

National Aeronautics and
Space Administration



EXPLORE SCIENCE

NASA's Exploration Program Update

UNCOPUOS STSC
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NASA SCIENCE

AN INTEGRATED PROGRAM

Planetary
Science



Earth
Science



Joint Agency
Satellite Division



Astrophysics



Heliophysics



RESEARCH

~**10,000** U.S. Scientists Funded
~**3,000** Competitively Selected Awards
~**\$600M** Awarded Annually

TECHNOLOGY DEVELOPMENT

~**\$500M** Invested Annually

EARTH-BASED INVESTIGATIONS

20 Airborne Missions
8 Global Networks

SPACECRAFT

98 Missions
82 Spacecraft

SMALLSATS/ CUBESATS

36 Science Missions
20 Technology Demos

SOUNDING ROCKETS

16 Science Missions
5 Tech/Student Missions

BALLOONS

10 Science Missions
4 Technology/Student

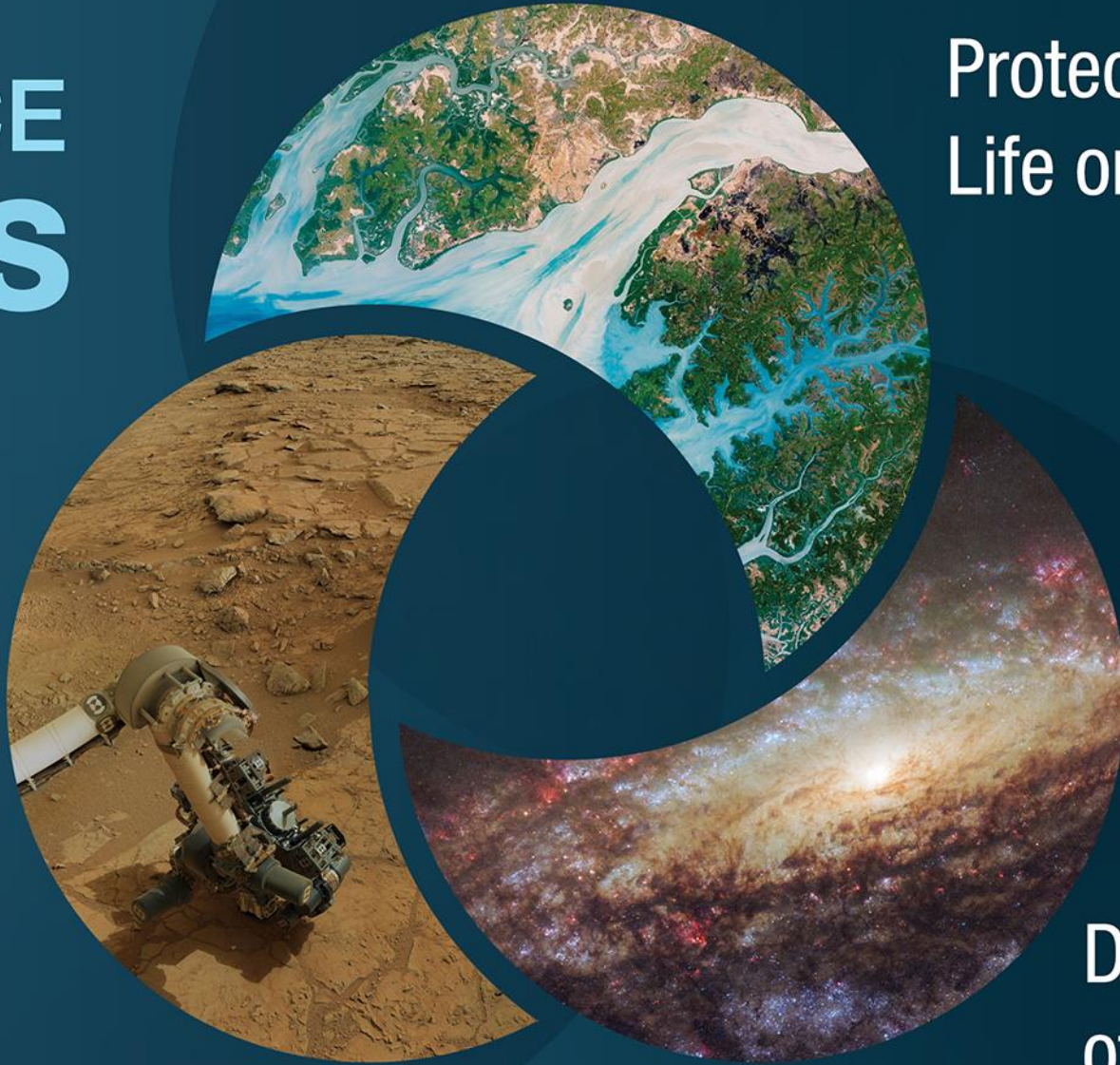
Science by the
NUMBERS

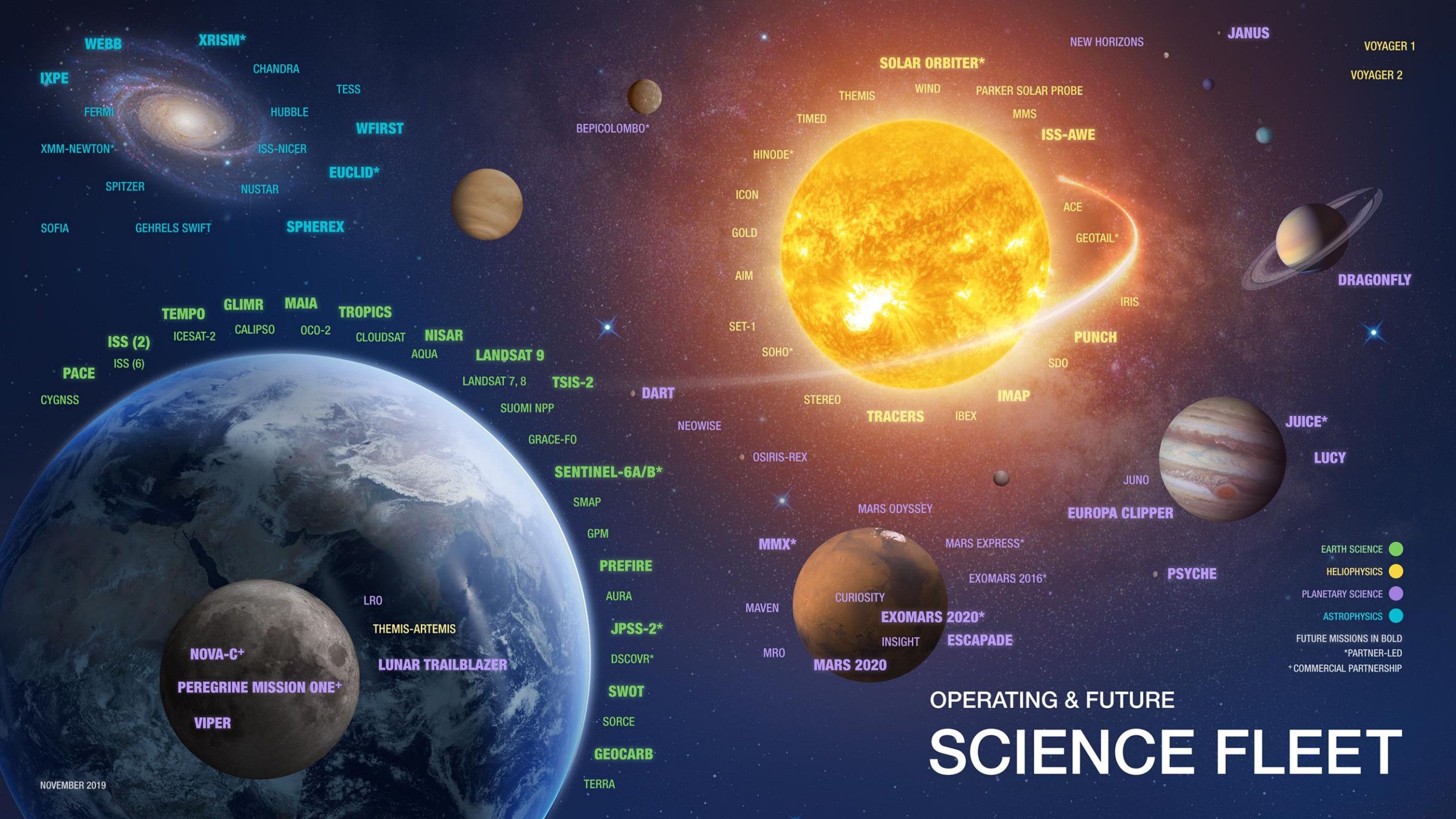
KEY SCIENCE THEMES

Protect & Improve
Life on Earth

Search for
Life Elsewhere

Discover Secrets
of the Universe





WEBB **XRISM***
IXPE **CHANDRA**
FERMI **HUBBLE**
XMM-NEWTON* **ISS-NICER**
SPITZER **NUSTAR**
SOFIA **GEHRELS SWIFT** **EUCLID***
SPHEREX

TEMPO **GLIMR** **MAIA** **TROPICS**
ISS (2) **ICESAT-2** **CALIPSO** **OCO-2** **CLOUDSAT** **NISAR**
ISS (6) **AQUA** **LANDSAT 9**
PACE **LANDSAT 7, 8** **TSIS-2**
CYGNSS **SUOMI NPP**
GRACE-FO

NOVA-C+
PEREGRINE MISSION ONE+
VIPER
LRO
THEMIS-ARTEMIS
LUNAR TRAILBLAZER

BEPICOLOMBO*

DART

SENTINEL-6A/B*

SMAP
GPM

PREFIRE

AURA
JPSS-2*

DSCOVR*

SWOT

SORCE

GEOCARB

TERRA

SOLAR ORBITER*

THEMIS **WIND** **PARKER SOLAR PROBE**
TIMED **MMS**

HINODE*

ICON

GOLD

AIM

SET-1

SOHO*

STEREO

TRACERS

OSIRIS-REX

MMX*

MAVEN

MRO

CURIOSITY

EXOMARS 2020*

INSIGHT

MARS 2020

MARS ODYSSEY

MARS EXPRESS*

EXOMARS 2016*

ESCADAPE

NEW HORIZONS

JANUS

VOYAGER 1

VOYAGER 2

ISS-AWE

ACE

GEOTAIL*

IRIS

PUNCH

SDO

IMAP

IBEX

JUNO

EUROPA CLIPPER

JUICE*

LUCY

PSYCHE

- EARTH SCIENCE** ●
- HELIOPHYSICS** ●
- PLANETARY SCIENCE** ●
- ASTROPHYSICS** ●

FUTURE MISSIONS IN BOLD
***PARTNER-LED**
+COMMERCIAL PARTNERSHIP

OPERATING & FUTURE SCIENCE FLEET

Solar Orbiter

Observing the Sun from new vantage points



MISSION
UPDATE



Nov. 1, 2019 – Solar Orbiter spacecraft arrived at NASA's Kennedy Space Center's Shuttle Landing Facility; Liftoff scheduled for Feb. 5, 2020, from Cape Canaveral Air Force Station aboard United Launch Alliance Atlas V rocket

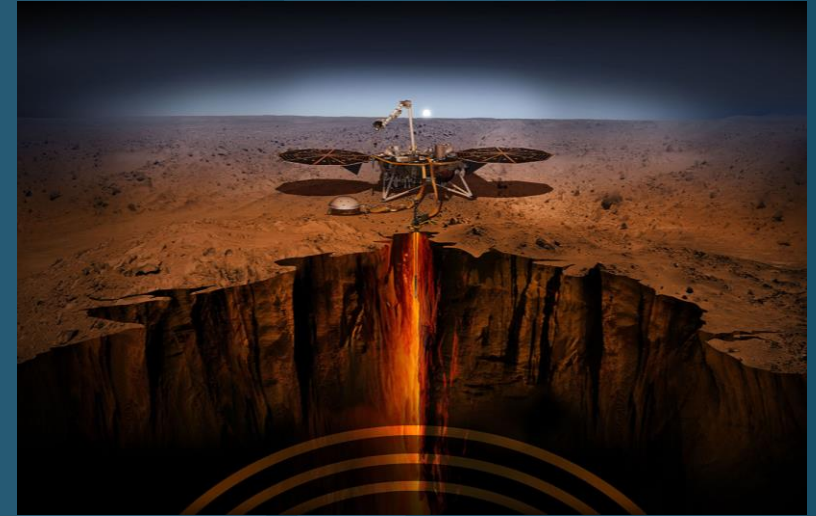


InSight

Taking the 'Vital Signs' of Mars



MISSION
UPDATE



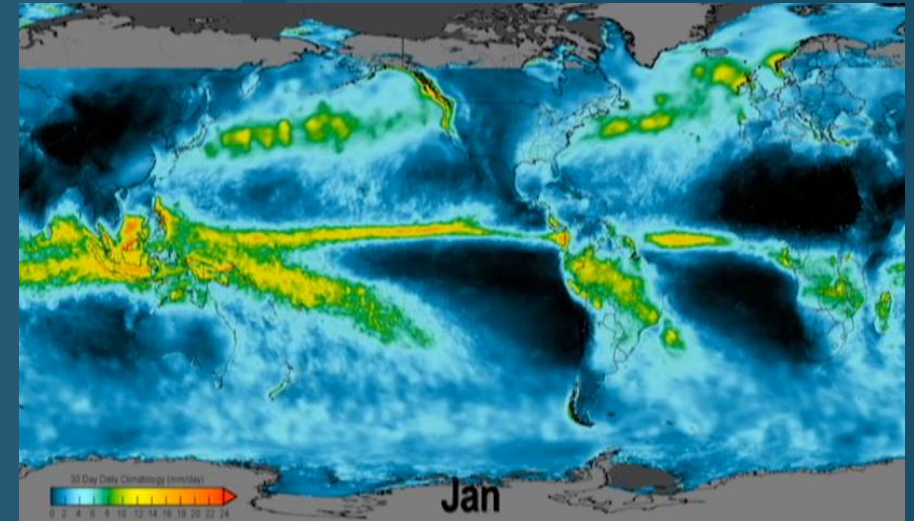
Nov. 19, 2019 – 50 hammer strokes were carried out with the scoop pressing against the soil/mole; the mole penetrated 4cm. The next hammering was on December 4, 2019

GPM

Global Precipitation Measurement



SCIENCE
HIGHLIGHT



Aug. 15, 2019 – NASA's newest IMERG analysis combines TRMM data with GPM's data to create a nearly 20-year record of precipitation



The Artemis Program

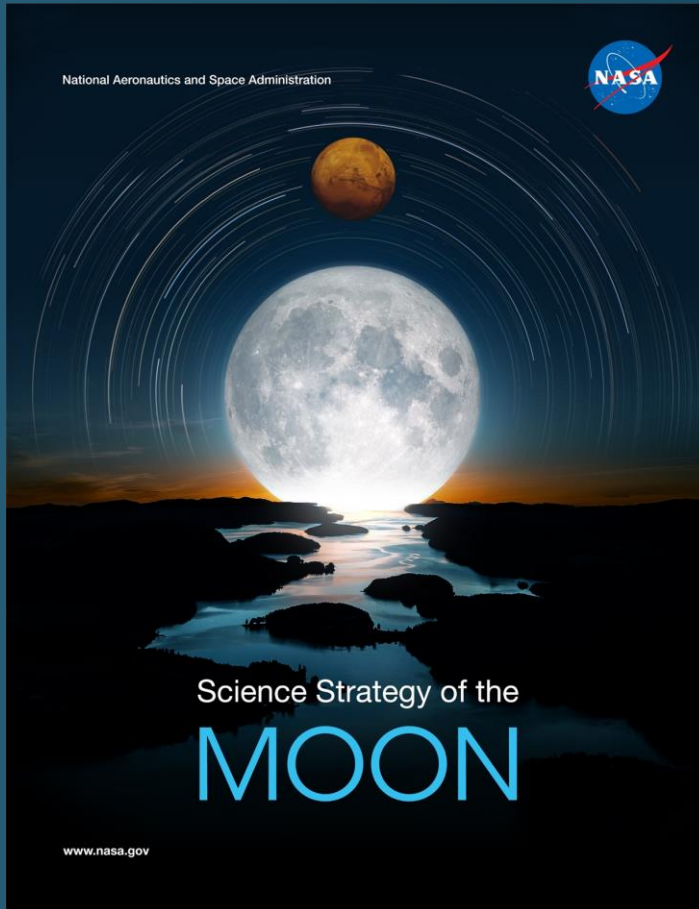
Artemis is the twin sister of Apollo and goddess of the Moon in Greek mythology. Now, she personifies our path to the Moon as the name of NASA's program to return astronauts to the lunar surface by 2024.

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.



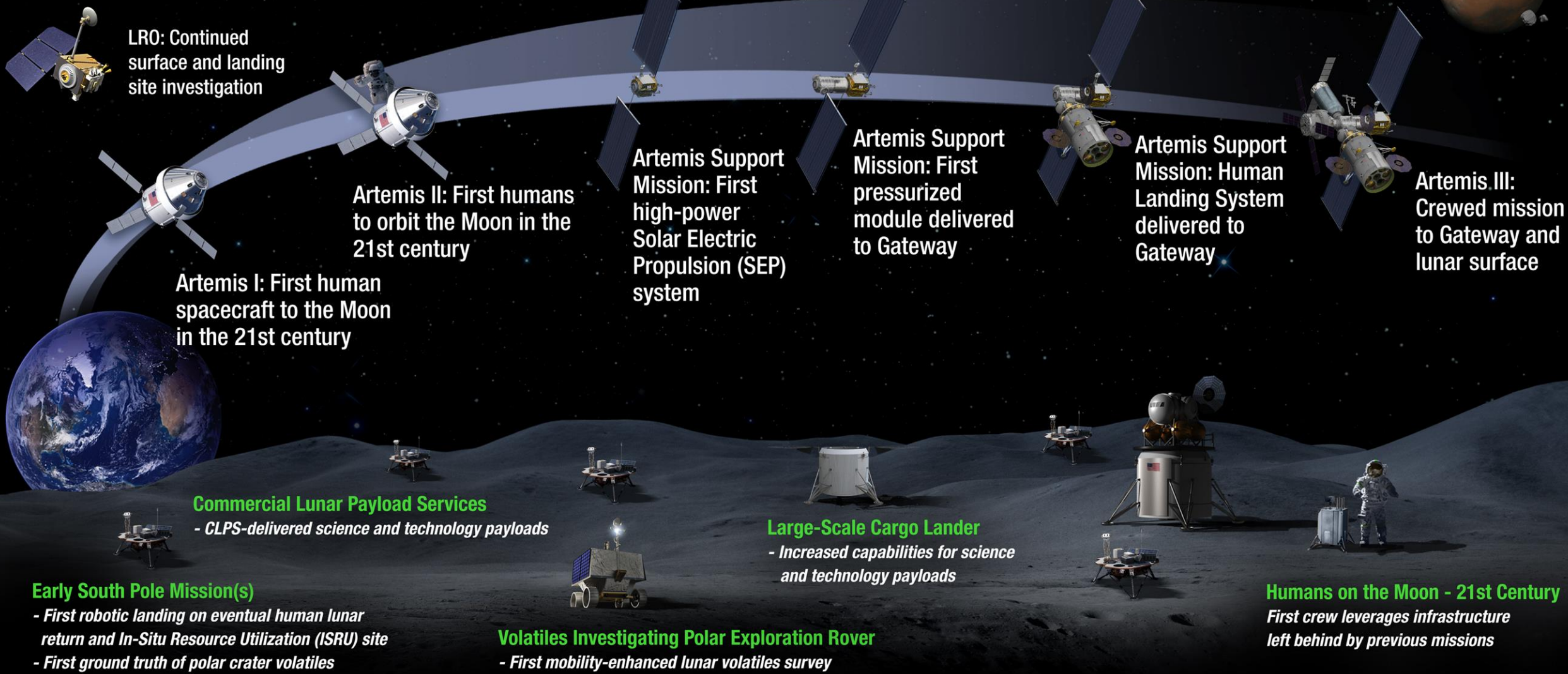
Science Strategy of the Moon



Implementation Strategy with Crew and Robotics

- Develop an exploration science mission plan for the first human return mission
- Use Commercial Lunar Payload Services (CLPS) contract to deliver instruments on and near the Moon
 - Volatile measurements are a priority
 - Science at both polar and non-polar locations
 - Drive increased capability including mobility and sample return
- Release and award science instrument development opportunities on an annual basis
- Develop an international strategy to enable partner scientific contributions

Humans Return by 2024



LUNAR SOUTH POLE TARGET SITE

2020

2024



BLUE ORIGIN



*Commercial Lunar
Payload Services
(CLPS)*



*Working together to deliver science and
technology to the lunar surface*

DRAPER



Astrobotic Technology



Peregrine Lander

PAYLOADS:

Exploration

- Laser Retroreflector Array (LRA)
- Navigation Doppler Lidar for Precise Velocity and Range Sensing (NDL)
- Surface Exosphere Alterations by Landers (SEAL)

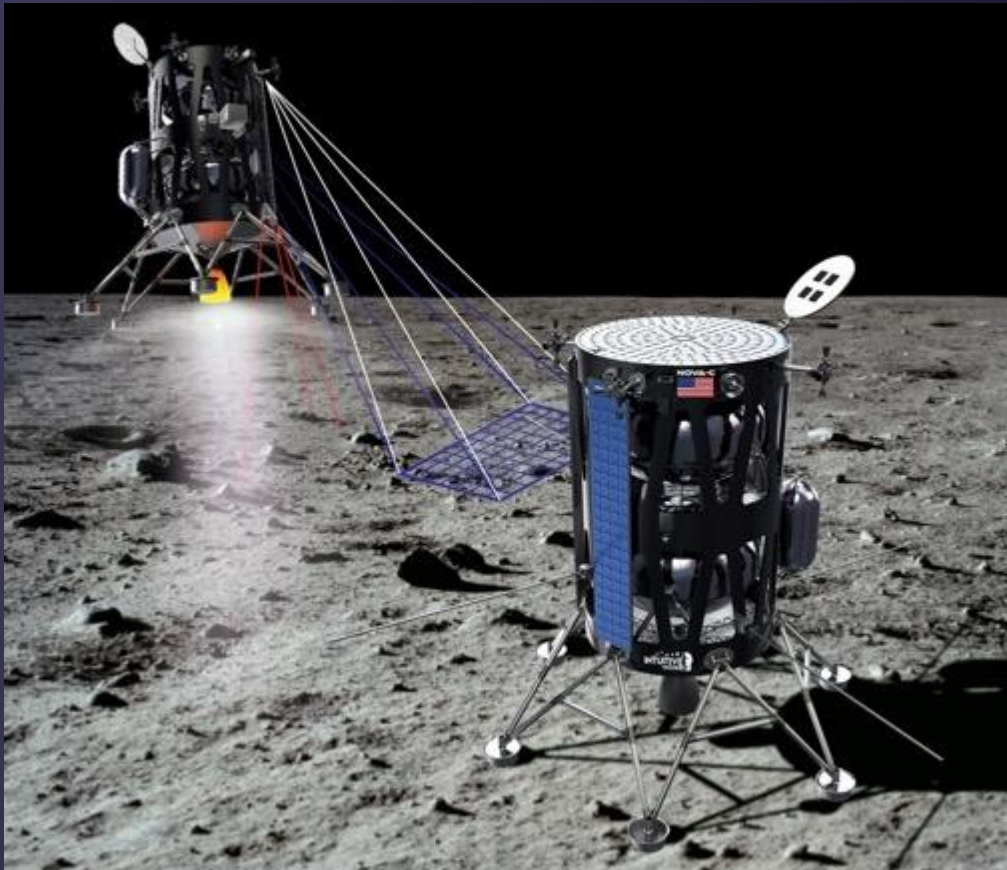
Technology

- Photovoltaic Investigation on Lunar Surface (PILS)

Science

- Fluxgate Magnetometer (MAG)
- Laser Retroreflector Array (LRA)
- Linear Energy Transfer Spectrometer (LETS)
- Mass Spectrometer Observing Lunar Operations (MSolo)
- Near-Infrared Volatile Spectrometer System (NIRVSS)
- Neutron Measurements at the Lunar Surface ((NMLS)
- Neutron Spectrometer System (NSS)
- PROSPECT Ion-Trap Mass Spectrometer (PITMS) for Lunar Surface Volatiles

Intuitive Machines



Nova-C Lunar Lander

PAYLOADS:

Exploration

- Laser Retroreflector Array (LRA)
- Navigation Doppler Lidar for Precise Velocity and Range Sensing (NDL)
- Stereo Cameras for Lunar Plume-Surface Studies (SCALPSS)

Technology

- Lunar Node 1 Navigation Demonstrator (LN-1)

Science

- Laser Retroreflector Array (LRA)
- Low-frequency Radio Observations from the Near Side Lunar Surface (ROLSES)

A vibrant space-themed background featuring a large blue and white planet (Earth) in the lower left, a bright yellow sun, and various other celestial bodies including a ringed planet (Saturn), a reddish planet (Mars), and a dark blue planet (Moon) in the upper left. The background is filled with stars and nebulae in shades of blue and green.

Summary of International Interest

- Australia - Australia Space Agency* & Curtin University**
- Canadian Space Agency
- European Space Agency*
- Italian Space Agency
- Japan Aerospace Exploration Agency
- Korea (Korea Astronomy & Space Science Institute, Exploration Science Working Group)
- Monaco
- Polish Space Agency
- Swiss Space Office**
- United Kingdom Space Agency*
- UAE

* Sol: Statement of Intent

** LoS: Letter of Support



EXPLORE MOON_{to}MARS

MOON LIGHTS THE WAY

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