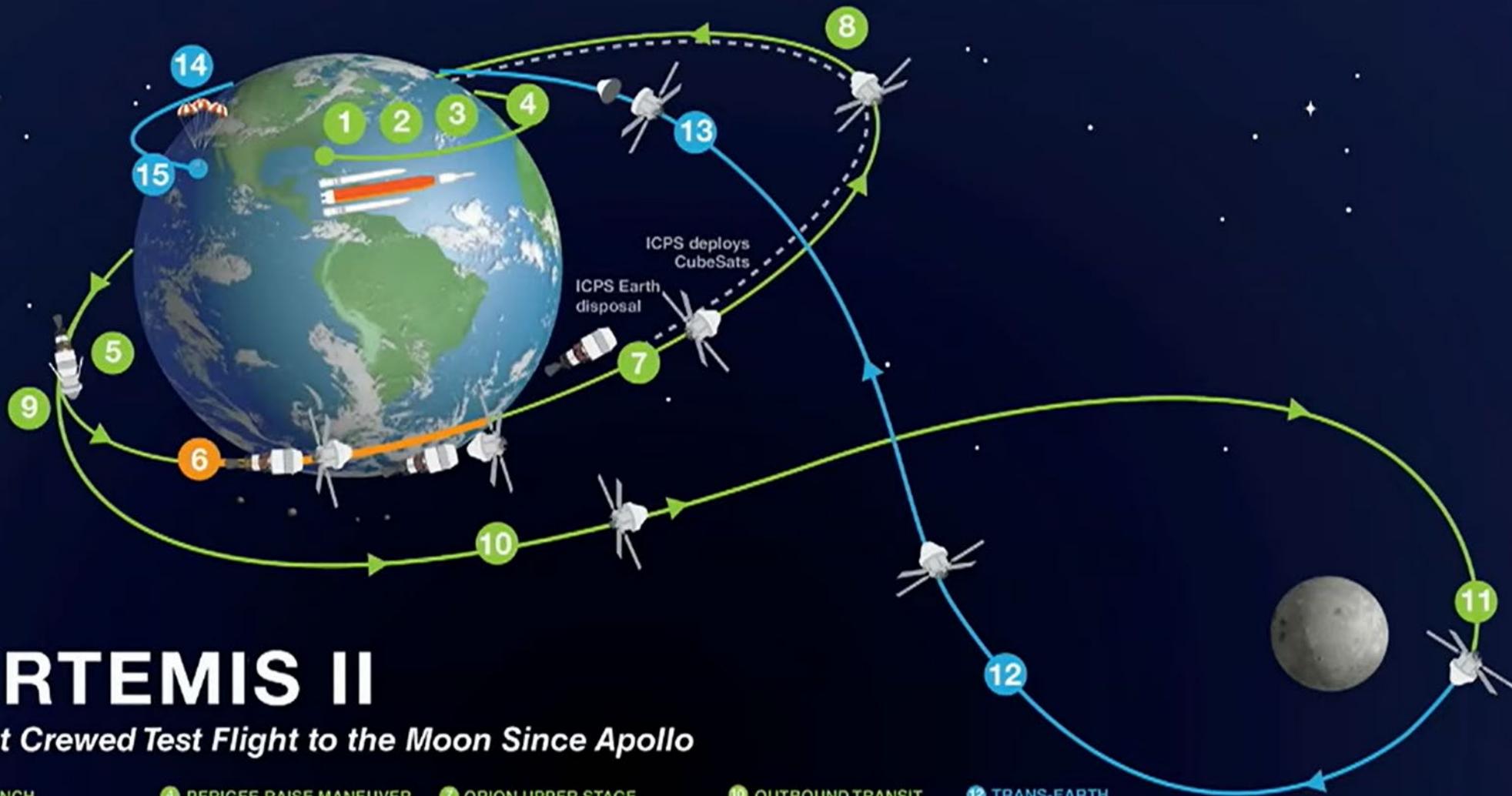
NASA's Space Launch System (SLS) rocket and Orion spacecraft, secured to the mobile launcher, is seen as it rolls out of the Vehicle Assembly Building to Launch Pad 39B



NASA's Artemis II Crew and Backup Crew pose for a picture with NASA's Space Launch System (SLS) rocket and Orion spacecraft, secured to the mobile launcher, as it makes the 4.2 mile journey from the Vehicle Assembly Building to Launch Pad 39B



NASA's Artemis II Space Launch System (SLS) rocket and Orion spacecraft are seen atop a mobile launcher at Launch Complex 39B



# ARTEMIS II

*First Crewed Test Flight to the Moon Since Apollo*

- 1 LAUNCH**  
Astronauts lift off from Launch Pad 39B at Kennedy Space Center.
- 2 JETTISON SOLID ROCKET BOOSTERS, FAIRINGS, AND LAUNCH ABORT SYSTEM**
- 3 CORE STAGE MAIN ENGINE CUT OFF**  
With separation.
- 4 PERIGEE RAISE MANEUVER**
- 5 APOGEE RAISE BURN TO HIGH EARTH ORBIT**  
Begin 23.5-hour checkout of spacecraft.
- 6 ORION SEPARATION FROM INTERIM CRYOGENIC PROPULSION STAGE (ICPS) FOLLOWED BY PROX OPS DEMO**  
Plus manual handling qualities assessment for up to 2 hours.
- 7 ORION UPPER STAGE SEPARATION (USS) BURN**  
Begins high Earth orbit checkout. Life support, exercise, and habitation equipment evaluations.
- 8 PERIGEE RAISE BURN**
- 9 TRANS-LUNAR INJECTION (TLI) BY ORION'S MAIN ENGINE**  
Lunar free return trajectory initiated with European service module.
- 10 OUTBOUND TRANSIT TO MOON**  
Outbound trajectory correction (OTC) burns as necessary for lunar free return trajectory; travel time approximately 4 days.
- 11 LUNAR FLYBY**  
4,047 mi/6,513 km (mean) lunar far side flyby altitude.
- 12 TRANS-EARTH RETURN**  
Return trajectory correction (RTC) burns as necessary to aim for Earth's atmosphere; travel time approximately 4 days.
- 13 CREW MODULE SEPARATION FROM SERVICE MODULE**
- 14 ENTRY INTERFACE (EI)**  
Enter Earth's atmosphere.
- 15 SPLASHDOWN**  
Ship recovers astronauts and capsule.

PROXIMITY OPERATIONS DEMONSTRATION SEQUENCE	
1	9
2	10
3	11
4	12
5	13
6	14
7	15
8	16
	17

# Artemis III Progress – Space Launch System



Interim cryogenic propulsion stage complete  
final testing and checkout: September 2023

- ICPS ready (if required)
- Boosters ready - shipping in April
- Engine section in VAB
- RS-25 Engines ready - shipping in April
- Core Stage TFF - shipping April
- LVSA ready - in storage at MSFC



Artemis III forward skirt was lifted and set atop the  
intertank and liquid oxygen tank: December 2025



Artemis III RS-25 flight engine processing at  
NASA Stennis (now complete and in storage)



Artemis III launch vehicle stage  
adapter completed and ready to be  
moved to KSC: March 30, 2025



Teams from Kennedy integrated Artemis III core  
stage engine section with its boattail inside the  
Vehicle Assembly Building at NASA's Kennedy  
Space Center: August 13, 2025



Assembly check-out of forward  
assemblies is complete at NASA's  
Kennedy Space Center in Florida



The core stage "major join" was completed  
at NASA Michoud in January 2026

# Artemis III Progress – Orion



- Orion Service Module is at KSC in testing and checkout
- Orion heatshield is in final assembly
- Orion Crew Module is in outfitting and testing



Teams prepare for the installation of the engine nozzle onto the European Service Module for NASA's Artemis III mission: February 17, 2026



Orion heat shield inside the Operations and Checkout Building at NASA's Kennedy Space Center in Florida: February 18, 2026



Technicians work on the Artemis III Orion crew module inside the Operations and Checkout Building at NASA's Kennedy Space Center: March 5, 2026

# Artemis III Progress – Human Landing Systems



A view of Earth from Starship's 11th test flight as it reenters the atmosphere prior to an ocean splashdown, gathering data to inform the design and continued development of the Starship HLS: October 2025

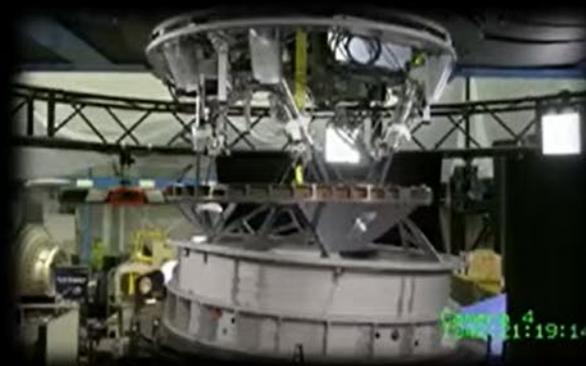
- SpaceX Starship Flight 12 (version 3) in April
- Blue Origin Mark 1 lander in 2026
- NASA has undertaken an effort to work with both HLS providers to accelerate lander development.
- Includes modifications to requirements, hardware, mission definition, and capabilities.
- The accelerated landers will be used for the Artemis III demonstration and initial lunar landings.



An artist's illustration of the SpaceX Starship HLS crew cabin interior. Engineers are fabricating the cabin at Starbase, Texas to demonstrate design maturity, support integrated hardware testing, and provide realistic training for Artemis astronauts.



SpaceX and NASA performed full-scale qualification testing of the docking system that will connect SpaceX's Starship HLS with Orion: 2023



Blue Origin recently completed soft capture system testing at NASA's Johnson Space Center confirming the performance of the Blue Moon MK2 crew lander's pressurized docking system: February 2026



Blue Origin Mark 1 lander

# Notional Plan for 2027 Artemis III Earth Orbit Mission



## GOALS

Buy down as much risk as possible prior to crewed lunar landing mission:

Demonstrate multi-launch campaign	Test xEVA hardware on orbit
Demonstrate Orion Rendezvous and Proximity Operations with lander(s) in Earth orbit	Demonstrate critical Human Landing Systems and vehicle performance in Earth orbit
Demonstrate crewed docked operations in Earth orbit	Demonstrate Orion Permeable Heatshield
Demonstrate increasing mission cadence with prompt turnaround of pad and ground systems with incorporating lessons learned	

## SUPPORTING MISSIONS

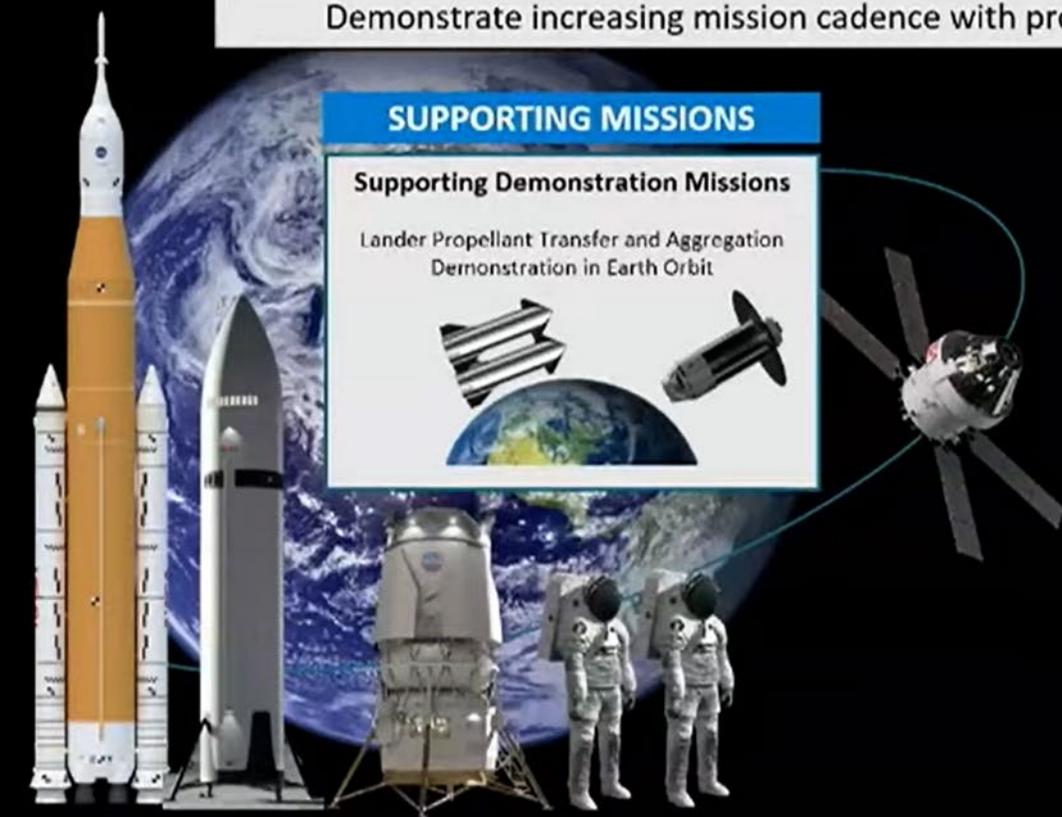
### Supporting Demonstration Missions

Lander Propellant Transfer and Aggregation  
Demonstration in Earth Orbit



## CREWED MISSION (Current State)

CREW INFO		ASSUMPTIONS	
TOTAL CREW	≤ 4 (TBD)	ORION – HLS RPOD	Earth orbit
ELEMENTS		CREW INGRESS	Crew ingress events
		DOCKING	Multiple docking/undocking events
SLS	Block 1 TBD: ICPS OR spacer	TOTAL MISSION DURATION	≤ 21 DAYS (Orion, mission extension with lander augmentation TBD)
ORION	Crewed, RPODU capable	ORION LANDING	San Diego FLETA HOT
HLS	Starship AND/OR Blue Moon		
xEVA	TBD: Axiom AxEMU		





# Milestones & Progress - Artemis IV (2028)





# Artemis IV Progress – Space Launch System and Orion



Artemis IV Orion crew module in the Operations and Checkout Building NASA's Kennedy Space Center in Florida: September 23, 2023

- Booster segments complete
  - Aft skirts in final production
- Core Stage engine section at KSC
- RS-25 Engines in storage
- Core Stage TFF in manufacturing
- Orion Crew Module in final assembly
- Orion Service Module at KSC



Artemis IV Liquid Hydrogen Tank for NASA's SLS rocket fully assembled: November 14, 2025



Technicians lift the engine section for NASA's Artemis IV SLS rocket ahead of further processing NASA's Kennedy Space Center in Florida: October 21, 2024



Teams at NASA's Michoud Assembly Facility in New Orleans lifting a forward skirt out of its vertical assembly center: January 31, 2025



European Service Module for NASA's Artemis IV mission in the Operations and Checkout Building at NASA's Kennedy Space Center in Florida: February 18, 2026

# Artemis IV Progress – Space Launch System Upper Stage



- NASA is replacing the Exploration Upper Stage (EUS) with the Centaur V – a proven capability that enables mission repeatability
  - Limits major changes between missions
  - The first Centaur V mission may be Artemis IV or Artemis V
- SLS, EGS, Orion, and ULA are actively working the implementation of this new stage
  - A new Stage Adapter will be required, which NASA is preparing to manufacture.
  - Changes to Mobile Launcher 1 to relocate umbilicals is also under assessment.



# Artemis Progress – Extravehicular Activity Suits



NASA crew members practice emergency rescue drills during simulated lunar surface operations at NASA's Neutral Buoyancy Laboratory where teams evaluate how well crew perform tasks while wearing the Artemis IV lunar spacesuit: January 20, 2026

- Axiom suits planning for checkout on A-III or ISS
- Suits to be delivered to HLS provider for integration
- NASA will provide direct support at Axiom facilities and suppliers to increase collaboration and accelerate hardware production
- NASA also providing test facilities and sub 1 G aircraft test platforms and personnel



Axiom astronaut and NASA spacesuit engineers conducted spacesuit testing in NASA's Neutral Buoyancy Lab. This is the first time that the spacesuits were tested in conditions that simulated gravity at the lunar surface: July 9, 2025



# Artemis IV Progress – Human Landing System

Simplifying mission profiles to accelerate initial landing and surface capability.



SpaceX Starship Launch



Blue Moon Lander



Starship Lander



Blue Origin New Glenn Launch

# Notional Plan for 2028 Initial Crewed Landing Mission – SpaceX/Blue Origin



## GOALS

### Demonstrate crewed lunar landing near the lunar South Pole

Demonstrate multi-launch campaign

Collect lunar surface samples

Demonstrate xEVA suits on the lunar surface

## CREWED MISSION (Current State)

### CREW INFO

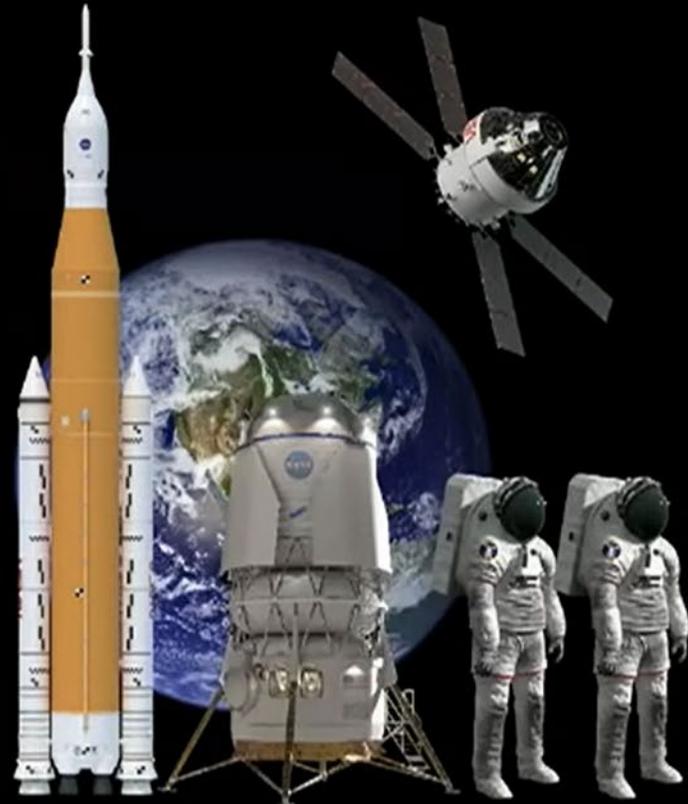
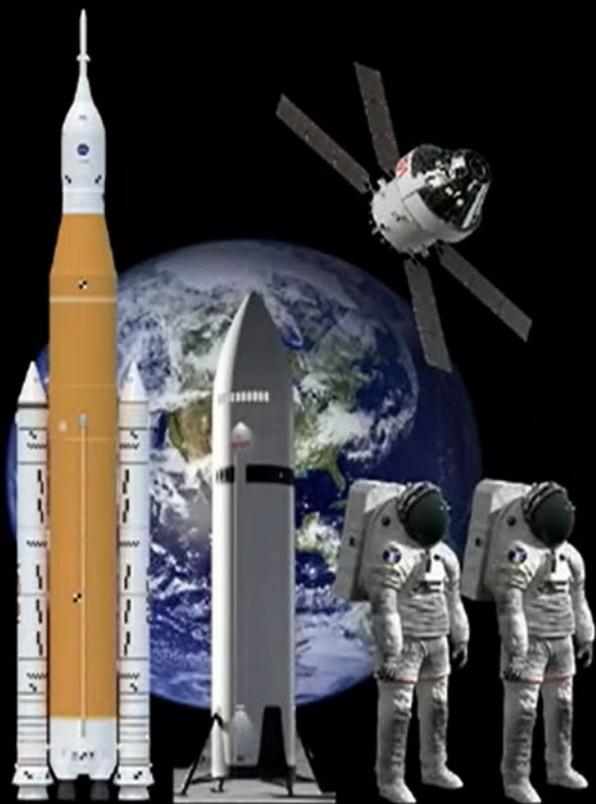
TOTAL CREW	4
LUNAR SURFACE CREW	2

### ELEMENTS

SLS	Block 1 Crewed (ICPS or Centaur V)
ORION	Crewed, RPODU Capable
HLS	Starship / Blue Moon
xEVA	Axiom xEMU

### ASSUMPTIONS

LANDING REGION	SOUTH POLE (84-90 deg)
# EVAs	2 to 4 EVAs / 1 to 2 EVAs
TOTAL MISSION DURATION	≤ 21 DAYS
LUNAR OPS (INCLUDES SURFACE STAY)	7 DAYS / 6 DAYS





# Milestones & Progress - Artemis V (2028)



# Artemis V Progress and Testing



At the European Service Module Integration halls in Bremen, Germany, stands the structure for the fifth spacecraft that will fly for Artemis to the Moon: July 2, 2023



Completed RL-10 engines for upper stage in storage



Core stage intertank panels awaiting production at NASA Michoud



Certification testing for production of new RS-25 Retrofit 3b engines to power the SLS rocket, beginning with Artemis V, completed early April 2024



RS-25 new production engine 20002 shown here at 70% completion in Canoga Park, CA



Artemis V liquid hydrogen tank barrel being removed from Vertical Weld Center at NASA's Michoud Assembly Facility: February 10, 2025



Artemis V SLS core stage first engine section barrel weld successfully completed at NASA's Michoud Assembly Facility: February 10, 2025



Artemis V crew module: February 18, 2026



## Summary

- Artemis III standardizes the architecture and reduces risk
- We have the hardware, the skills, and capabilities to accelerate while this Administration is committed to removing all obstacles
- NASA is prepared to advocate for increased supply chain criticality and build components ourselves if necessary
- NASA personnel will be embedded as active, not passive, participants in the supply chain. We will help drive outcomes.
- We are building new tools that allow us insight and real time resolution across the Artemis enterprise.
- To support a common understanding and initiate solutions, each CEO/company leader will be briefing the NASA Administrator in next few weeks.
- We are signaling demand and dropping an RFI for two pathways for crewed missions to the moon beyond Artemis V

**NASA and our partners are ready and prepared to meet the challenge**



NASA

# IGNITION



# Gateway Pivot

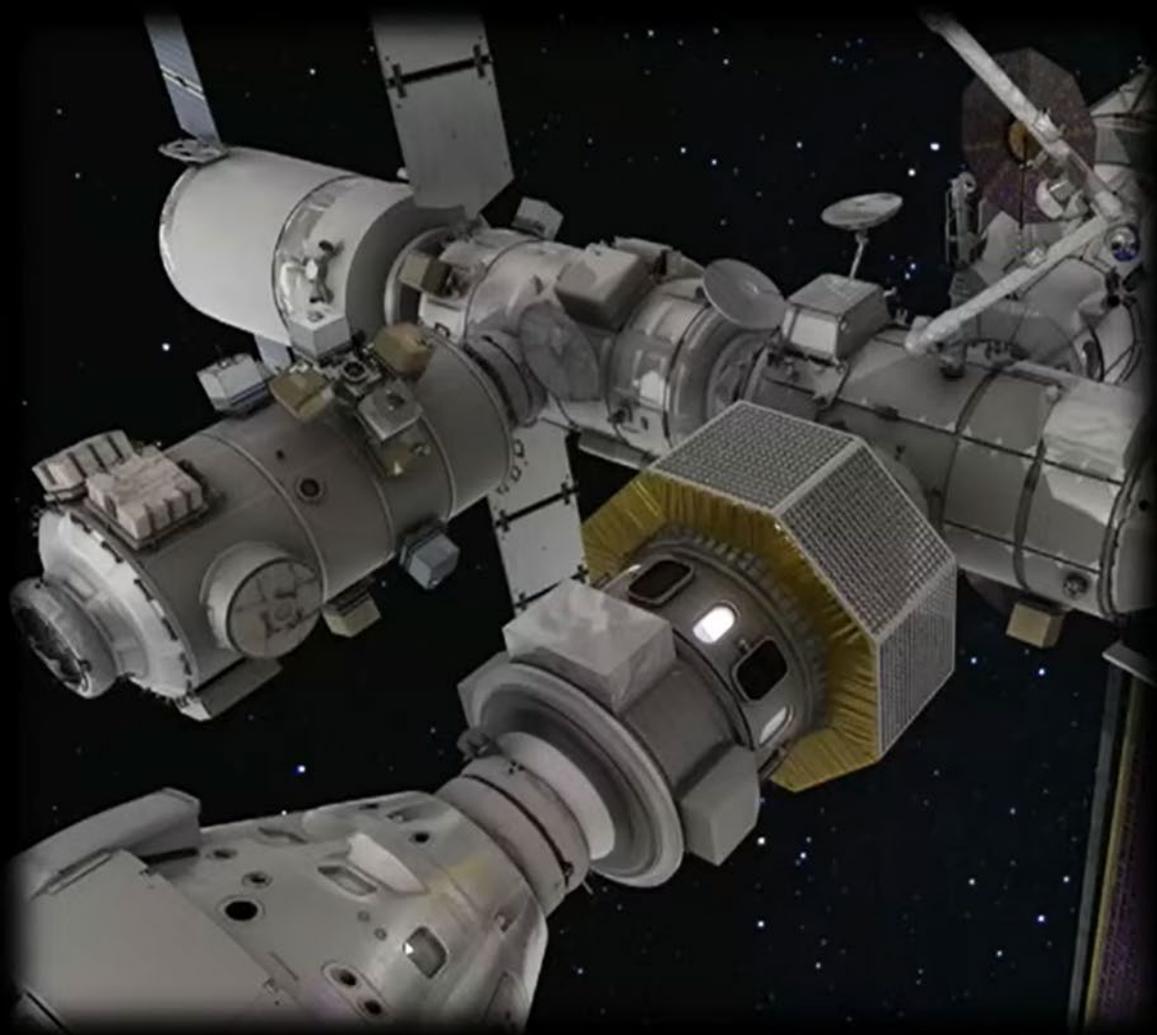
National space policy prioritizes sending astronauts back to the lunar surface and building a lunar outpost on the surface of the Moon.

The current Gateway architecture, while relevant to long term exploration goals, is not required to accomplish the primary objectives of landing humans on the Moon and establishing a Moon Base.

As a result, NASA is using Gateway elements to enable building the Moon Base, shifting the focus of the resources and people to the surface, which will also include orbital elements to support surface ops.

## Additional considerations:

- HLS providers do not require Gateway to accomplish their missions. Docking with orbiting platform came with performance penalties
- Gateway launch to lunar orbit is significantly behind schedule: PPE+HALO launch will likely be further delayed due to on-going HALO corrosion mitigation. Not expected to reach initial operational status until 2030+
- Other Gateway modules also behind schedule, with significant technical challenges ahead: corrosion mitigation (same issues as with HALO), overweight, complex assembly sequence



# Gateway Evolution

Significant parts of existing Gateway hardware and facilities can be directly repurposed to support near-term exploration objectives along with those orbital elements needed to support a surface-focused mission.

NASA, industry, and international partners are assessing best repurposing ideas of existing hardware.

- Many of the facilities are designed for an evolving architecture and can be adapted to current near-term needs in test, verification, and assembly/integration
- Repurposing options include using PPE for other high-priority missions, existing communications HW on the Moon Base, HALO subsystems/components/structures on future Moon Base modules

The NASA Gateway team will pivot to support Moon Base development efforts or other high priority initiatives.

We're working with our international partners to make this transition together and repurpose our partnerships towards building Moon Base.



**Phase 1:**

Secure reliable access to the surface and experiment

**Starts now**

**Phase 2:**

Establish the initial Moon Base operating capability

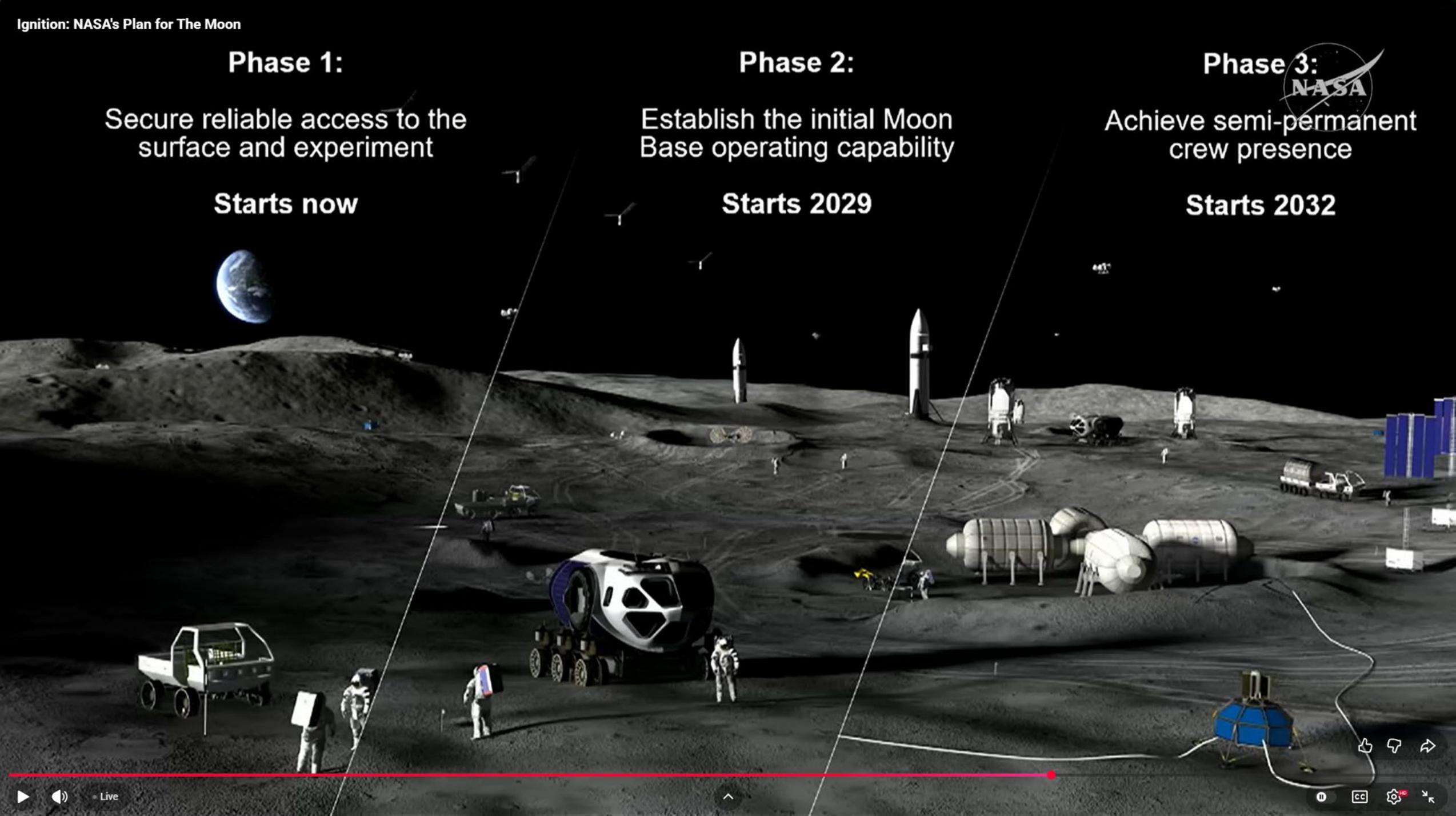
**Starts 2029**

**Phase 3:**



Achieve semi-permanent crew presence

**Starts 2032**





# *PHASE ONE*

- Achieve high-rate, reliable surface access
- Establish ground truth for Moon Base landing sites
- Experiment and test capabilities
- Complete first crewed Moon Base mission





25 launches



21 landings



Radioisotope heating units



~4,000 kg payload to surface



2 lunar orbital comm satellite constellations

*Now through 2028*





 Navigation Capability

 Orbital Comm Relays

 Observation Satellites

 MoonFall Drone

 CLPS

 Human Landing System

 Uncrewed LTV

 VIPER

 RHU Survive the Night

 Crewed LTV

# Lunar Terrain Vehicles

## Initial deployment of lunar crewed and uncrewed Lunar Terrain Vehicles (LTVs)

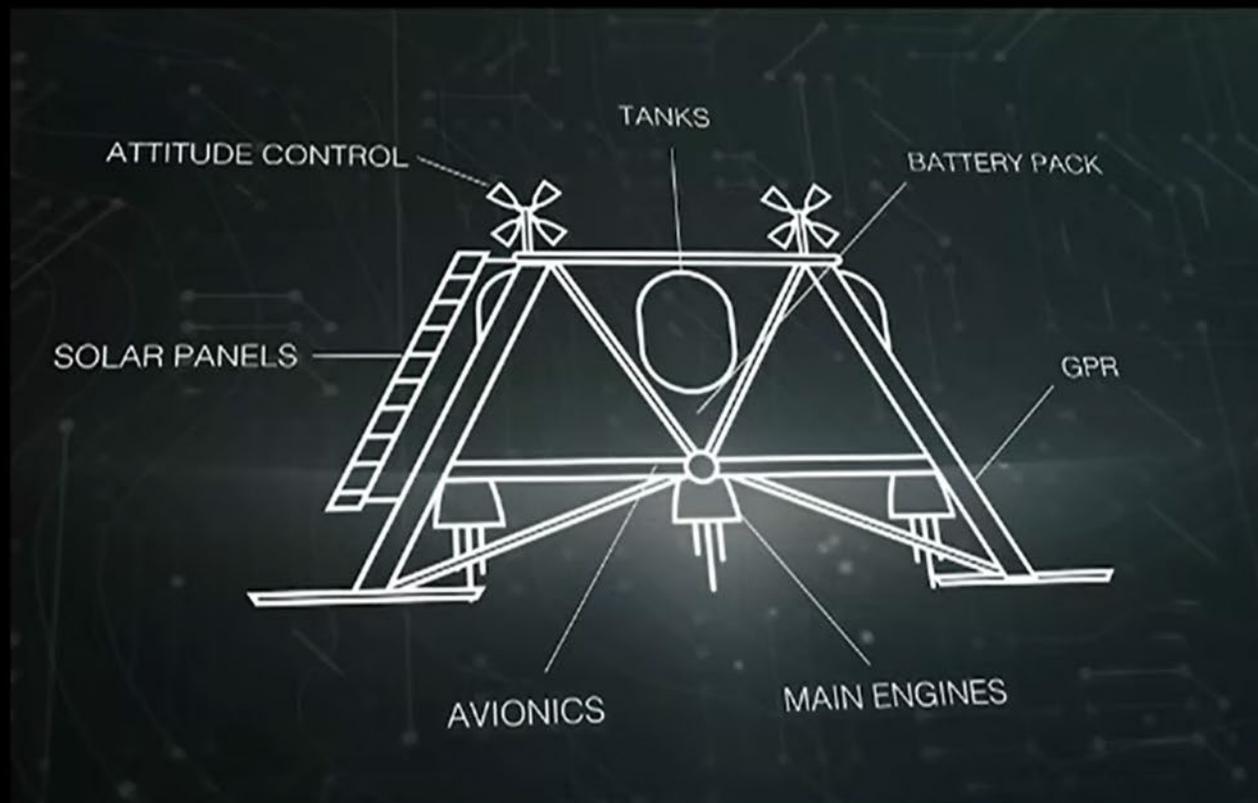
- Crewed vehicle to extend EVA traverse distances
- Uncrewed vehicle for exploration and technology demonstration
- 2m x 1.7m x 1.9m (height)
- 500 kg maximum rover mass
- Traverse slopes up to +/- 20 degrees
- Survives up to 150 hours in shadow
- Max speed 10 km/hr



# MoonFall Drones

## Site surveillance and terrain surveying

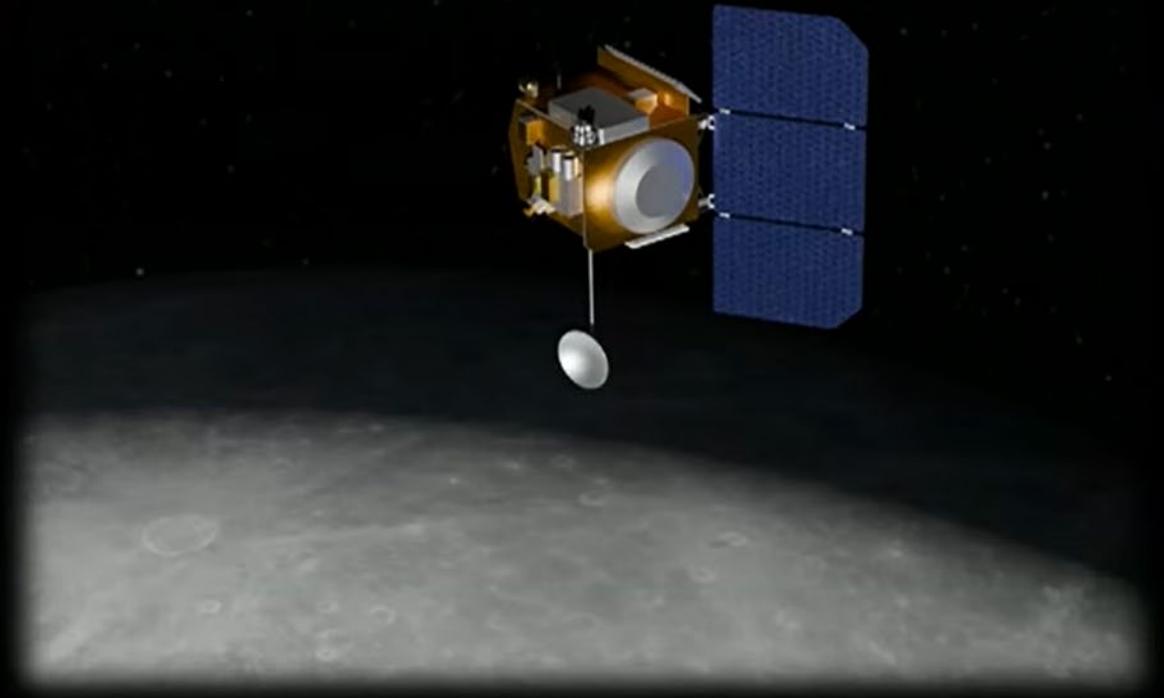
- Deploy highly mobile drones over the lunar South Pole in a single launch architecture
  - Drones land themselves and are independent spacecraft
  - Ability to survey harder-to-reach terrain
  - Each drone capable of several propulsive hops covering up to 50km each in total
  - 150 seconds launch to landing with a maximum altitude of 1km
- Hosts multiple payloads:
  - Optical camera(s)
  - Survive the night avionics demonstrations



# Communications and Observation Satellites

**Taking the world along as we establish and grow lunar surface operations at Moon Base**

- Increase throughput to/from Earth to cislunar space >500 Mbps
- Increase the number of available surface to orbit links
- Increase throughput to/from the lunar surface
- Test initial LunaNET interoperability standards





KEY MISSION

# VIPER

**Mapping of water and volatiles for lunar resource prospecting**

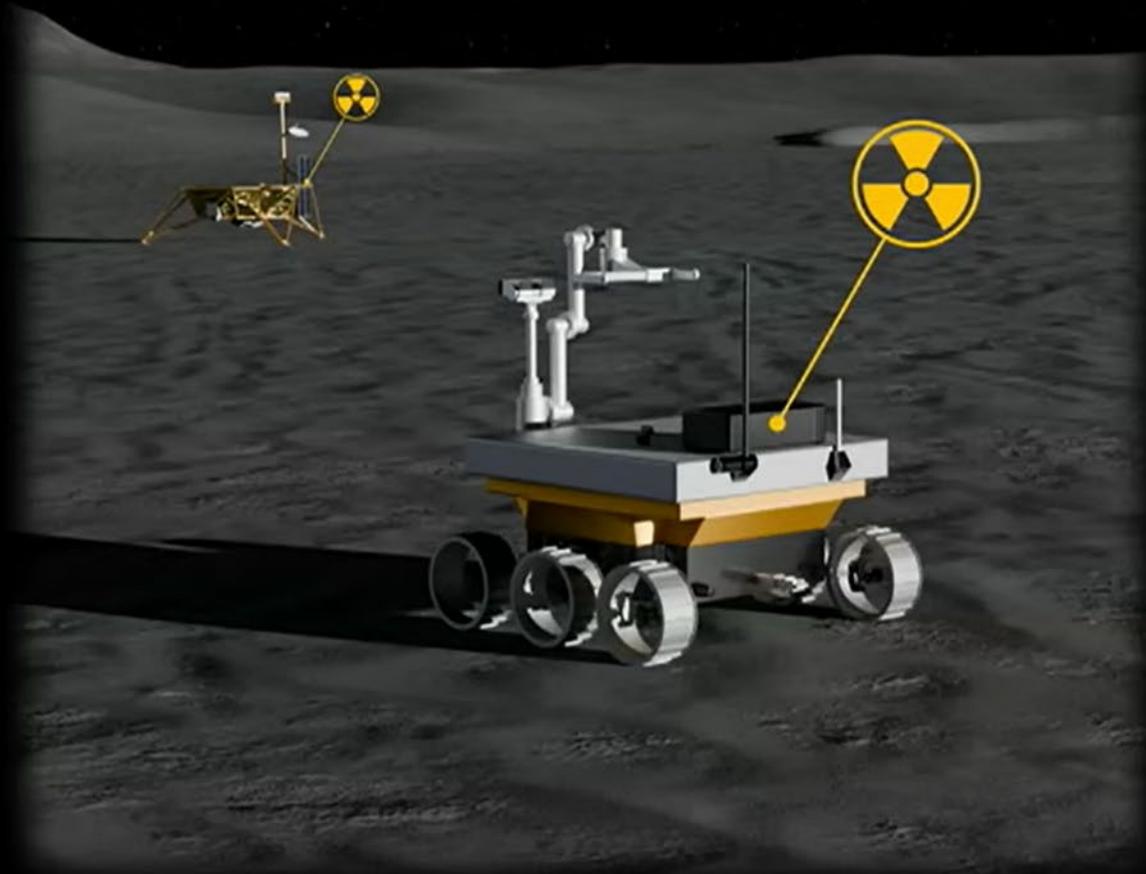
- 1.7m x 1.7m x 2.5m
- 450 kg rover mass
- 100+ day mission traversing 30+ km
- Survives up to 50 hours in shadow
- Three spectrometers & one drill



# Radioisotope Demos

**Radioisotope heater units (RHUs) provide heat, allowing for survive the night capability during lunar surface operations**

- Test updated nuclear fuel sources for increased reliability and safety for commercial use
- Initial lander demonstrations will survive 120+ continuous hours of darkness and send a signal back to Earth
- Enable future lunar assets to survive 354+ hours of local darkness



# MOON BASE: PHASE 01



YEAR	2026	2027	2028
INVESTMENT	\$10 BILLION		
SURFACE & ORBITAL ASSETS	 x 1	 x 2  x 5	 x 1  x 5  x 4  x 3
LANDERS	 x 1  x 1	 x 8  x 1	 x 3  x 3  x 4
LAUNCHES	 x 2	 x 10	 x 12



# *PHASE TWO*

- Secure initial site(s)
- Establish initial lunar infrastructure
- Increase CLPS lander payload mass capability to 5 MT
- Technology demonstrations to enable lunar permanence
- Semi-annual crewed missions



27 launches



24 landings



7 rovers

~60,000 kg payload to surface:

NASA



Pressurized Rover, MoonFall  
drones, solar power stations,  
nuclear power demos (RTGs),  
surface comm, science

2029–2033





 Solar Power Augmentation

 Nuclear Power/  
Thermal (RTGs)

 Logistics Demo

 Surface  
Comm & Nav

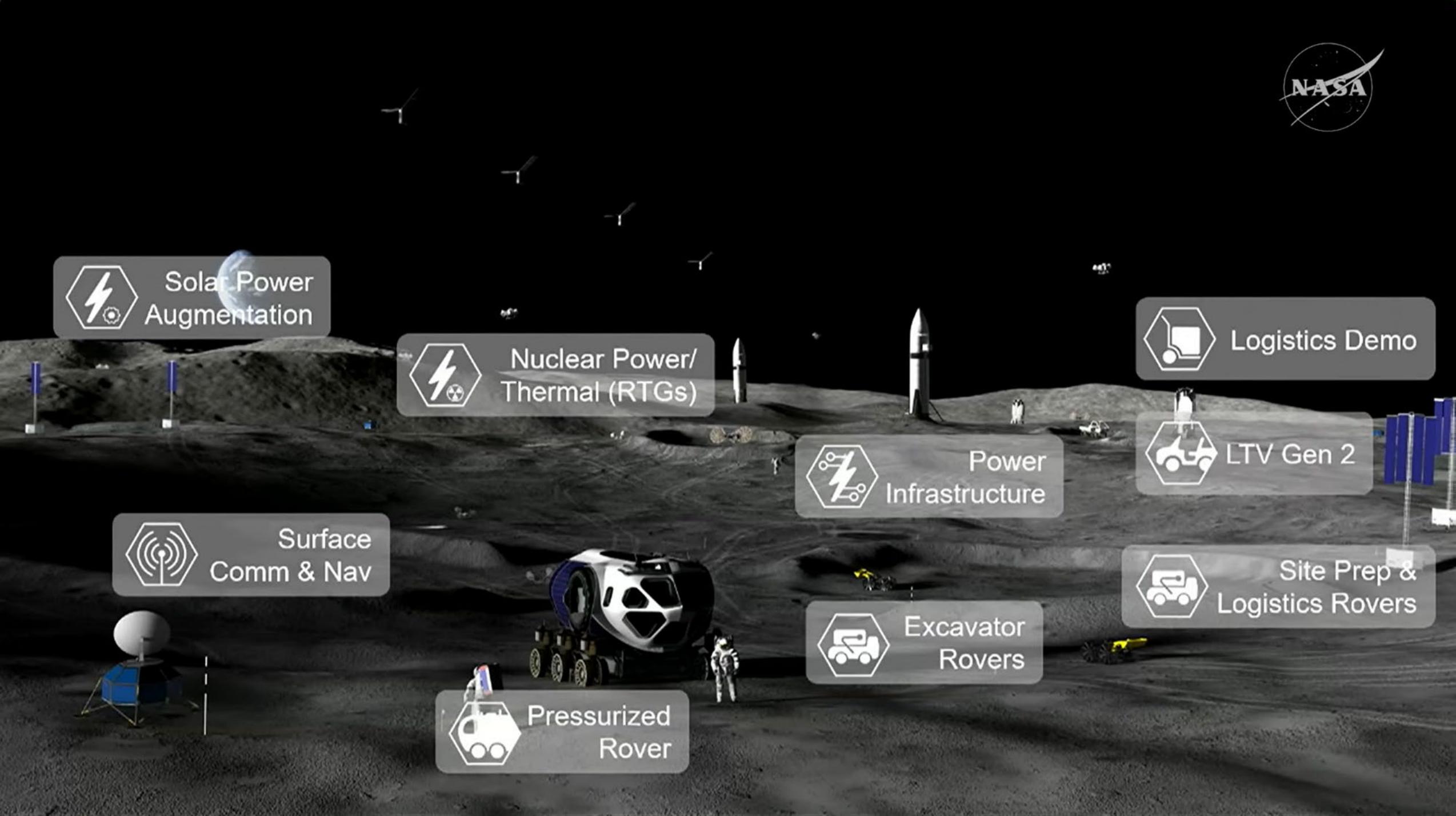
 Power  
Infrastructure

 LTV Gen 2

 Site Prep &  
Logistics Rovers

 Excavator  
Rovers

 Pressurized  
Rover





# Pressurized Rover

**In partnership with NASA, the Japanese Aerospace Exploration Agency (JAXA) Pressurized Rover contribution**

- Mobile habitat to extend human exploration range
- Supports two crew in shirt sleeve environment while also enabling surface EVAs
- 10-year design life
- 15,000 kg rover mass
- Cargo mass 3,000 kg
- Traverse slopes up to +/- 15 degrees
- Survives up to 150 hours in shadow
- Max speed 3.5 km/hr



*Credit: JAXA/Toyota*

# Solar Power Augmentation

**Demonstrate and deploy solar power augmentation systems with energy storage and distribution**

- Early demonstration of solar array deployment, battery systems, & power distribution hub
- Deploy solar array stations for permanent infrastructure
  - 10 kW+ during illumination
  - 360 kWh during shadow



# Surface Communications

**Establish and expand surface network to enable more throughput and connections**

- Deploy dedicated surface-to-orbital communication stations
  - Integrate/aggregate comm for other assets
- Deploy surface communication system to enable direct communication across lunar surface
  - Enables asset-to-asset communication
  - ~10km range



# Site Preparation and Logistics Rovers

Rovers deployed to enable site preparation, regolith manipulation, and initial logistics capabilities

- NASA LTV Gen 2
- Other industry and international rovers for:
  - Logistics & cargo
  - Site preparation
  - Excavation & compaction



# Nuclear Surface Power Capability

**Demonstrate radioisotope thermal generators (RTGs)**

- Hundreds of watts
- Demonstrate technologies, processes, and operations for future larger scale nuclear power/propulsion
- Demonstrate thermal management concepts and methods for larger scale future applications
- Used as power generation stations
- Used within assets to enable night survival and permanently shadowed region exploration



# MOON BASE: PHASE 02



YEAR  
INVESTMENT

2029

2030

2031

2032

\$10 BILLION

SURFACE &  
ORBITAL  
ASSETS



LANDERS



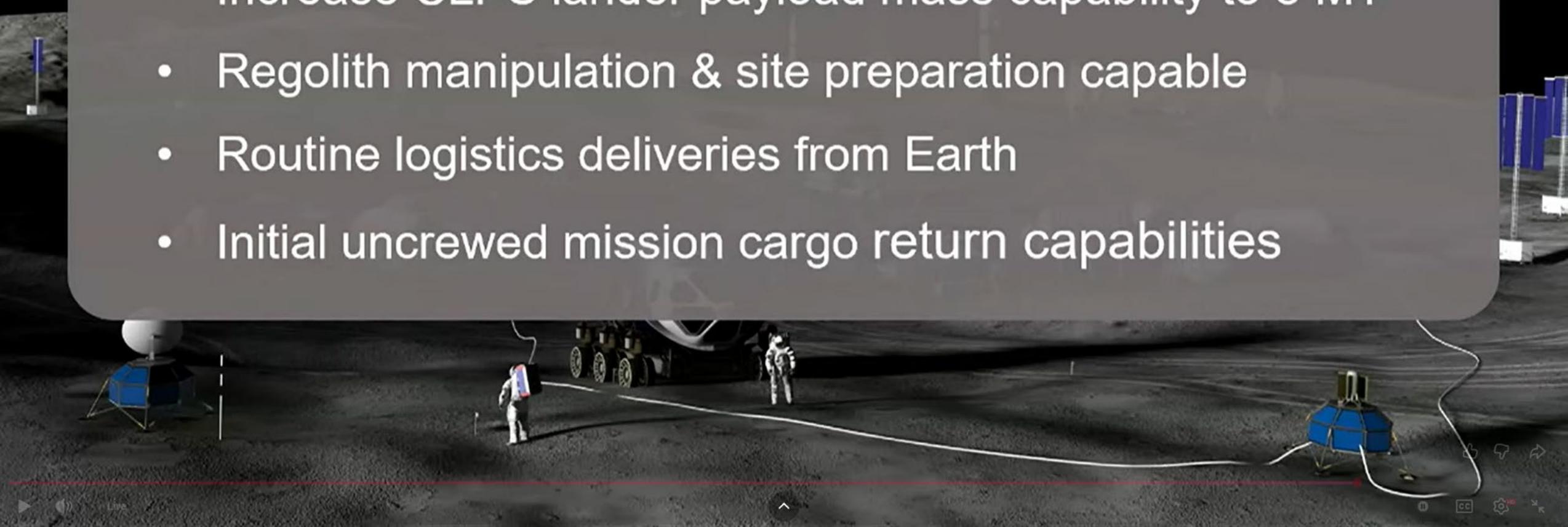
LAUNCHES





# *PHASE THREE*

- Enable long-duration and -distance human exploration
- Increase CLPS lander payload mass capability to 8 MT
- Regolith manipulation & site preparation capable
- Routine logistics deliveries from Earth
- Initial uncrewed mission cargo return capabilities





29 launches



28 landings



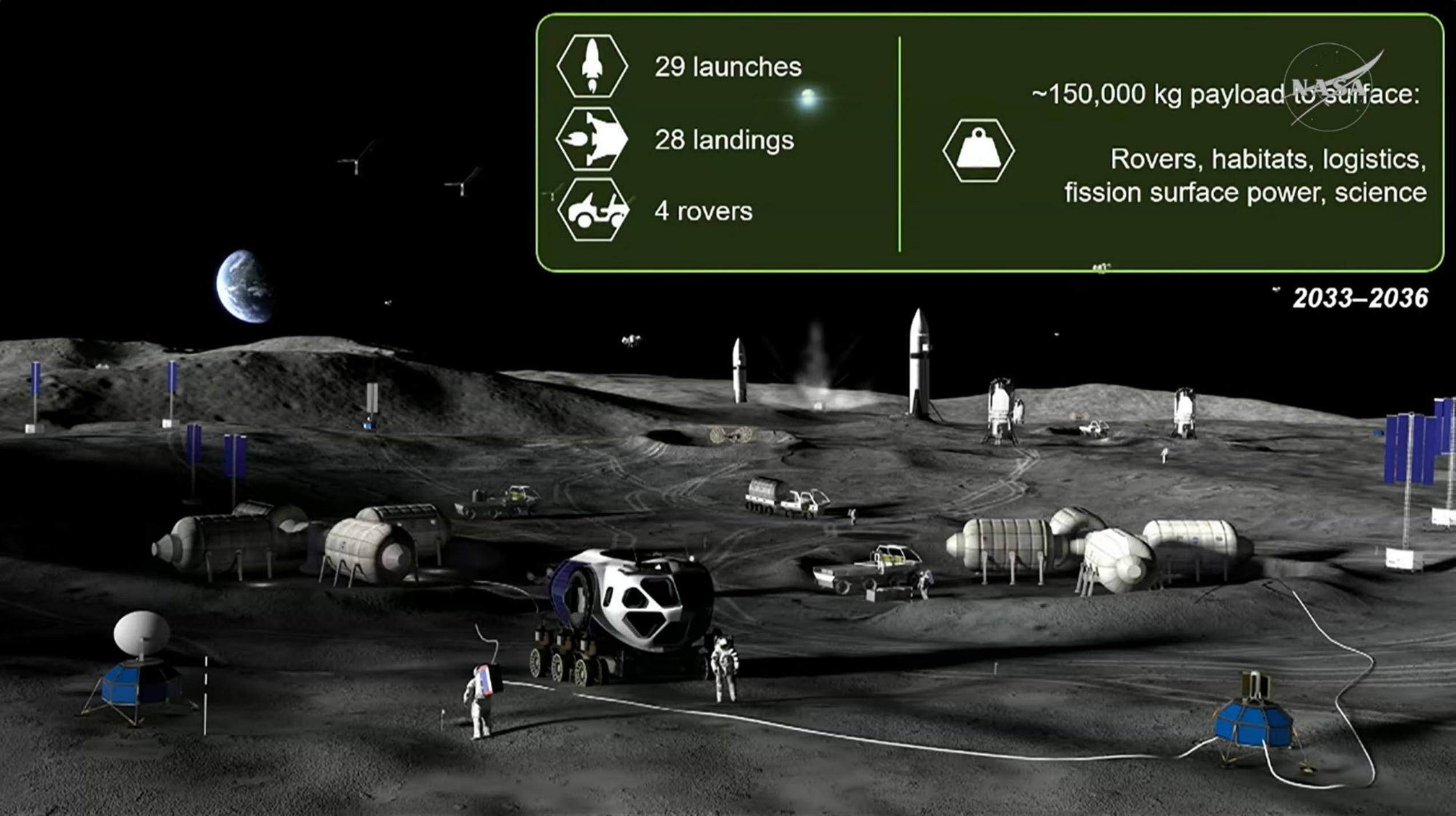
4 rovers



~150,000 kg payload to surface:

Rovers, habitats, logistics,  
fission surface power, science

2033-2036





 Cargo Return

 Fission Surface Power

 Habitats

 Logistics

 ISRU

 Habitats

 Power Distribution



# Logistics

## End-to-end logistics services in support of crewed operations

- Deployment, operation, and disposal of systems needed to deliver, transfer, sustain, utilize, and dispose of logistics items needed to support crew on the lunar surface
- Example of mass needed: ~8,000 kg of carriers, consumables, and other items to support a 4-crew, 28-day mission.



# Habitats

**Enable a continuous human presence with increased habitable volume and floor space**

- Multiple habitable volumes across multiple site locations
- Various capabilities and needs, including:
  - ECLSS
  - Surface mating
  - Airlocks
- Expands surface science and utilization capabilities
- Increase Earth-independent operations



# Cargo Return

## Return cargo from the lunar surface

- Initial demo in Phase 2
- Phase 3: implement capability with mass goal of 500 kg
- Uncrewed cargo return missions:
  - Science returns
  - Critical hardware
  - Inspiration



# In-situ Resource Utilization



## In-situ Resource Utilization (ISRU) technology and implementation

- Phase 1 & 2 experiment & demo
- Phase 3 continue demo and begin implementation
- Enabling use of lunar commodities could enable reductions in launch mass, cost, and risk to human exploration
  - Key commodities from regolith:
    - Oxygen, water, rare Earth elements, hydrogen
- Converting regolith into durable and sustainable materials with techniques such as
  - Corbelling, 3D printing, sintering



# MOON BASE: PHASE 03



YEAR	2033	2034	2035	2036
INVESTMENT	\$10 BILLION +			
SURFACE & ORBITAL ASSETS	 x 1  x 2	 x 1  x 1	 x 1  x 1	 x 1  x 1  x 1
LANDERS	 x 3  x 2  x 1	 x 2  x 3  x 2	 x 2  x 3  x 2	 x 2  x 4  x 2
LAUNCHES	 x 7	 x 7	 x 7	 x 8



# Rising to the Challenge

To achieve the near-impossible, we are driving to a high volume of complex missions with challenging execution timelines.

There are known current limitations that will challenge us...

- Supply chain
- Reliable access to capable test facilities
- Manufacturing capability and capacity
- Technology maturation

NASA will actively participate to help overcome challenges...

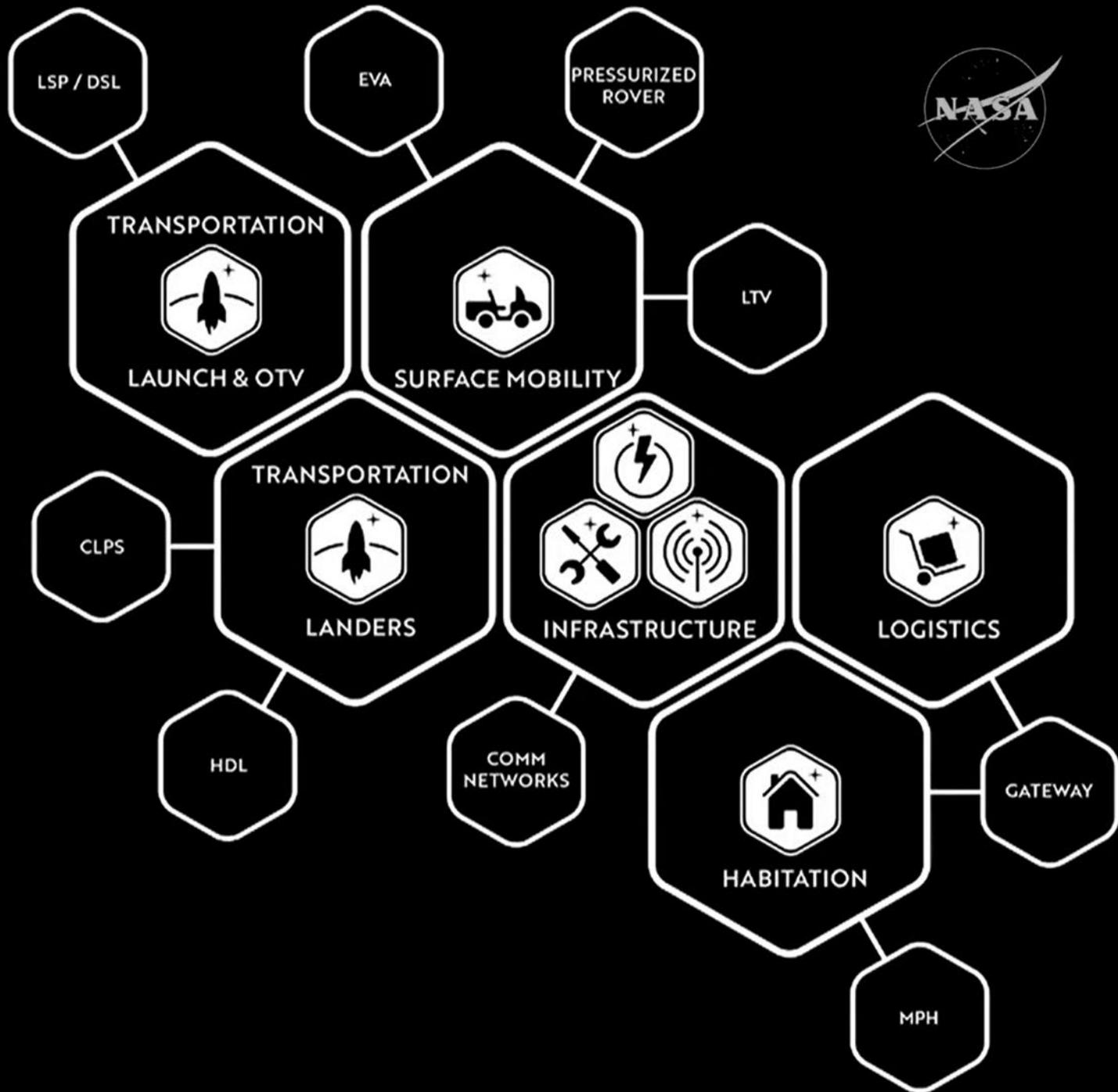
- Leverage highly capable NASA facilities (environmental testing, propulsion testing, etc.)
- Leverage core NASA expertise to provide collaboration, in-line support and lessons learned – this starts now on existing projects
- Leverage previous development experience, and relationships, to assist with supply chain issues



***We need your ideas*** — requests for information soliciting inputs are ***posted to sam.gov today!***

CAPABILITIES

Every Asset, Every  
Kilogram, and All  
Lunar Exploration  
Resources Focused  
On Building the  
Moon Base



# Launch Services Program & Deep Space Logistics

Leveraging the agency's Launch Services Program & Deep Space Logistics Project provides commercial end-to-end contract management and mission integration expertise to ***enable lunar access and logistics deliveries through a mixed fleet approach, enabling*** unique mission support and block buys for standardized delivery capabilities.

This enables both existing and emerging domestic launch & in-space transit capabilities to assure reliable access to the Moon, across all levels of capability.

This experience base will help us accelerate access to cislunar space through the purchase of an abundance of launch & transit capacity to serve NASA and our partnering organizations' needs (academia, international partners, and other government agencies).





CAPABILITIES

# Transportation: Landers

# Commercial Lunar Payload Services



## CLPS was set up to:

- Enable low cost (more risk tolerant) lunar payload delivery opportunities
- Incubate a new US-led industry base

## With the Moon Base directive, the CLPS approach will evolve to increase:

- Lander payload delivery capability through Phase 3 and beyond
- Mission reliability
- Increased mission quantity and cadence

## To achieve this goal, NASA will immediately:

- Release two new Requests for Task Order Proposals (RFTPs) to support Phase 1
- Infuse NASA's core competencies to increase mission reliability
- Release a follow-on CLPS solicitation to support Phase 2 & 3



# Large Cargo Landers

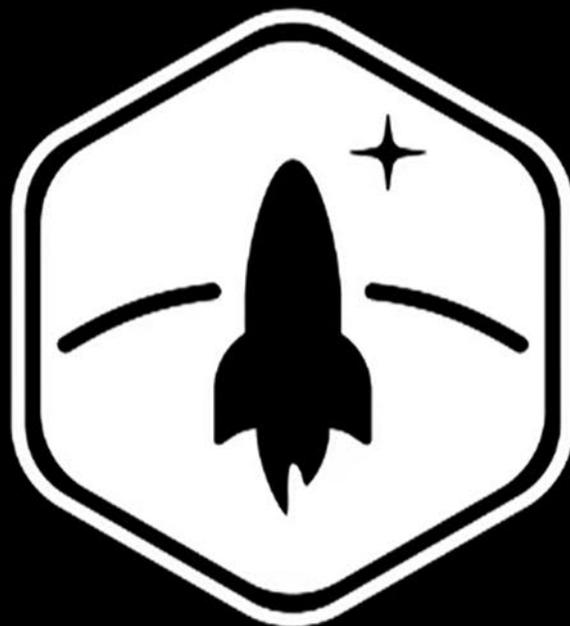


Drawing on the Human Landing System for cargo with **Human-class Delivery Landers**





# Transportation Procurements



## ***Launch Opportunities***

NASA Launch Services task orders issued starting in CY 2027

## ***Lander Opportunities***

*New Commercial Lunar Payload Services (CLPS) Opportunities:*

- CLPS 1.0 Draft RFTPs ***issued today*** for large payloads (500 kg) & smaller science payloads (<100 kg)
  - Task Order awards within 90 days
- Follow-on Draft RFTP issued within 50 days
  - Task Order award(s) within 150 days
- CLPS 2.0 Draft Request for Proposals issued today
  - New Contract awards by the end of GFY26

*Baseline Planned CLPS Opportunities:*

- CLPS 1.0 Draft Request for Task Plan to vendors in mid-June for CP-32 DIMPLE Delivery



## CAPABILITIES

Infrastructure: Communications & Positioning, Navigation, Tracking, and Observation



Phase 1  
Relay Satellites  
w/ Observability



Phase 2  
Deployable Surface  
Comm Tower



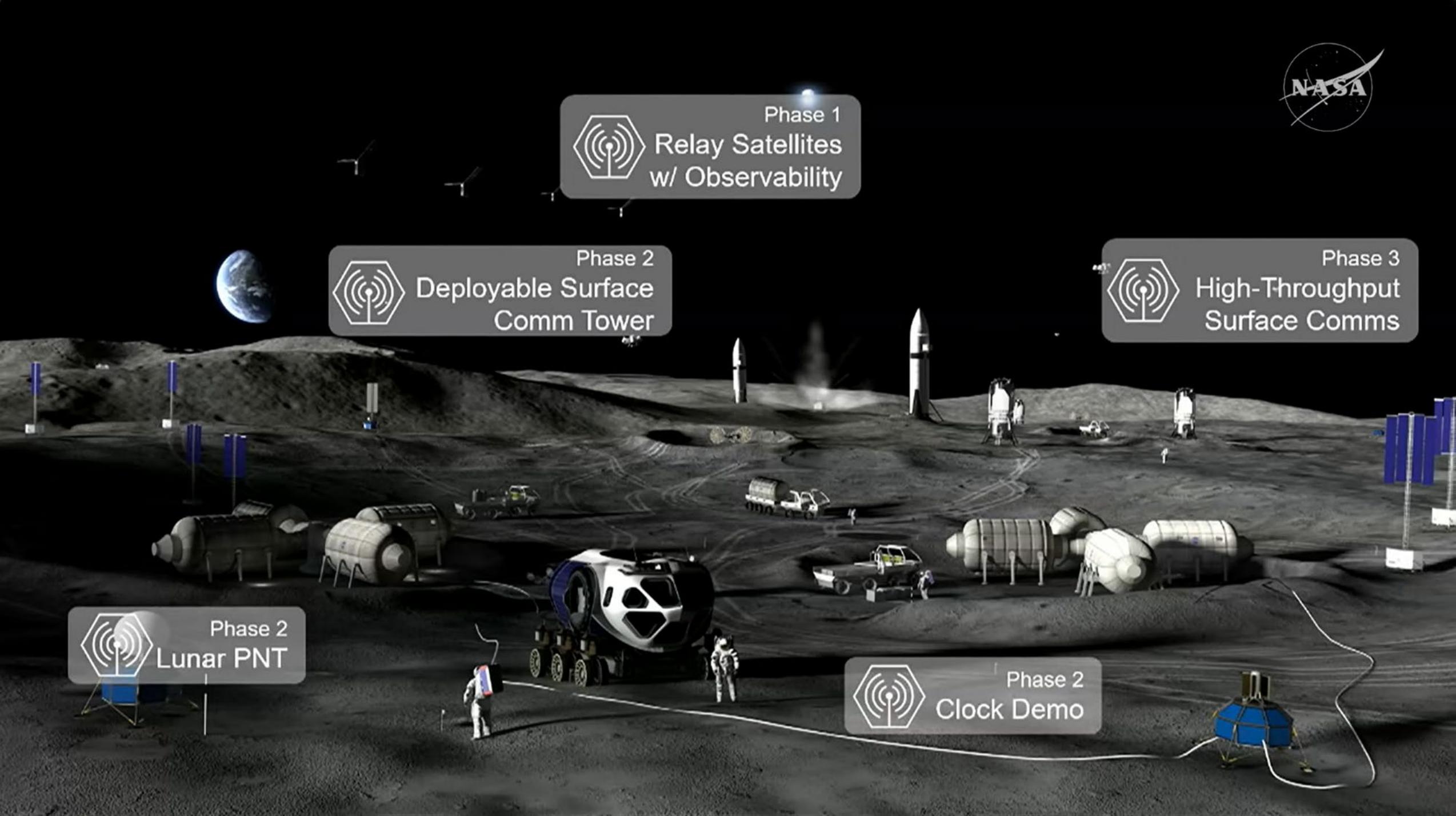
Phase 3  
High-Throughput  
Surface Comms



Phase 2  
Lunar PNT



Phase 2  
Clock Demo





# Communications, Position, Navigation, Timing

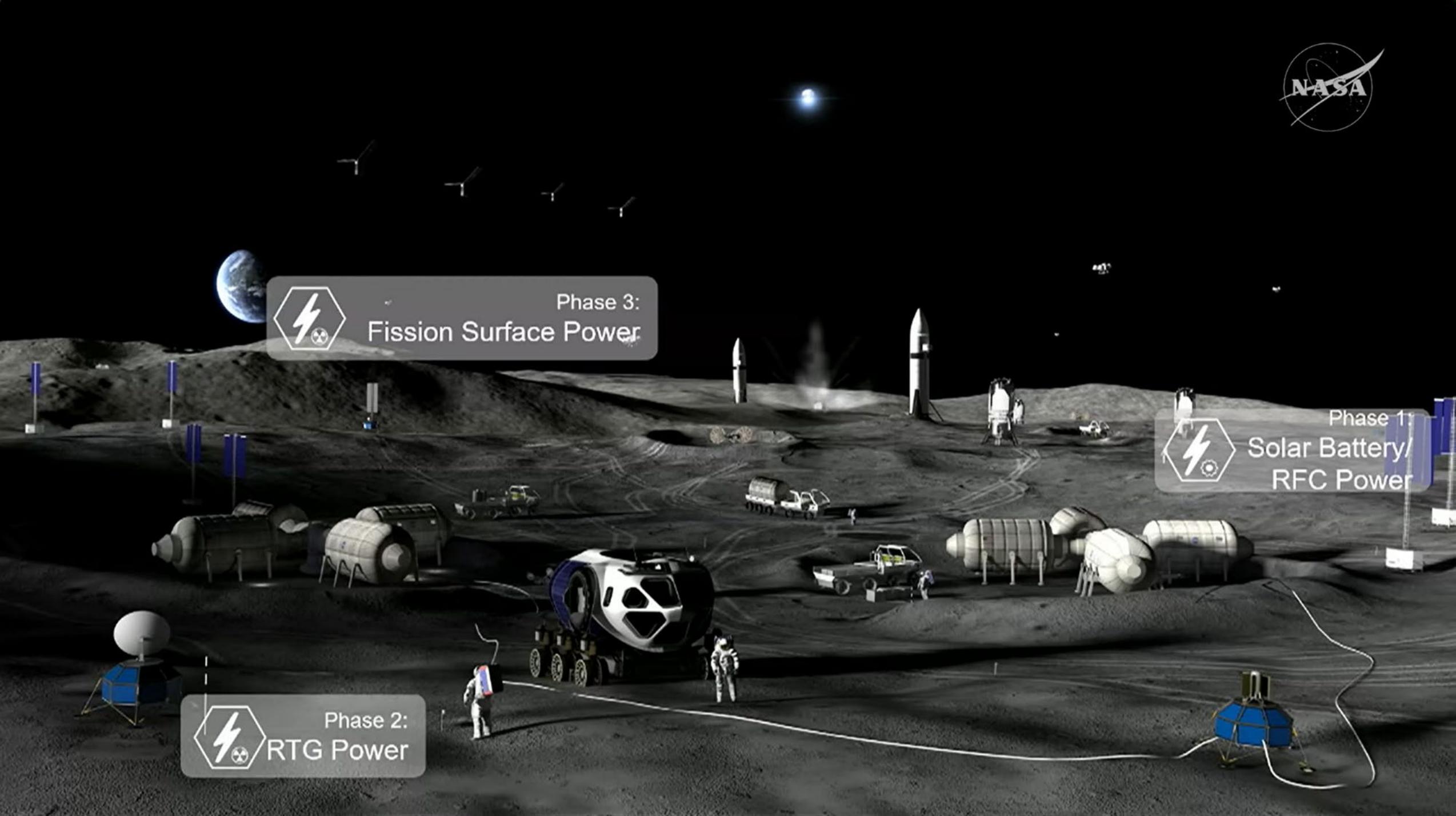
<b>Phase 1</b>	<b>Phase 2</b>	<b>Phase 3</b>
<p><b><i>Orbital comm &amp; PNT relay</i></b></p> <ul style="list-style-type: none"> <li>• Deploy initial 5-satellite constellation</li> <li>• Add second provider constellation</li> </ul> <p><b><i>Add observation capability</i></b> <b><i>Data and standards</i></b></p> <ul style="list-style-type: none"> <li>• Mature interoperability specification baseline across all users and infrastructure - LunaNET</li> </ul>	<p><b><i>Surface communications</i></b></p> <ul style="list-style-type: none"> <li>• Permanent surface "cell towers"</li> <li>• Simultaneous support for multiple users via integrated surface network terminals</li> </ul> <p><b><i>Navigation infrastructure</i></b></p> <ul style="list-style-type: none"> <li>• Clock technology demonstration</li> </ul>	<p><b><i>Surface communications</i></b></p> <ul style="list-style-type: none"> <li>• Coordinated communication across all assets in support of Moon Base</li> <li>• Scaled network deployment across regions</li> </ul> <p><b><i>Navigation infrastructure</i></b></p> <ul style="list-style-type: none"> <li>• Clock ensembles – persistent time broadcast</li> </ul>



 Phase 3:  
Fission Surface Power

 Phase 1:  
Solar Battery/  
RFC Power

 Phase 2:  
RTG Power





<b>Phase 1</b>	<b>Phase 2</b>	<b>Phase 3</b>
<p><b><i>Initial Power</i></b></p> <ul style="list-style-type: none"> <li>• Deploy assets responsible for self-supported power generation and survival</li> <li>• Demo initial hibernation points</li> <li>• Demo initial Radioisotope Heater Units (RHUs)</li> </ul>	<p><b><i>Deploying Power Infrastructure</i></b></p> <ul style="list-style-type: none"> <li>• Deploy Solar Arrays Power Stations</li> <li>• Deploy Radioisotope Thermal Generator (RTG) Power Stations</li> <li>• Assets begin routinely using RHUs &amp; RTGs to enable night survival and additional night operational capability</li> <li>• Demonstrate wireless charging for Rovers</li> <li>• Demonstrate dust tolerant electrical connectors</li> <li>• Demonstrate electrical cable deployment</li> </ul>	<p><b><i>Enabling Power Distribution</i></b></p> <ul style="list-style-type: none"> <li>• Fission Surface Power</li> <li>• Power distribution deployed to support habitats and surface assets <ul style="list-style-type: none"> <li>• Wireless charging</li> <li>• Dust tolerant electrical connectors</li> <li>• Electrical cable deployment</li> </ul> </li> <li>• Permanently Shadowed Region exploration</li> </ul>



Phase 2+  
Advanced  
LTV



Phase 1  
LTV



Phase 2+  
International  
Partner Rovers



Phase 1+  
Science  
Rovers



Phase 2  
Pressurized  
Rover



Phase 1  
Site Preparation  
& Logistics





<b>Phase 1</b>	<b>Phase 2</b>	<b>Phase 3</b>
<p><b><i>CLPS 1.0 Science Rovers</i></b></p> <ul style="list-style-type: none"> <li>• NASA - VIPER</li> <li>• Astrolab - FLIP</li> <li>• UAE Rover – Rashid</li> </ul> <p><b><i>MoonFall Drones</i></b></p> <ul style="list-style-type: none"> <li>• Science, overnight survival tech demo, surface communication</li> </ul> <p><b><i>Lunar Terrain Vehicle Phase 1</i></b></p> <ul style="list-style-type: none"> <li>• Less complicated rovers, one-year design life &amp; NASA as the only user</li> <li>• Simplified crewed rover(s)</li> <li>• Autonomous rover(s) capable of site surveying, site preparation demonstration, &amp; logistics mobility</li> </ul>	<p><b><i>Lunar Terrain Vehicle</i></b></p> <ul style="list-style-type: none"> <li>• Increased reliability of crewed &amp; uncrewed rovers (NASA as the only user)</li> <li>• Increase logistics and science payload carrying capability</li> <li>• Regolith manipulation demo(s)</li> </ul> <p><b><i>Partner Rover</i></b></p> <p>JAXA - Human Pressurized Exploration Rover</p> <p><b><i>Partner Potentials</i></b></p> <ul style="list-style-type: none"> <li>• Science rovers</li> <li>• Landing &amp; habitation site prep rover demo(s)</li> <li>• Power cable deployment rover demo(s)</li> <li>• Initial logistics transfer rovers</li> <li>• Increase robotic manipulation capabilities</li> </ul>	<p><b><i>Lunar Terrain Vehicle</i></b></p> <ul style="list-style-type: none"> <li>• Crewed &amp; uncrewed rovers 10-year design life requirement (NASA &amp; commercial users)</li> <li>• Full logistics transfer capabilities</li> <li>• Robotic manipulation capabilities</li> <li>• Permanently shadowed region exploration capable using RHU &amp; RTG</li> <li>• Regolith manipulation</li> </ul> <p><b><i>Partner Potential Rovers</i></b></p> <ul style="list-style-type: none"> <li>• Landing &amp; habitation site prep rovers</li> <li>• Power cable deployment rovers</li> <li>• Large logistics/utility rovers</li> <li>• Robotic manipulation capabilities</li> </ul>

# Lunar Terrain Vehicles

## LTV contract was set up to:

- Deliver a “fully capable” crewed rover to survive for 10 years
- Per current schedule, delivery to the lunar surface by 2030
- Cost, technical complexity, and schedule puts NASA in a “no fail” solution space

## With the Moon Base directive, LTV must adapt to:

- Gain quicker access to crewed and uncrewed lunar surface rover operations
- Increase quantity of rovers on lunar surface
- Add uncrewed rovers that can evolve to serve numerous additional lunar surface needs
- Allow for multiple vendor solutions, de-risking NASA
- De-risk long-term mission success through learning and phased design evolution





# LTV Procurements

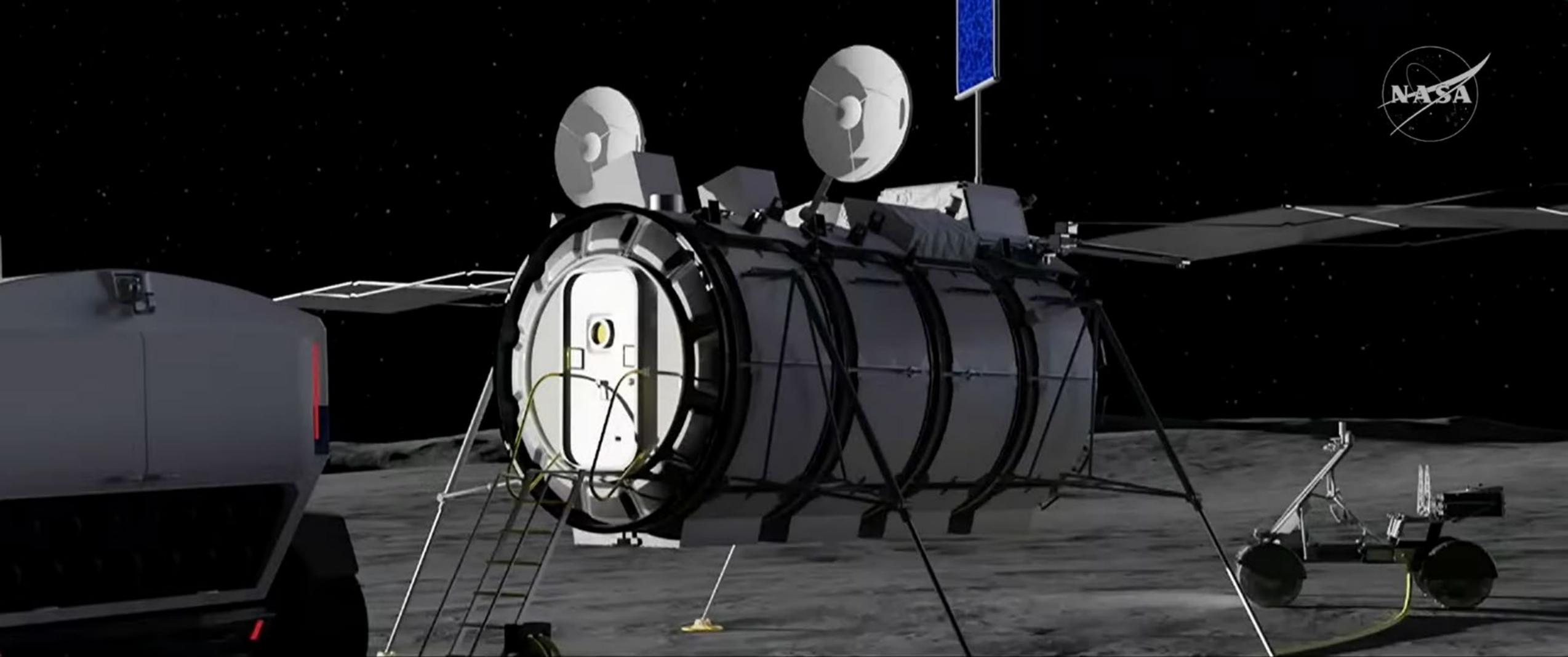


## *LTV Opportunities*

LTV draft RFTP *issued today* for proposals on a more simplified variant of both crewed and uncrewed rovers.

On-ramp RFP to increase vendor pool for Phase 2 LTVs *planned for 2027*.

Foresee Task Order competitions *every 18 to 24 months* for future rover deliveries as Moon Base capability needs evolve.



CAPABILITIES

# Habitation and Logistics



Phase 3  
Cargo  
Return

Phase 1  
Logistics  
Deliveries

Phase 3  
Habitats



# Habitation & Logistics



Phase 2	Phase 3
<p><b><i>Early Surface Logistics</i></b></p> <ul style="list-style-type: none"> <li>• Deploy initial logistics capabilities               <ul style="list-style-type: none"> <li>• 0.5 to 1.5 metric tons</li> <li>• Initial sustainment</li> </ul> </li> <li>• Demo surface mating</li> <li>• Demo small cargo return</li> </ul> <p><b><i>Demo Habitation</i></b></p> <ul style="list-style-type: none"> <li>• Establish early human habitation lunar base capability</li> <li>• Early pressurized module(s) with minimal environmental control and life support systems supported by external power</li> </ul>	<p><b><i>Operational Surface Logistics</i></b></p> <ul style="list-style-type: none"> <li>• End-to-end logistics capabilities               <ul style="list-style-type: none"> <li>• Up to eight metric tons per 28-day mission</li> </ul> </li> <li>• Operational surface mating</li> <li>• Sustained small cargo return</li> <li>• Demo med/large cargo return               <ul style="list-style-type: none"> <li>• Goal: 500 kg</li> </ul> </li> <li>• Initial surface habitats &gt; 100 m<sup>3</sup> <ul style="list-style-type: none"> <li>• Partner habitats</li> <li>• US habitats</li> </ul> </li> <li>• Additional elements               <ul style="list-style-type: none"> <li>• Airlocks</li> <li>• Nodes</li> </ul> </li> </ul>



# 2026 Procurement Timeline

