

National Aeronautics and
Space Administration




EXPLORE SCIENCE

NASA Space Exploration and Space Weather Workshop

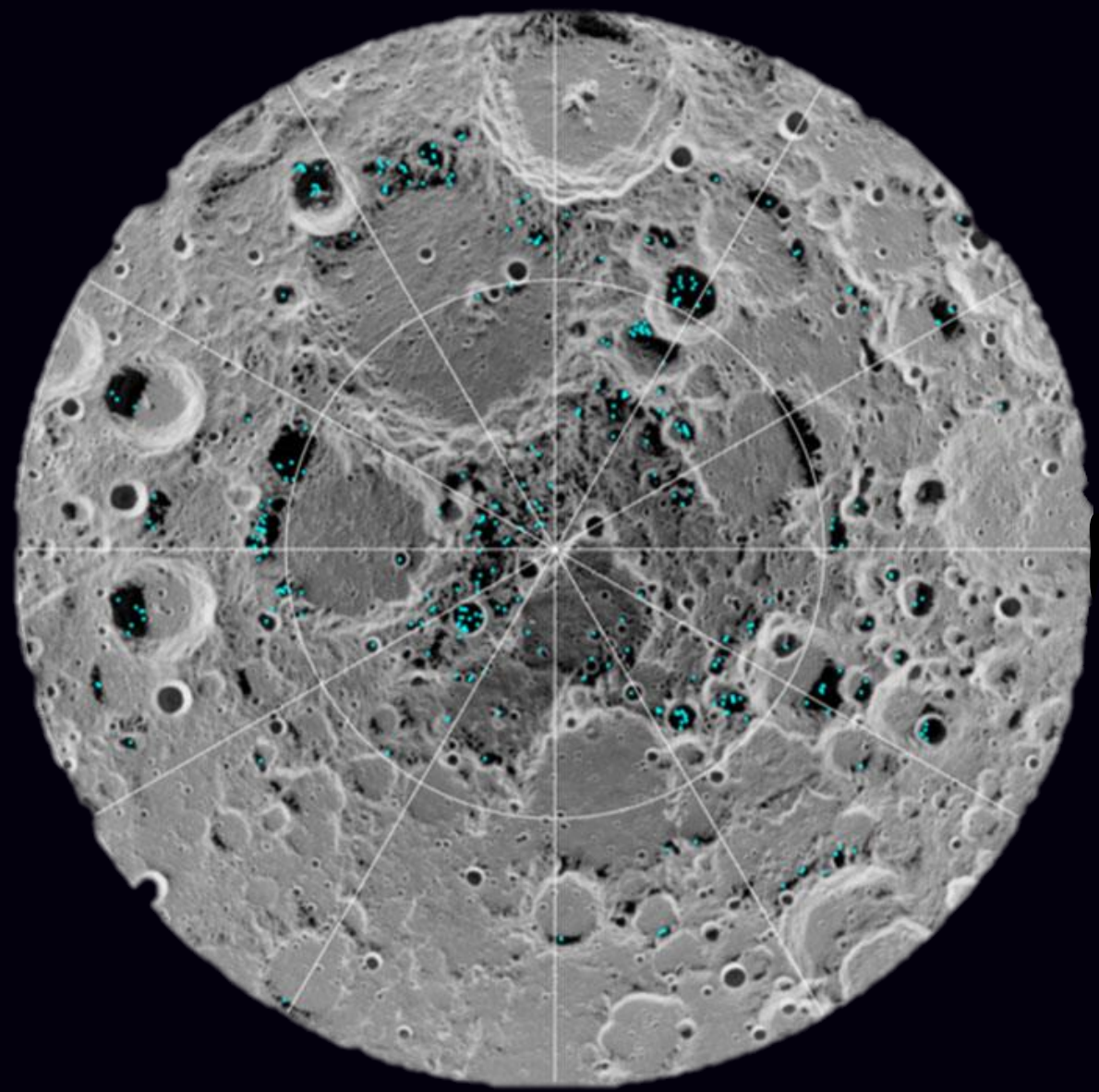
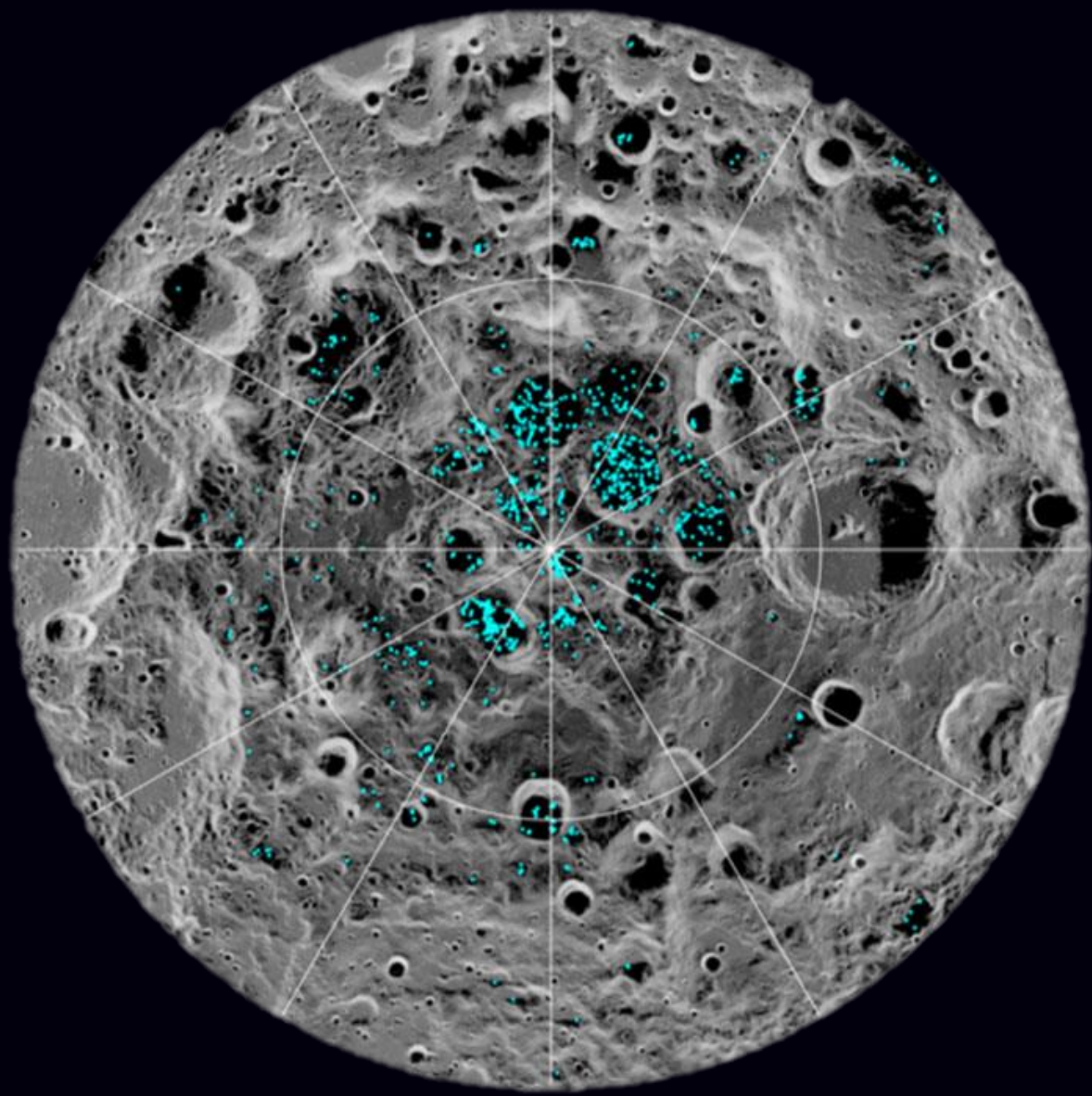
17 October 2019

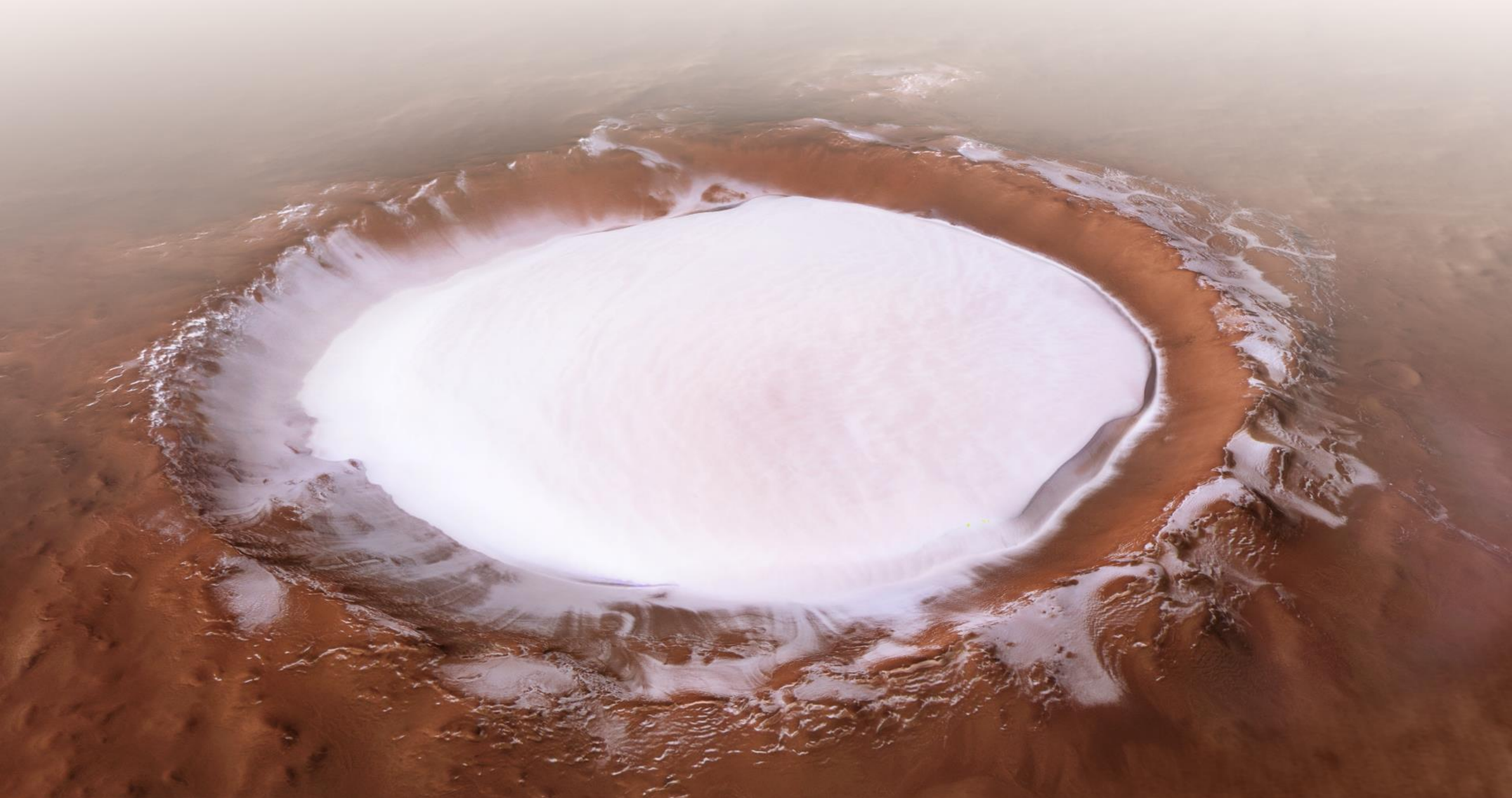
Steven W. Clarke
Deputy Associate Administrator for Exploration
Science Mission Directorate, NASA

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...”





The Artemis Program

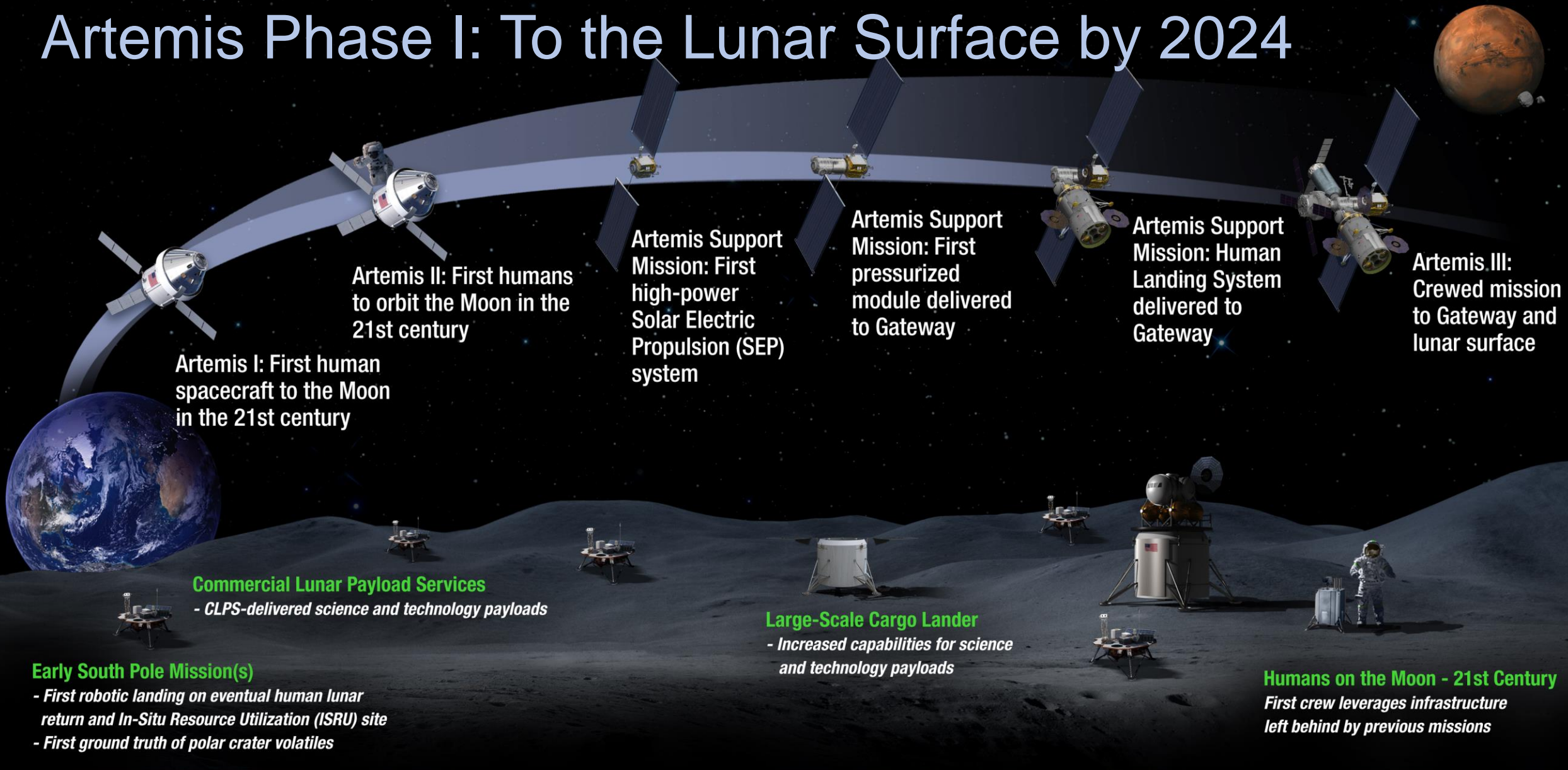
Artemis is the twin sister of Apollo and goddess of the Moon in Greek mythology. Now, she personifies our path to the Moon as the name of NASA's program to return astronauts to the lunar surface by 2024.

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 I: To the Lunar Surface by 2024



As of September 2019

LUNAR SOUTH POLE TARGET SITE

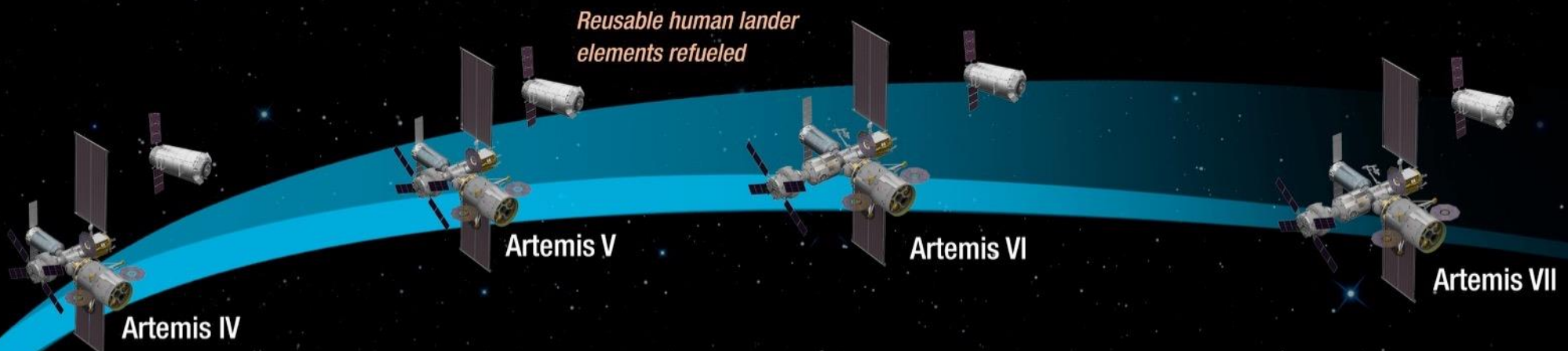
2020

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

Commercial Lunar Payload Services (CLPS)

- Contract awards announced November 29, 2018
- 10-year, indefinite delivery indefinite quantity (IDIQ) contract

Astrobotic Technology, Inc

Deep Space Systems

Draper

Firefly Aeronautics, Inc.

Intuitive Machines, LLC

Lockheed Martin Space

Masten Space Systems, Inc.

Moon Express

Orbit Beyond

- Services will be acquired through Task Orders
- First Lunar Surface Transportation Task Order awarded May 2019
- Expected Task Order cadence of 2 per year
- Future on-ramps for additional providers and as more capabilities are needed

➤ ***On-ramp RFP for enhanced lander services capability released; expected award in November 2019.***



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

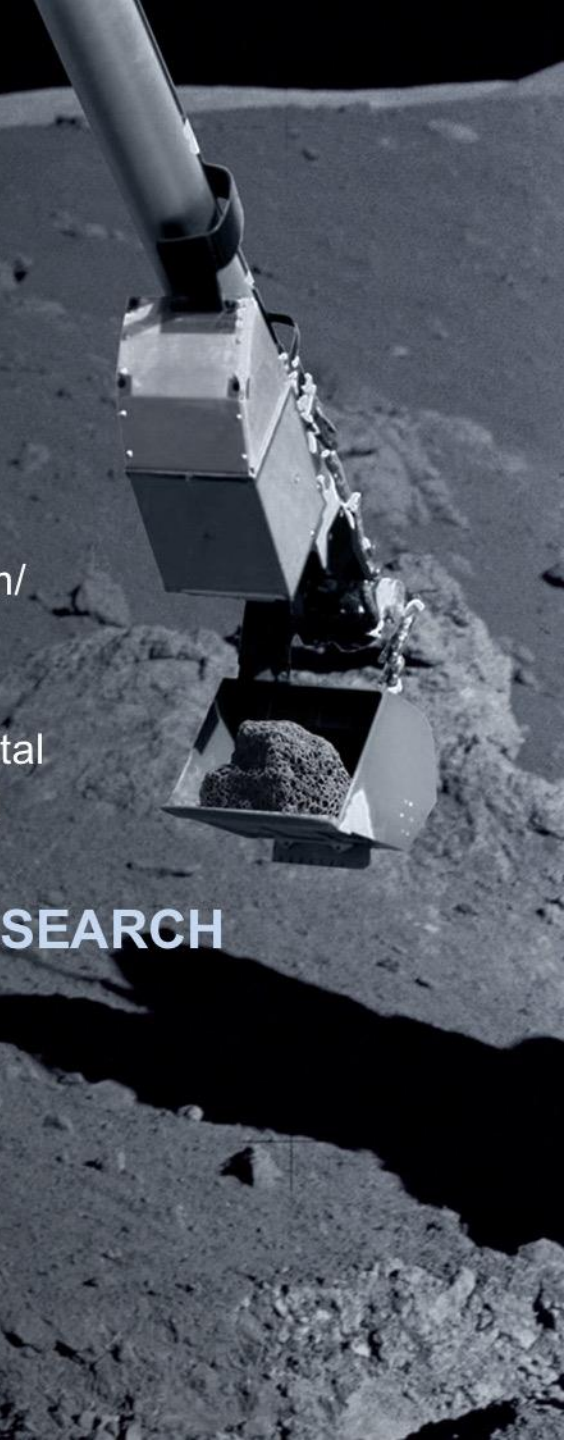
- Explore scientifically valuable terrains not investigated by Apollo, including landing at a lunar swirl and making first surface magnetic measurement
- Using PI-led instruments to generate Discovery-class science, like establishing a geophysical network and visiting a lunar volcanic region to understand volcanic evolution

ORBITAL DATA

- Deploy multiple CubeSats with Artemis I
- 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





EXPLORE MOON *to* MARS

MOON LIGHTS THE WAY

