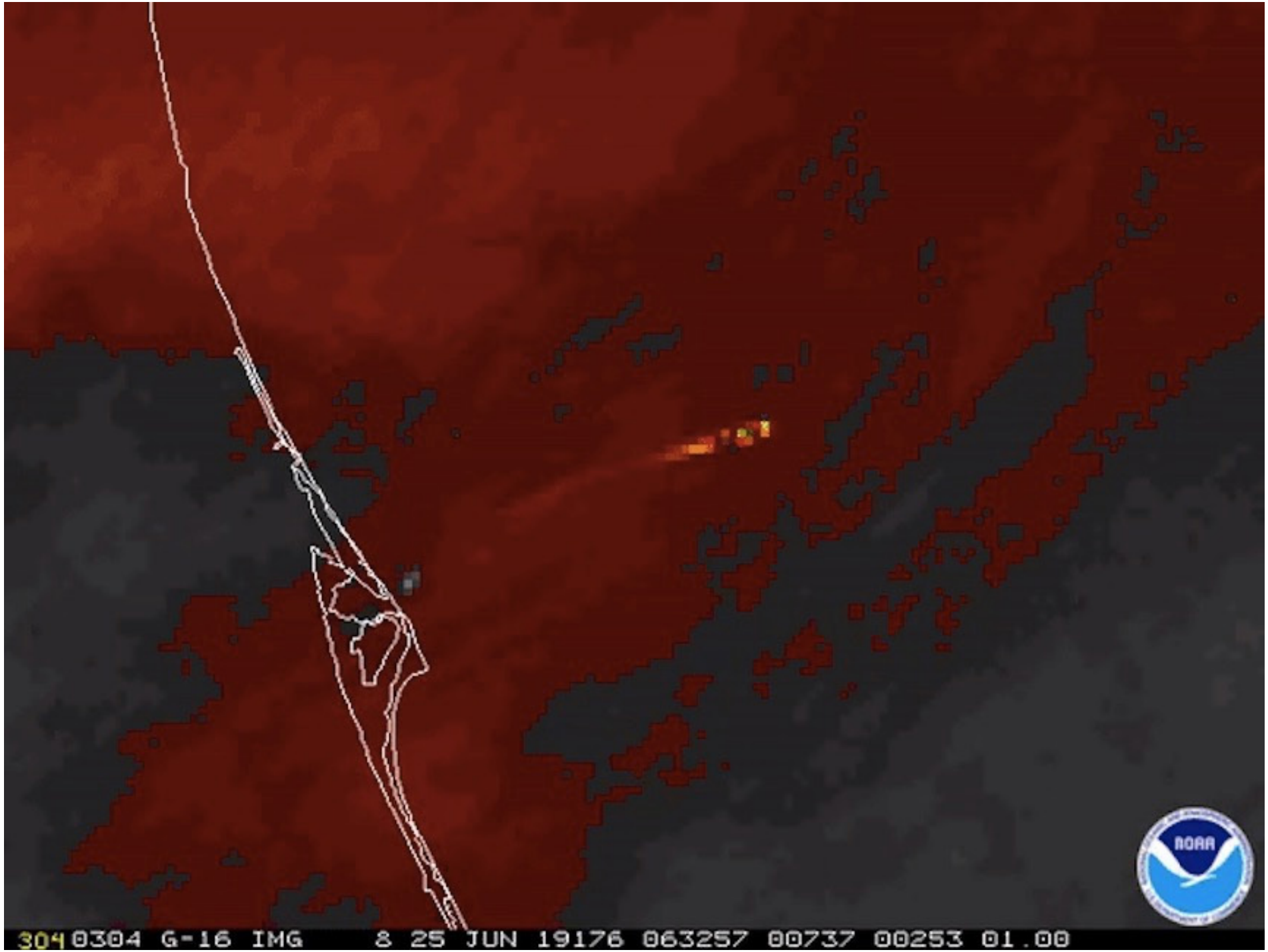
DSX (USAF)

COSMIC-2 (NOAA-Taiwan)

24 SATELLITES!

SET-1 (NASA)

DSOC (NASA)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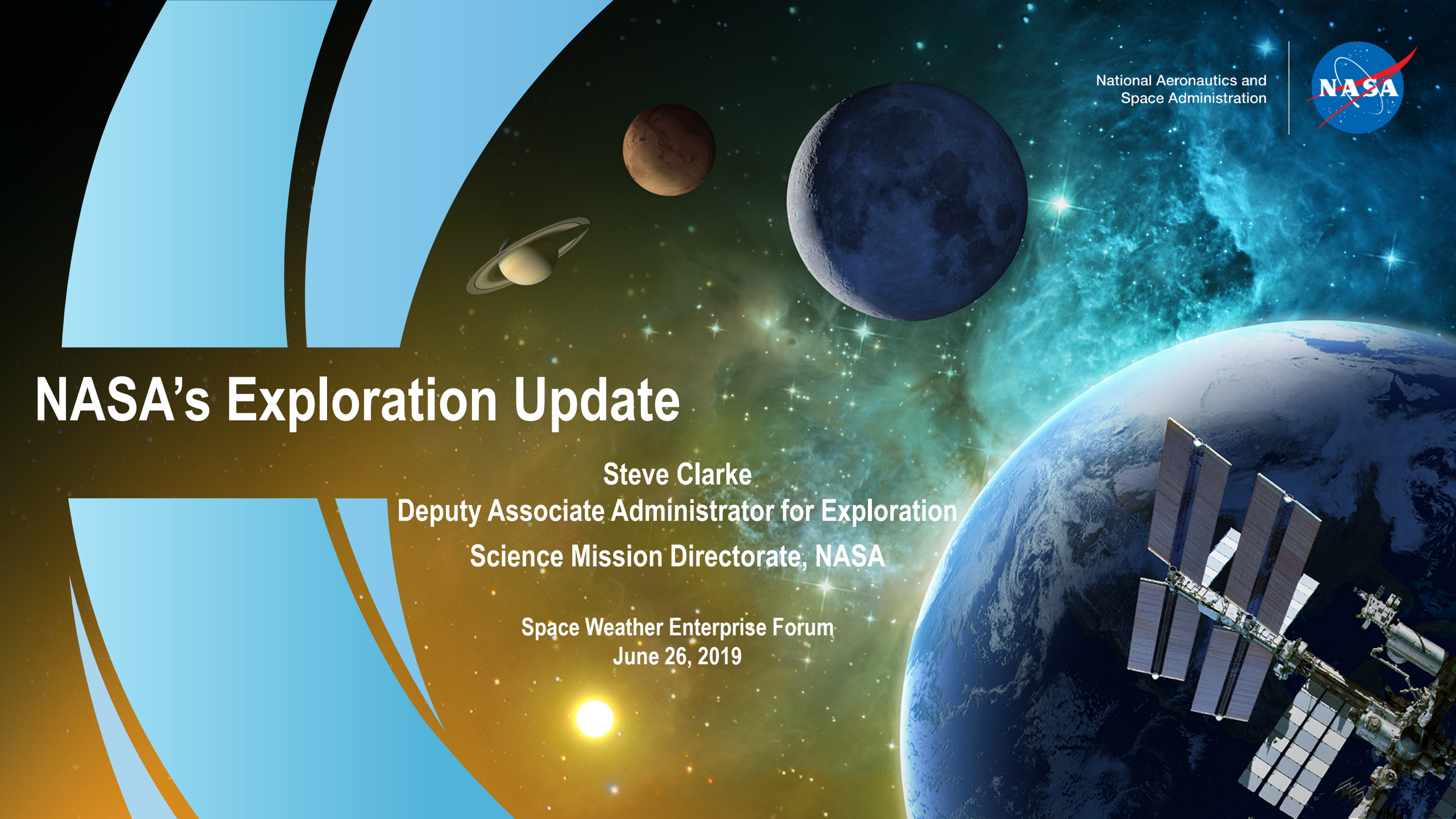
NOAA

National Aeronautics and Space Administration



NASA's Exploration Update

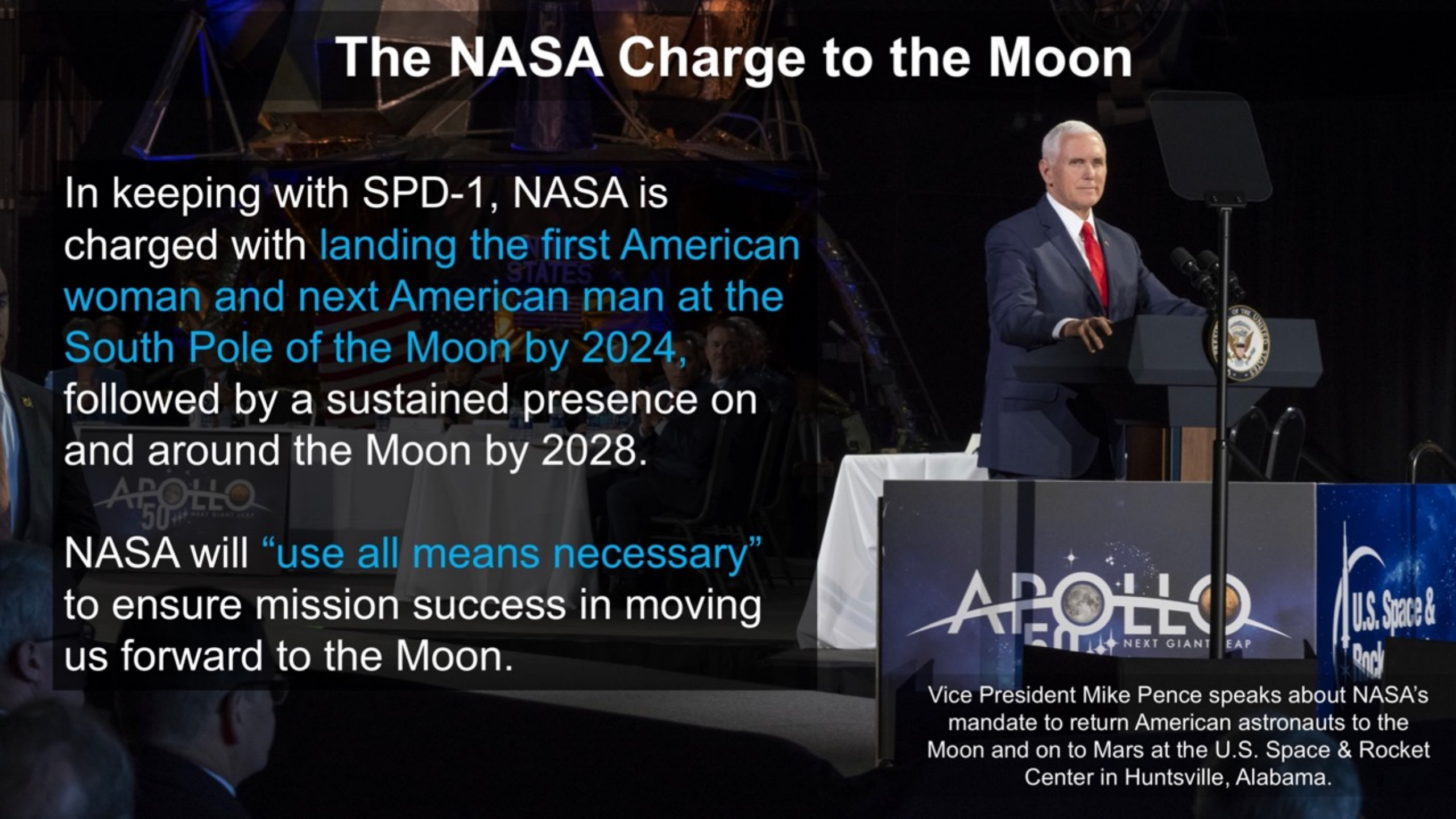
Steve Clarke
Deputy Associate Administrator for Exploration
Science Mission Directorate, NASA

Space Weather Enterprise Forum
June 26, 2019

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.



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.

Why Go to the Moon?

Establishes American leadership and strategic presence

Proves technologies and capabilities for sending humans to Mars

Inspires a new generation and encourages careers in STEM

Leads civilization changing science and technology

Expands the U.S. global economic impact

Broadens U.S. industry & international partnerships in deep space

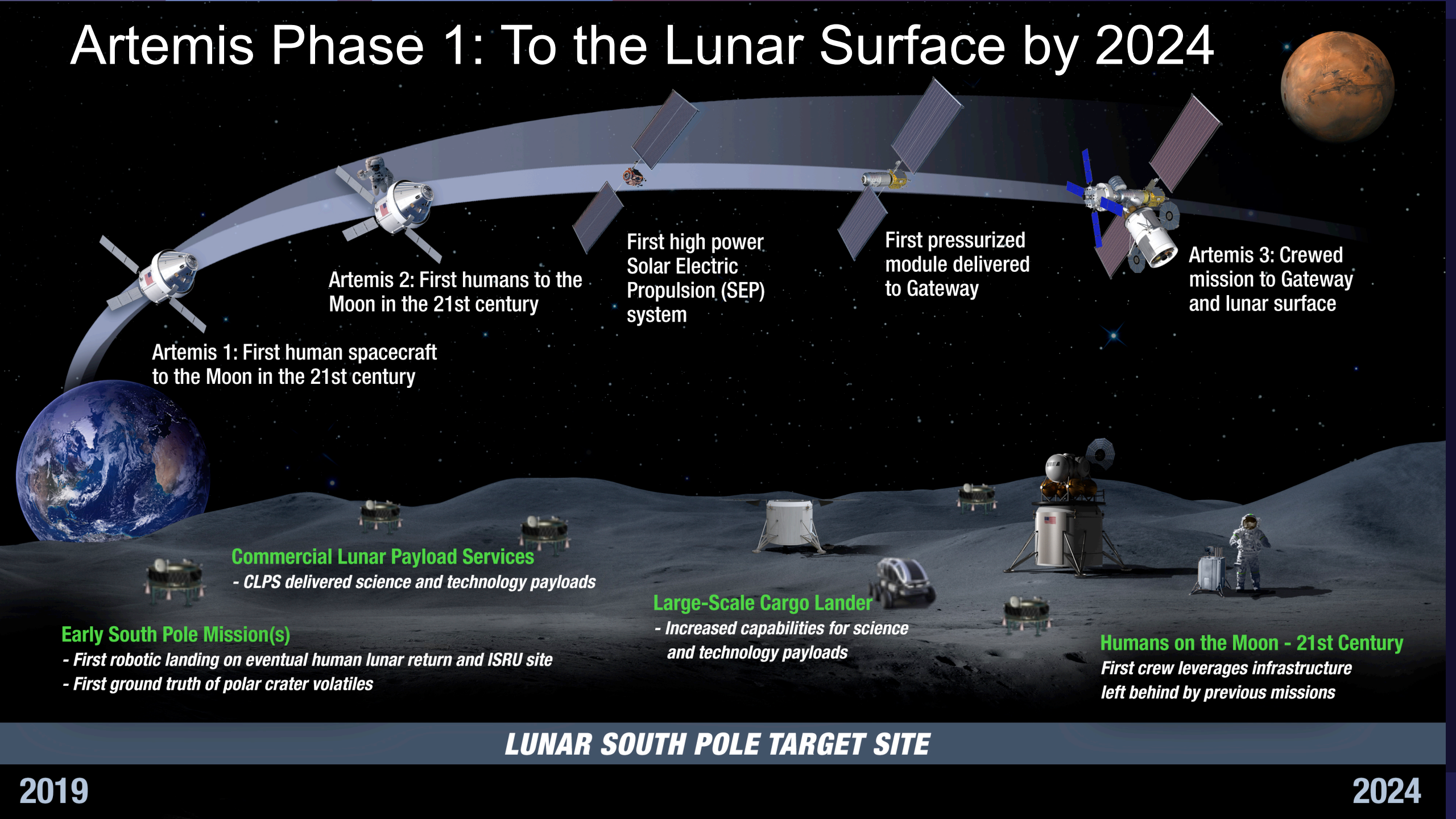
The Artemis Program

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.

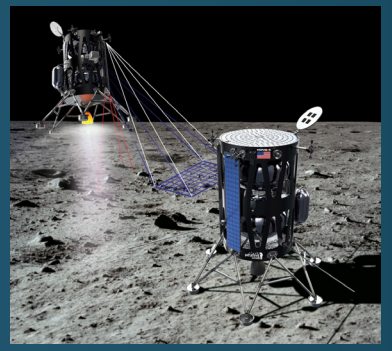
Artemis Phase 1: To the Lunar Surface by 2024




New American
Exploration Partnerships
EXPLORE
MOON to MARS
NASA

CLPS Selections

Astrobotic



Intuitive Machines

Orbit Beyond

- May 31, 2019 NASA selects first Commercial Moon Landing Services for Artemis Program to deliver science and technology to the Moon
  - Astrobotic of Pittsburgh awarded $79.5 million to fly as many as 14 payloads to Lacus Mortis, by July 2021
  - Intuitive Machines of Houston awarded $77 million to fly as many as five payloads to Oceanus Procellarum by July 2021
  - Orbit Beyond of Edison, New Jersey awarded $97 million to fly as many as four payloads to Mare Imbrium, by September 2020

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 over a dozen CubeSats with Artemis 1
- 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

Science After 2024

Human and Robotic Missions Provide Unique Science Opportunities

On Gateway

- Deep space testing of Mars-forward systems
- Hosts groundbreaking science for ***space weather forecasting***, full-disc Earth observation, astrophysics, ***heliophysics***, lunar and planetary science
- Mars transit testbed for reducing risk to humans

Surface Exploration

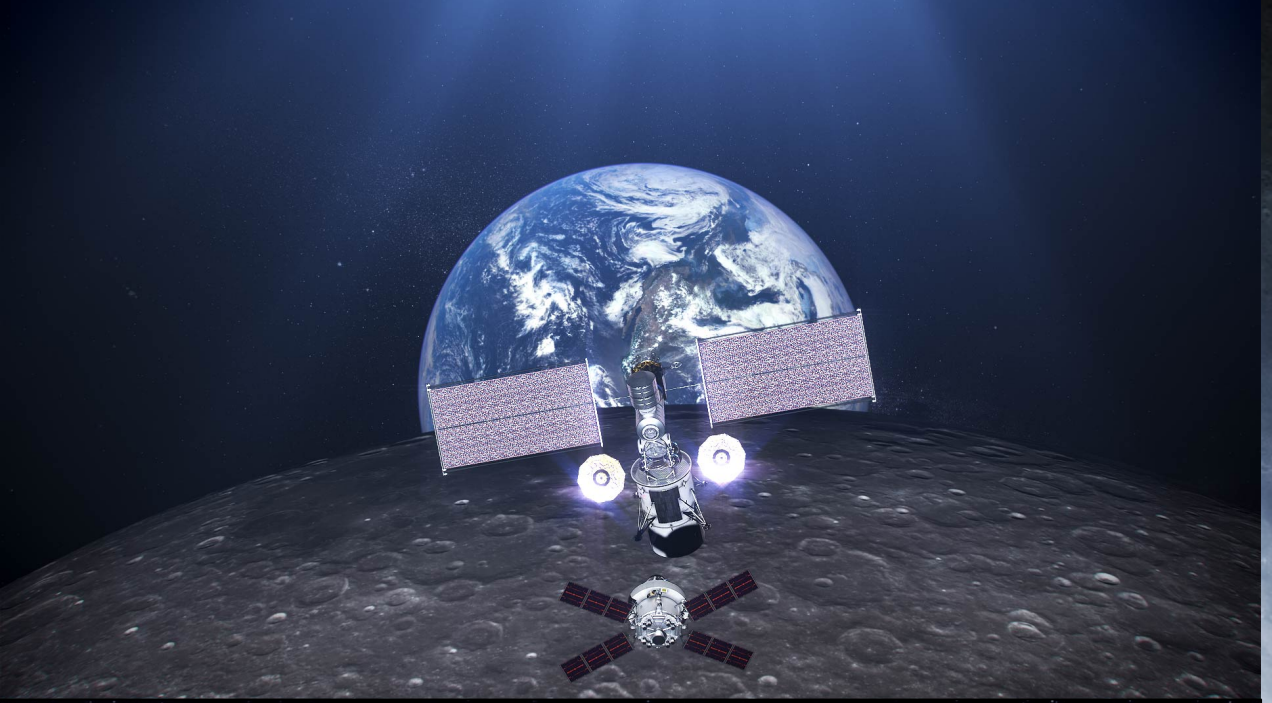
- Understanding how to use in-situ resources for fuel and life
- Revolutionizing the understanding of the origin and evolution of the Moon and inner solar system by conducting geophysical measurements and returning carefully selected samples to Earth
- Studying lunar impact craters to understand physics of the most prevalent geologic process in the solar system, impact cratering
- Setting up complex surface instrumentation for astrophysics, ***heliophysics*** and Earth observation
- Informing and supporting sustained human presence through partial gravity research in physical and life sciences, from combustion to plant growth

Surface Telerobotics to Provide Constant Science

- Sending rovers into areas too difficult for humans to explore; rovers can be teleoperated from Earth to maximize the scientific return

Science on Gateway Workshop

- Dedicated Space Weather session with 15 presentations
- Data to support Space Weather Forecasting
  - Possibly utilize smallsats released from the Gateway
- Observations of different phenomena
  - Solar Energetic Particle Events
  - X-ray Flares
  - Coronal Mass Ejections (CMEs)
  - Solar Wind Plasma
  - Interplanetary Magnetic Field
  - Galactic Cosmic Rays (GCRs)
  - GCR generated energetic particles from the lunar surface
  - Charged & neutral particle
- Spacecraft Charging & Space Environment Monitoring
  - Measure plasma/spacecraft interaction
- NASEM to host workshop in late 2019/early 2020



EXPLORE
MOON to MARS


NASA
EXPLORE MOON to MARS
MOON LIGHTS THE WAY