

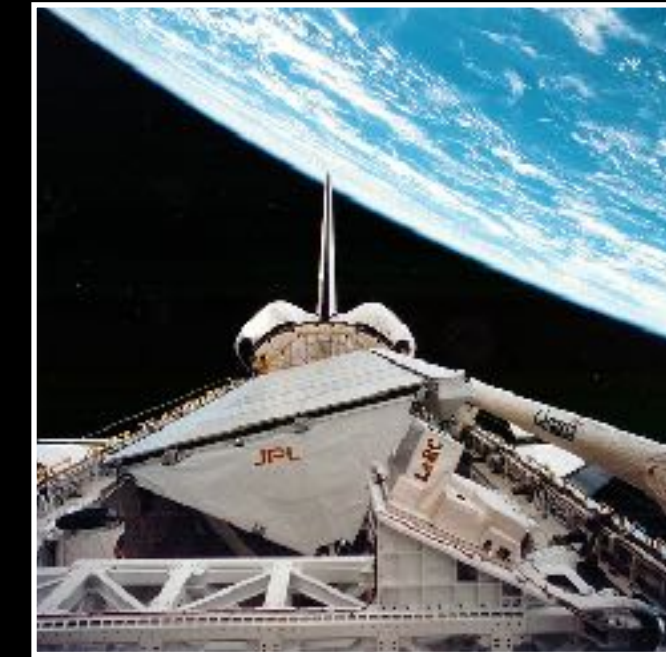
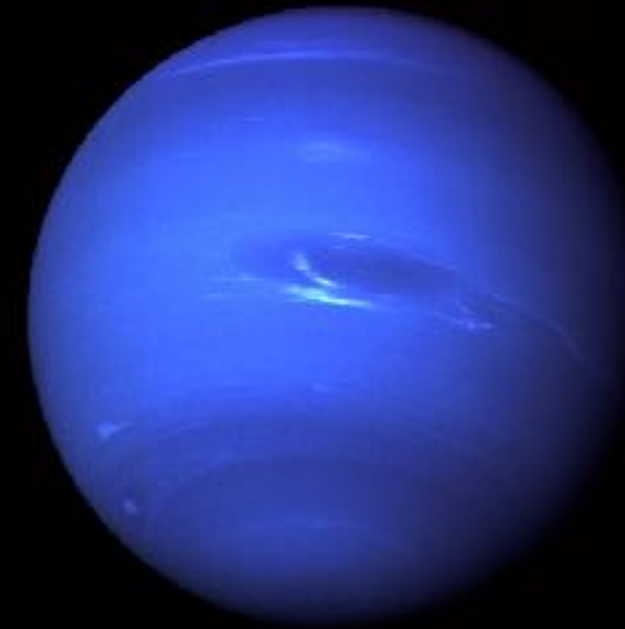
Return to the Moon

Jay Trimble
July 20, 2019
Apollo 11 50th Anniversary





Me



1960's

1981
NASA JSC Intern

1989
Science Ops
Voyager Neptune

1994
Lead Ops Director
Space Radar Lab 1

Now
Lunar Rover MOM
HLS Operations
Lunar Catalyst

NASA Johnson Space Center

NASA Jet Propulsion Laboratory

NASA Ames Research Center

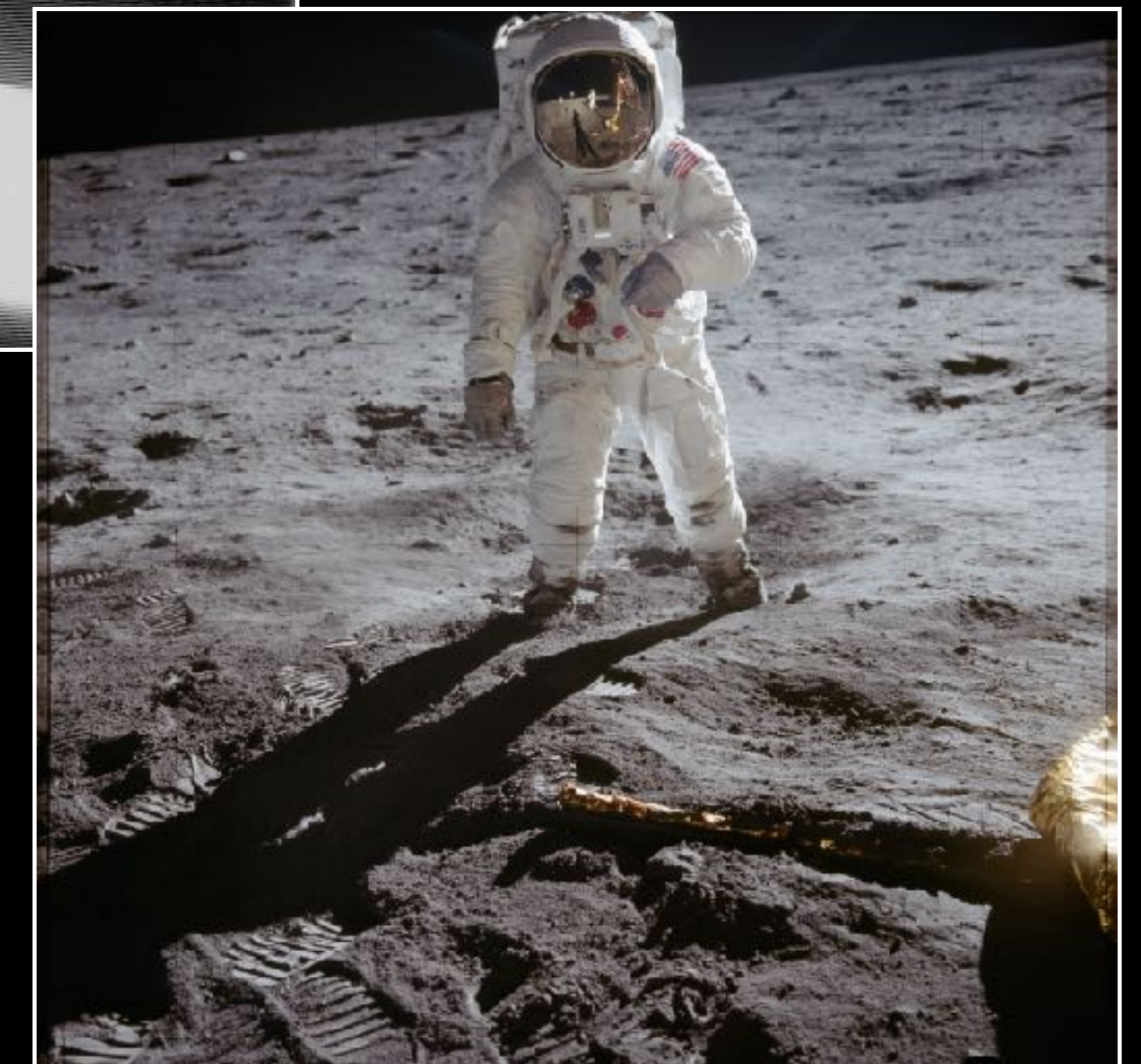
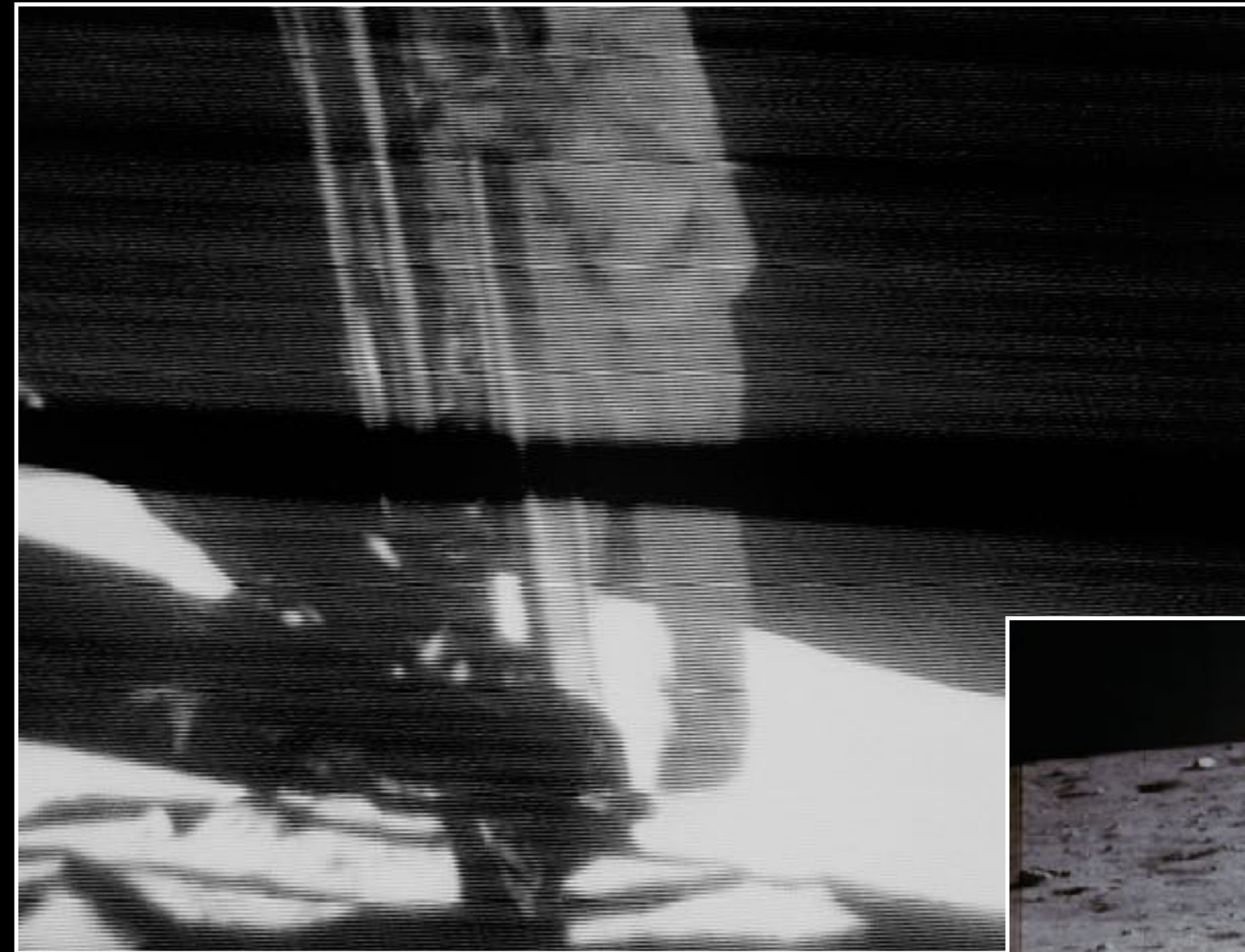


50 Years Ago

50 Years ago today

Neil and Buzz took the first human steps on another world

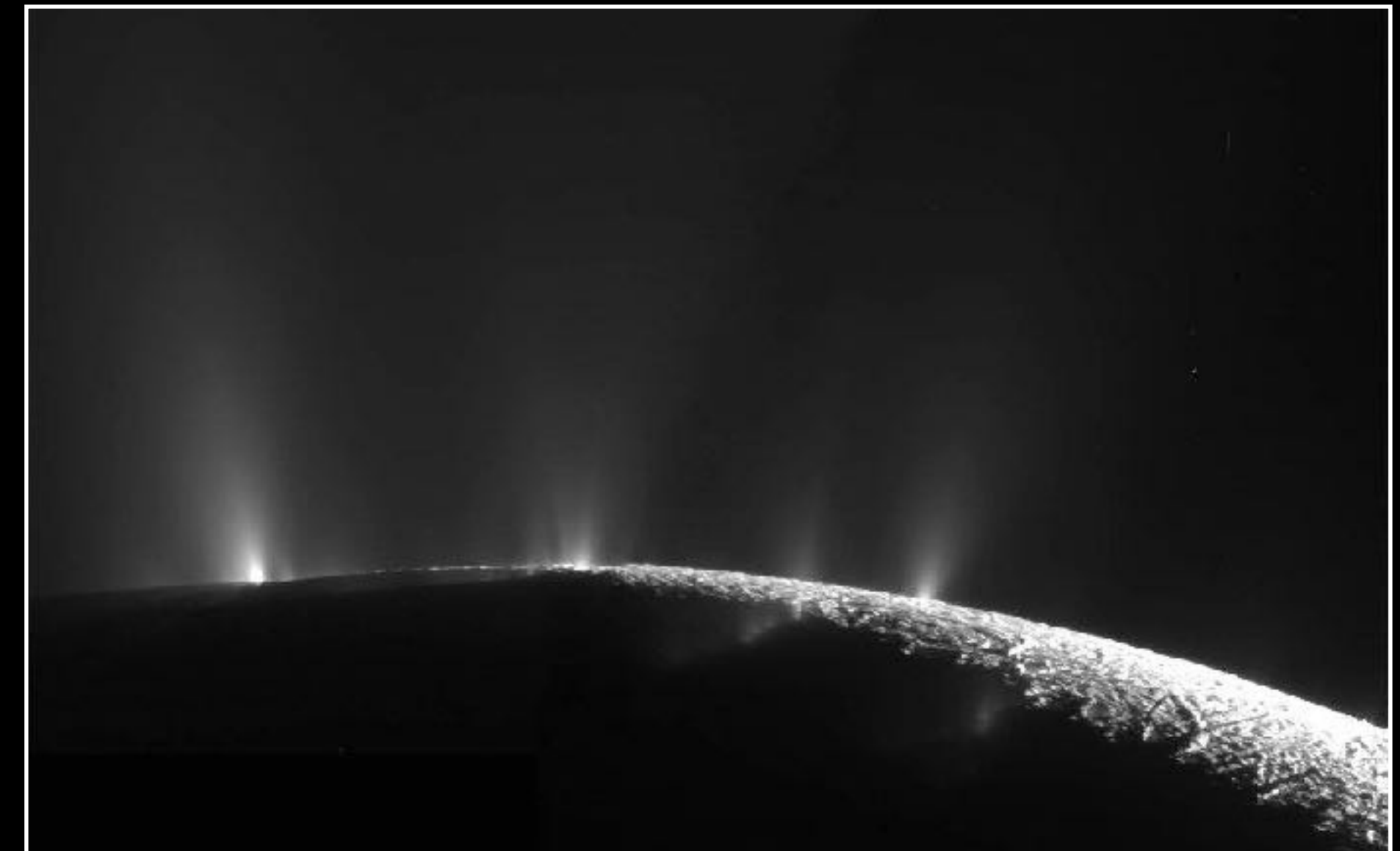
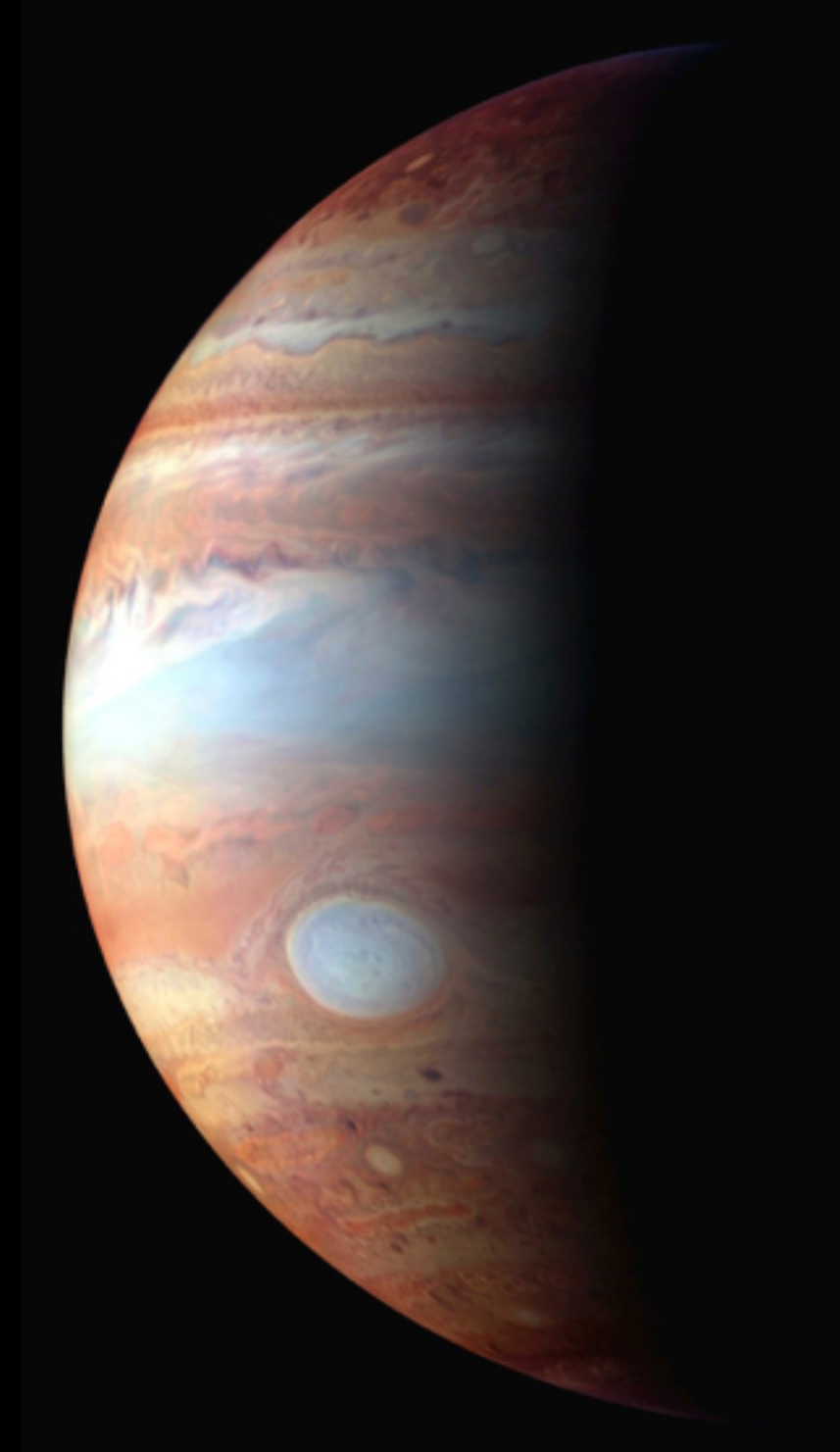
Do you remember the moment?





Since that day in 1969

Robotic explorers have visited every planet in the solar system





Since that Day in 1969

Spaceborne
observatories have
opened the universe to
us

We have extended our
senses farther than
they've ever been, giving
us new perspectives on
our place in the Universe

However...





No crewed mission has left Earth orbit since the last Apollo mission, in 1972



Our Best Days?

Apollo

A look back



Artemis

A look forward





Apollo

May 25, 1961, a young president, John F. Kennedy, challenges the nation to do the impossible

“I believe that this nation should commit itself to achieving the goal, before this decade is out, of landing a man on the moon and returning him safely to the earth”

When JFK challenged the nation, in front of the world, the United States total crewed space flight experience was 15 minutes





Mission Accomplished

July 20, 1969

**American Astronauts walk on
the Moon**



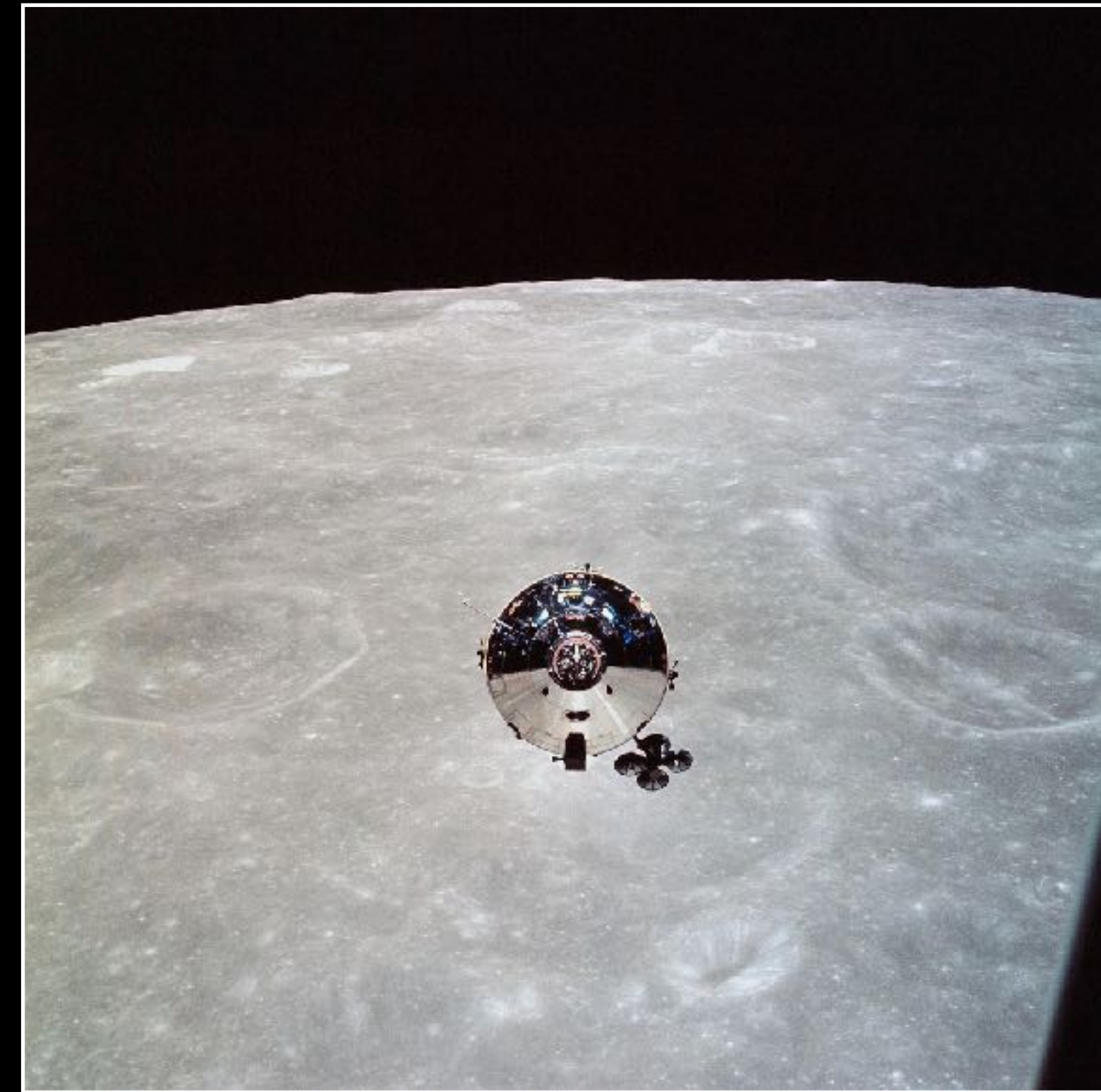


Saturn 5



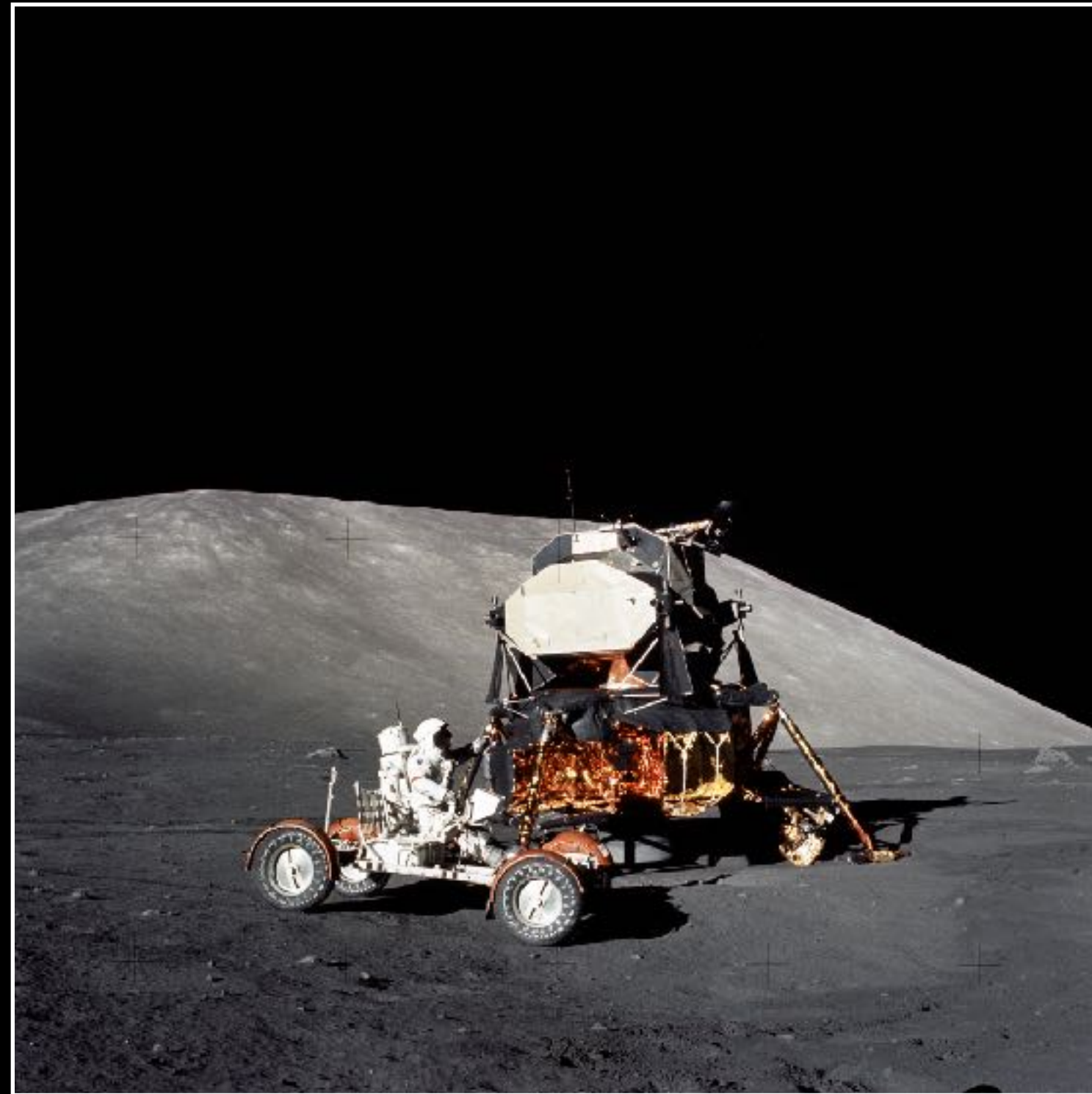
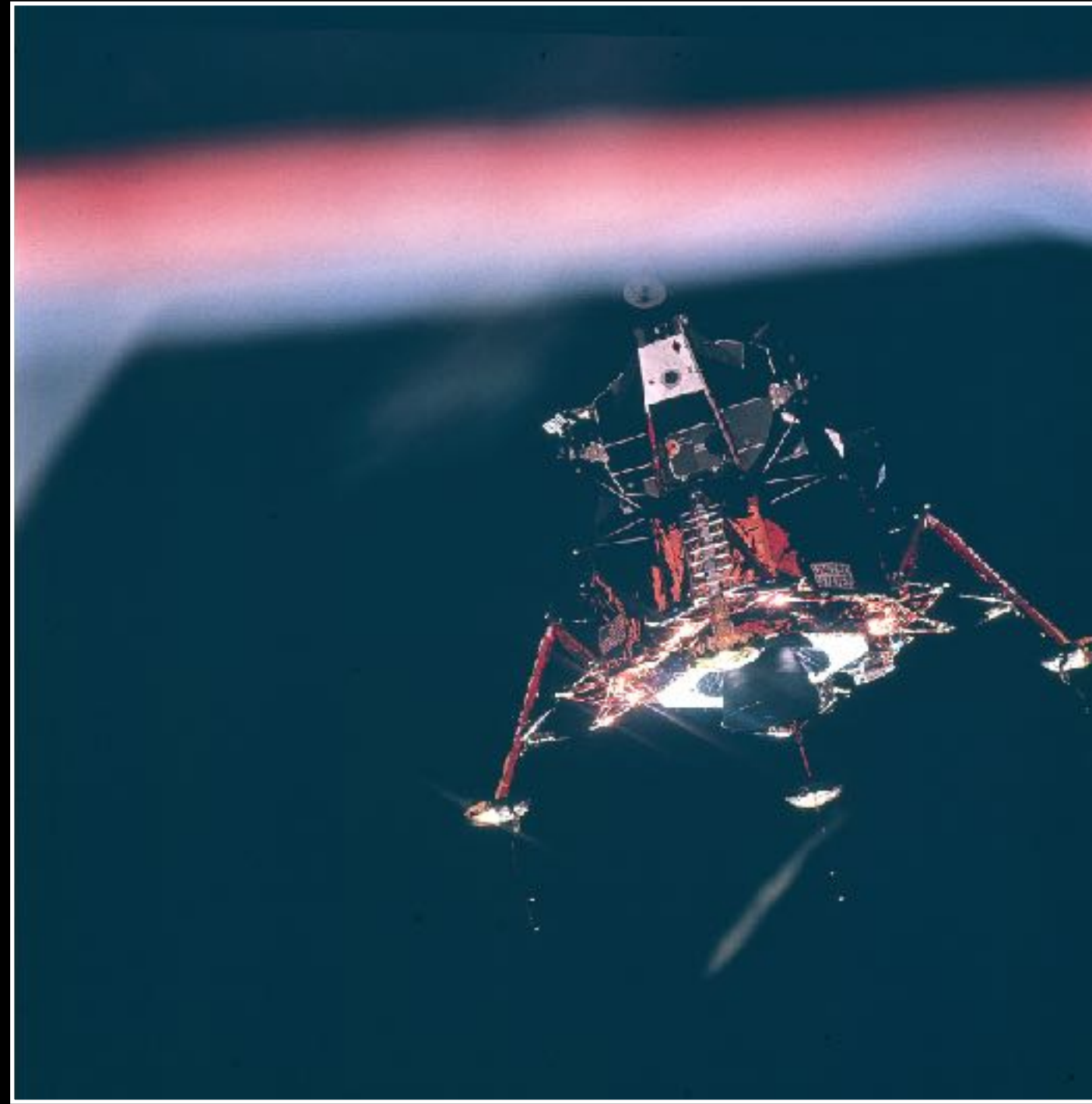


The Apollo Command-Service Module





The Apollo Lunar Module





Six Crews Explored the Surface



The first crewed lunar surface explorations, 1969 - 1972



What did we accomplish?

**“We went there to find the Moon
but instead we found the Earth” -
Bill Anders, Apollo 8**



The first Earthrise seen by human eyes,
Christmas Eve, 1968



What did we accomplish?

**Science, Knowledge,
Perspective, Inspiration**

**Look up at the Moon,
notice the heavily
cratered areas vs. the
sparsely cratered areas**





The Way Back - Artemis

**It's time to return to the Moon,
this time to stay**

Public-private partnerships

**Robotic missions as early as next
year**

**Human landings mandated by
2024**



A New Way of Working

Commercial Lunar Payload Services

NASA buys a service

Building a commercial capability

Three winners selected for the first missions

Astrobotic, Intuitive Machines, Orbit Beyond

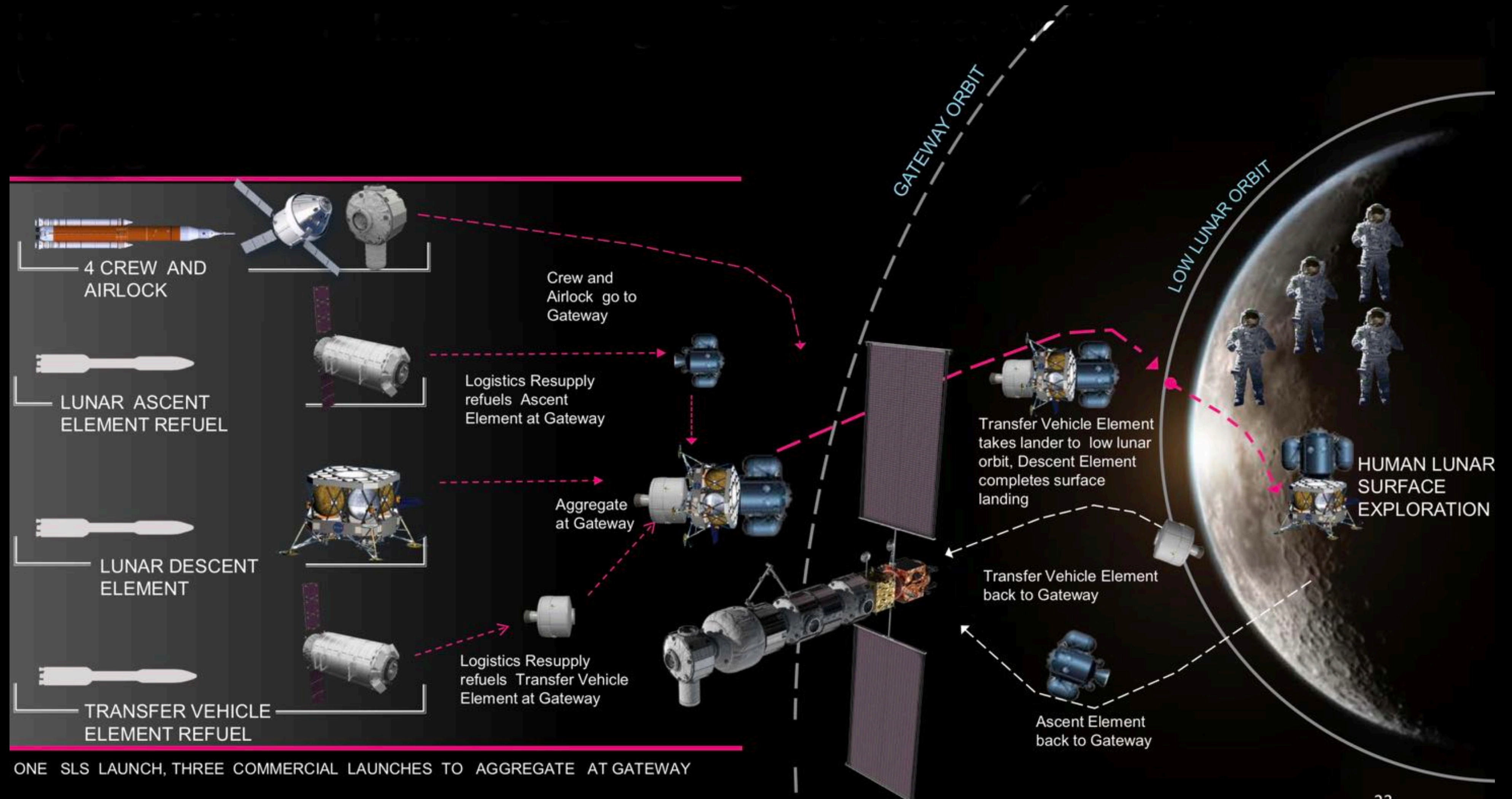


Astrobotic Peregrine Lander

Image Courtesy Astrobotic



An Artemis HLS Reference Architecture





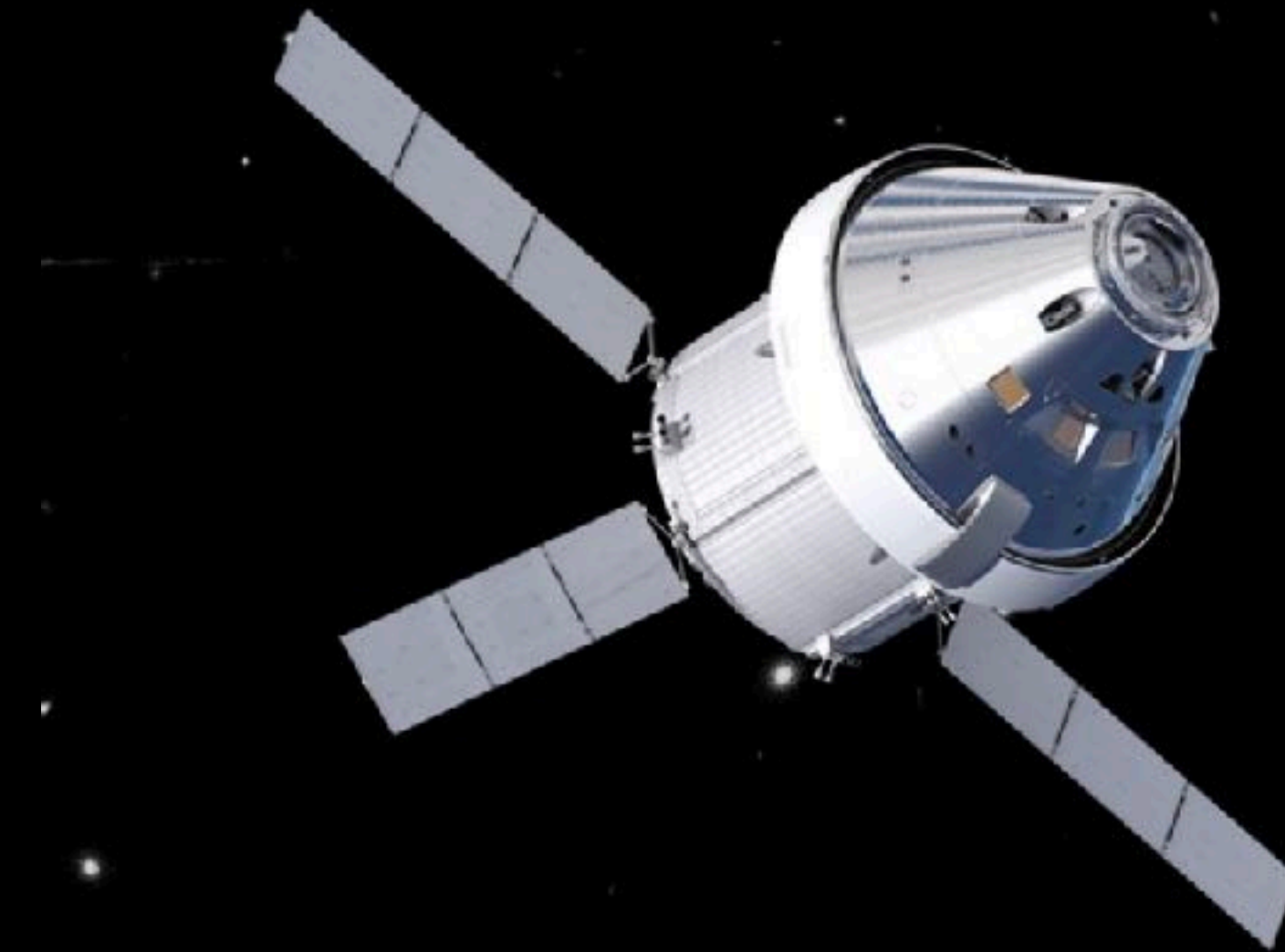
Orion

Flies the crew from Earth to the Lunar Gateway

Crew capacity

Mission duration

Reuse





The Gateway

The Lunar Gateway will provide staging, logistics, launch flexibility and global lunar surface access for landings





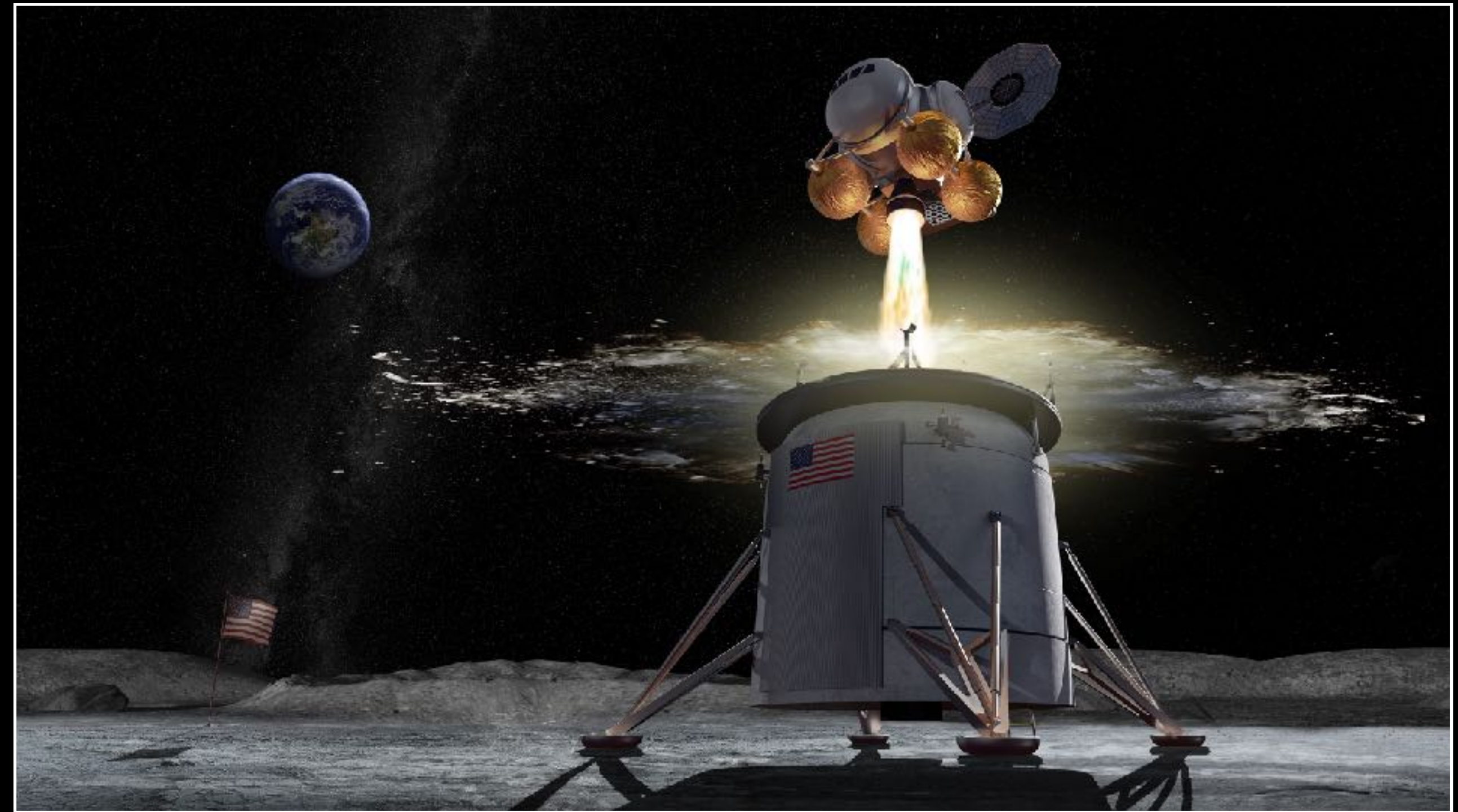
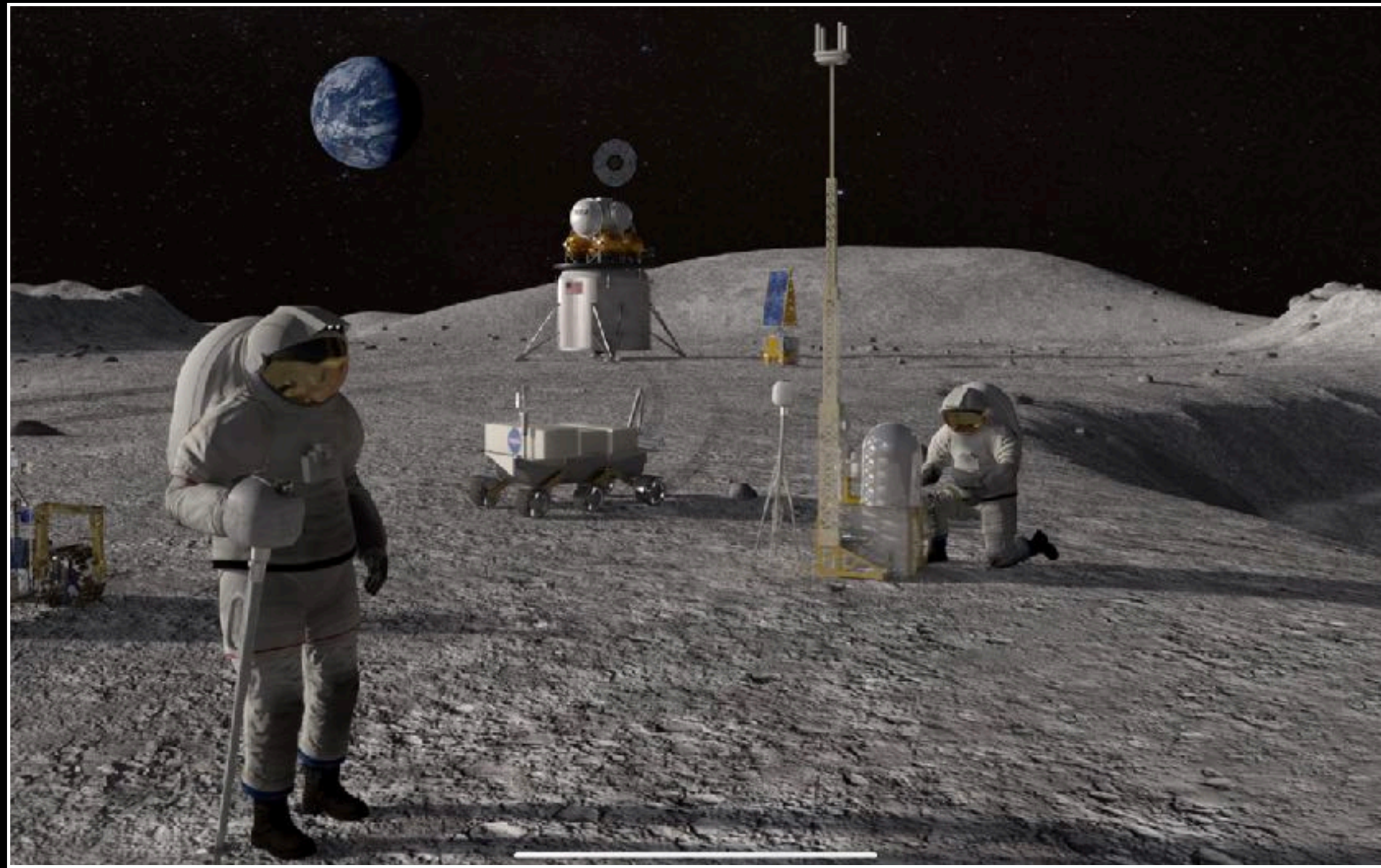
The Human Landing System



Picks up the crew at the Lunar Gateway and takes them to the lunar surface



The Human Landing System



Supports the crew on the surface and returns them to the Gateway



Reuse

Apollo - each vehicle used once

Artemis - reuse, refueling, eventual use of in-space resources



Why Go Back?

Knowledge - Science, astronomy, resources

Perspective - I can blot out the Earth with my thumb, a multi-planetary species



Managing for Success

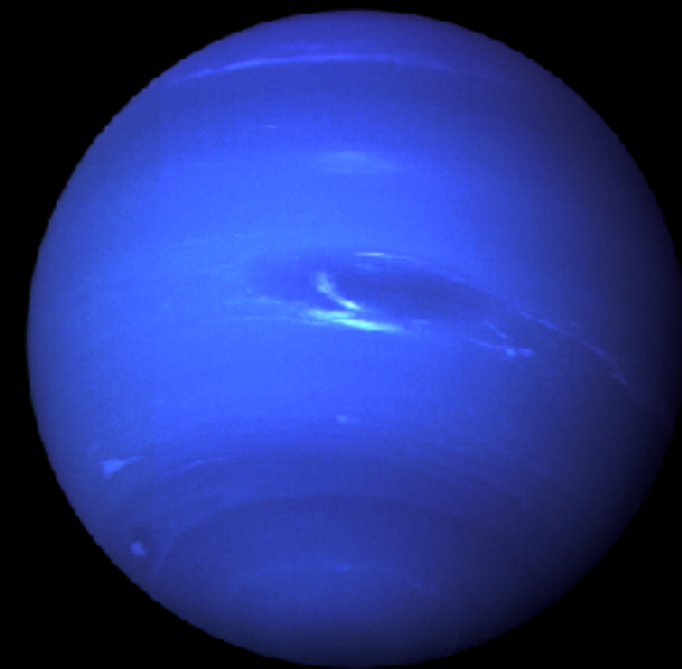
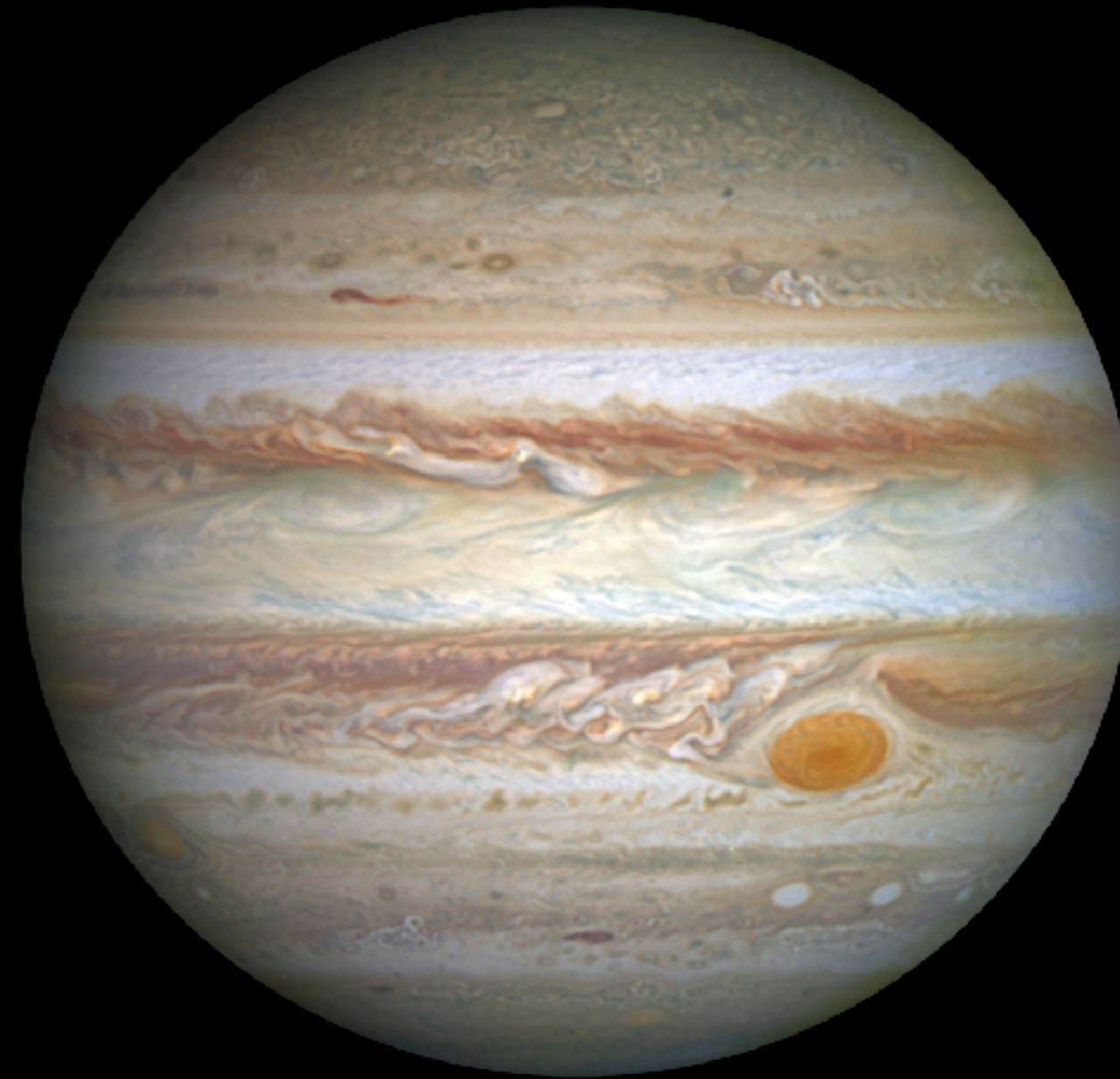
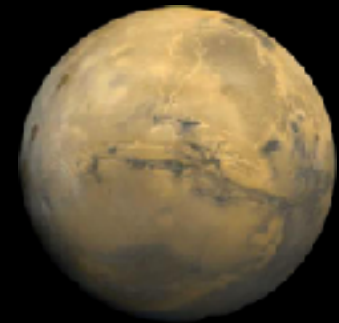
Failure is not an option

TRL

Risk posture and human behavior



The Light Speed Constraint



Earth-Moon
~6 - 25s

Mars
~14 - 40 Min

Jupiter
~80 Min

Neptune
~8 hours



Mission Control Famous Calls





Mission Control Famous Calls





Perspectives

Earth from the Moon

The Earth-Moon system

Pale Blue Dot

Earth from the surface of Mars

Earth from Saturn





Resources

Apollo 11 in real time -

Apollo 17 in real time -

images.nasa.gov

photojournal.jpl.nasa.gov

My favorite space movies and documentaries on Apollo

Apollo 11

Mission Control: The Unsung Heroes of Apollo

In The Shadow of the Moon

For All Mankind



Tours

Mission Control Restored