



National Aeronautics and
Space Administration

2023 NASA SCIENCE

**Space Science
Week 2023**

March 28, 2023

Dr. Nicola J. Fox

Associate Administrator

NASA Science Mission Directorate

 @solargirl2018



BUDGET SUMMARY





A view of Earth's horizon from the International Space Station

FY24 Agency Budget Highlights

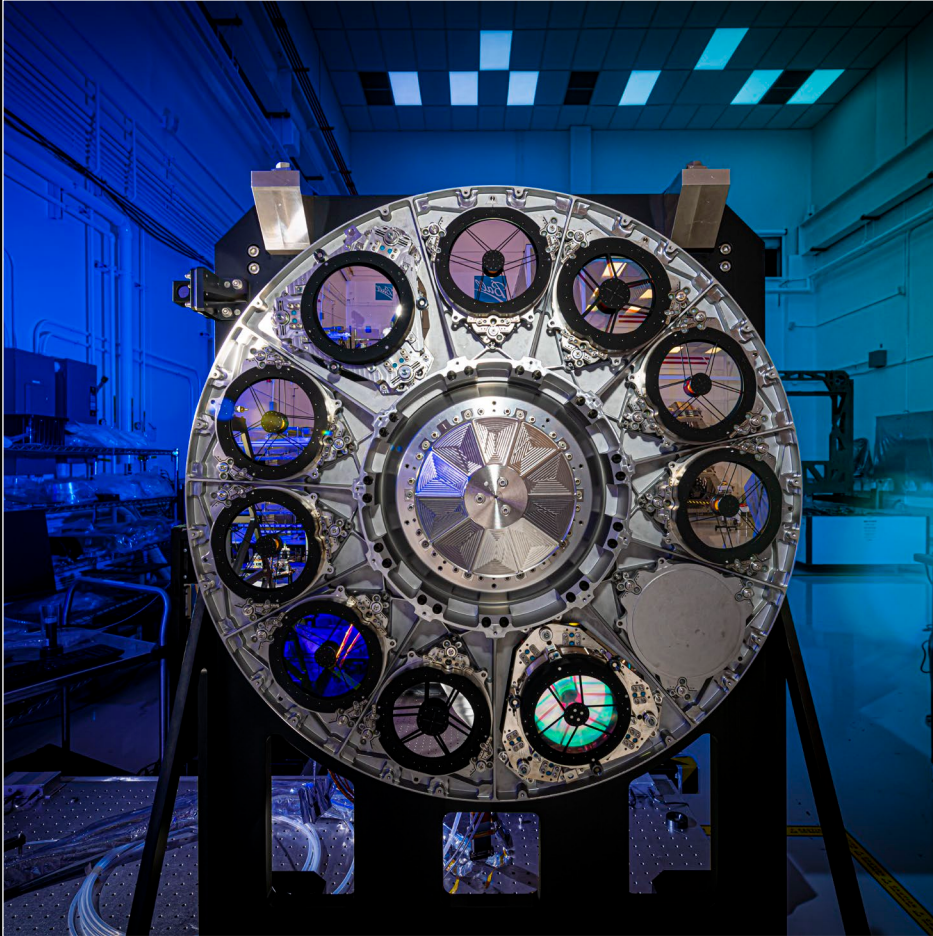
- Builds on the successful launch of Artemis I and paves the way for a long-term presence at the Moon and on to Mars for the U.S. and our partners
- Over \$3.3 billion in investments in Earth Science and Aeronautics to observe, understand, and protect our home planet
- Enables the transition from the International Space Station to Commercial Low-Earth Orbit Destinations
- Invests \$3.9 billion in NASA's workforce and infrastructure

FY24 SMD Budget Priorities



30 Doradus, informally the Tarantula Nebula, located in the Large Magellanic Cloud

- Build an innovative and balanced program driven by the highest national priorities
- Advance Moon to Mars objectives and lead Artemis science
- Promote US leadership in Earth system science
- Broaden participation and increase diversity in science
- Advance open science for all and leverage cutting edge data science techniques



Nancy Grace Roman Space Telescope's element assembly wheel

Build an Innovative and Balanced Program Driven by the Highest National Priorities

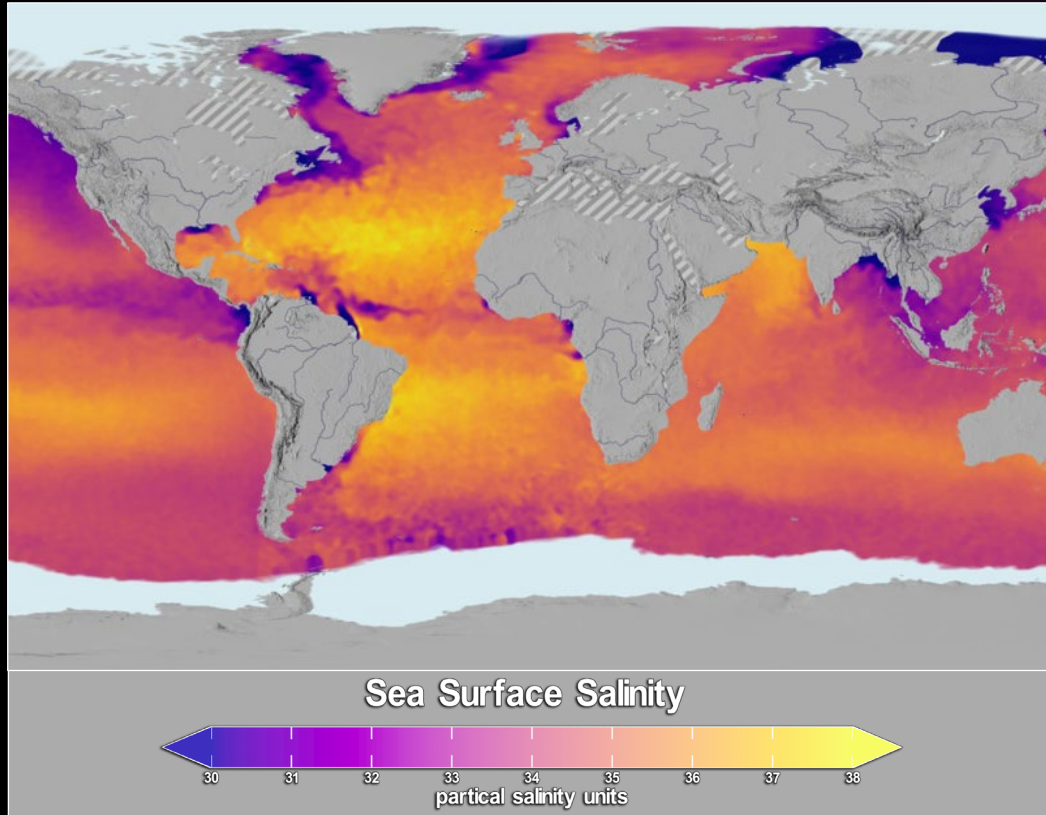
- Execute program informed by **Decadal Surveys** and other national priorities including wildfire management, planetary defense, orbital debris, space weather, etc.
- Over **56 missions in formulation and development** on a full range of platforms; including Roman Space Telescope, Europa Clipper, Dragonfly, PACE, NISAR and IMAP
- Competitively awarded, **PI-led missions** in all divisions including Astrophysics, Heliophysics, Earth Explorers, Earth Venture, Discovery and New Frontiers
- **Operate over 70 missions**, including James Webb Space Telescope, which conduct leading edge science investigations
- Support **innovative scientists** across the country, turning science mission data into groundbreaking discoveries and economic advancement

Advance Moon to Mars objectives and lead Artemis Science



Illustration of NASA astronauts on the lunar South Pole
Credit: NASA

- Prepare for eventual human missions to Mars by demonstrating the ability to return Martian samples to Earth via the **Mars Sample Return** mission
- Develop SmallSats, instruments, and other payloads that serve science, long-term exploration, and utilization needs via a broad portfolio of lunar and planetary science, heliophysics, and biological and physical **science investigations**
- Conduct lunar science through the innovative Commercial Lunar Payloads Services (**CLPS**) initiative, leveraging commercial partnerships to deliver science, exploration, and technology payloads to the Moon
- Confirm the presence of volatiles/ice early in FY2025 with the Volatiles Investigating Polar Exploration Rover (**VIPER**)
- Continue development of the Heliophysics Environmental and Radiation Measurement Experiment Suite (**HERMES**) space weather investigation to be installed on Gateway



Sea surface salinity (i.e., ocean salt concentration) over a ten year period (2011 to 2021). Warm colors (orange to yellow) are areas of high salinity/hot tropics. Cooler colors (blue to violet) are fresher waters, many of which can be seen coming from rainy/river/wetter tropics.

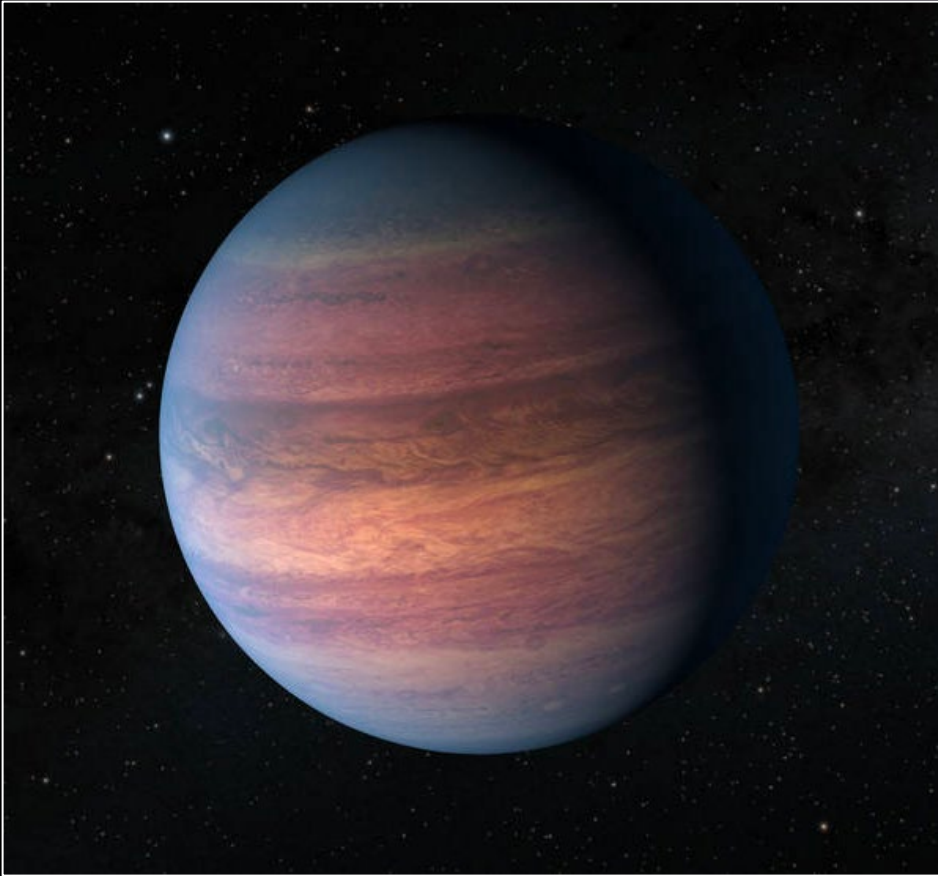
Promote US leadership in Earth System Science

- Build the **Earth System Observatory**—the next generation of integrated decadal missions to advance understanding of the complex Earth system
- Establish a new class of competed **Earth System Explorers** missions to enable innovative approaches and expand the breadth of the Observatory
- Observe Earth's land, ocean, ice, and atmosphere to understand the drivers and outcomes of the changing climate
- Partner with commercial industry and international collaborators for cost-effective approaches to Earth science observations
- Advance technology, research, models, data systems, and applications to improve our understanding of, and ability to predict, the changing climate and its interactions with human communities
- Deliver **actionable solutions** such as risk assessments, decision support systems, and forecasting, to meet the needs of partners at other federal agencies, local, state, and tribal governments
- Communicate the dynamics of the Earth system to the public via expanded physical and virtual displays of the **Earth Information Center**



Broaden Participation and Increase Diversity in Science

- Implement **diversity strategies** in alignment with broader agency plan
 - Increase number of solicitations, both NRAs and AOs, requiring proposals to contain inclusion plans
 - Transition dual-anonymous peer review to be the default review method for all ROSES proposals
 - Prioritize broad use of accessibility tools and multiple languages (e.g., accurate closed-captioning, Spanish literature, etc)
- Implement **Equity Action Plan**
 - Continue SMD Bridge Program to create an environment where underserved communities are better equipped to partner with NASA
 - Make data available on the cloud and provide free, multi-lingual training on how to use NASA data to address priority needs in underserved communities
- Implement 2023 Plan to Increase Support and Opportunities for Historically Black Colleges and Universities
- Improve psychological and physical safety of science teams by encouraging establishment of statement of principles for team engagements



"Citizen Scientists" used data to spot a new planet that's about the size of Jupiter, depicted in this illustration

Advance Open Science for All and Leverage Cutting Edge Data Science Techniques

- Initiate the SMD Core Data and Computing Services Program to enable efficient open science using latest capabilities in data and cloud computing
- Advance transparency, inclusivity, access, and reproducibility in scientific data and research
- Implement the data and information policy for SMD to make scientific data, publications and software open
- Execute Transform to OPen Science (TOPS) initiative to train 20,000 scientists in open science practices over the next 5 years
- Investments in Artificial Intelligence and Machine Learning techniques which, when applied to NASA mission science datasets, can improve data discovery.

RECENT HIGHLIGHTS



JWST Discoveries



WORLDWIDE OBSERVING CAMPAIGN 2022 2023



Arizona
LDT (4.3 m)
Hall (1.1 m)
Spacewatch (0.9 m)

California
Goldstone
Palomar (5 m)
TMO (1 m)

Hawaii
IRTF (3 m)
ATLAS (0.5 m x 2)

Texas
LCOGT (1 m)

New Mexico
MRO (2.4 m)

West Virginia
Green Bank

Canary Islands
TNG (3.5 m)
NOT (2.56 m)
LCOGT (1 m)

Morocco
TRAPPIST-North (0.6 m)

Italy
Asiago (1.8 m, 1 m)

Turkey
TUG (1.0 m, 0.12 m)

Israel
Wise (0.71 m)

Qatar
Qatar Univ. (0.3 m)

Kenya
OPTiK (0.4 m)

Namibia
Drebach South (0.4 m)
Springbok (0.36 m)

Réunion
Les Makes (0.6 m)

Australia
LCOGT (1 m)

Chile
ALMA
VLT (8.2 m x 4)
Magellan (6.5 m)
SOAR (4.1 m)
La Silla (1.54 m, 0.6 m)
LCOGT (1 m)
Swope (1 m)
ATLAS (0.5 m)

Argentina
Jorge Sahade (2.15 m)
EABA Bosque Alegre (1.5 m)

South Africa
LCOGT (1 m)
SAAO (1 m)
ATLAS (0.5 m)
SMARTnet (0.5 m)
Watcher (0.4 m)

Antarctica
ASTEP (0.4 m)

New Zealand
Mt. John (1.8 m)



HST

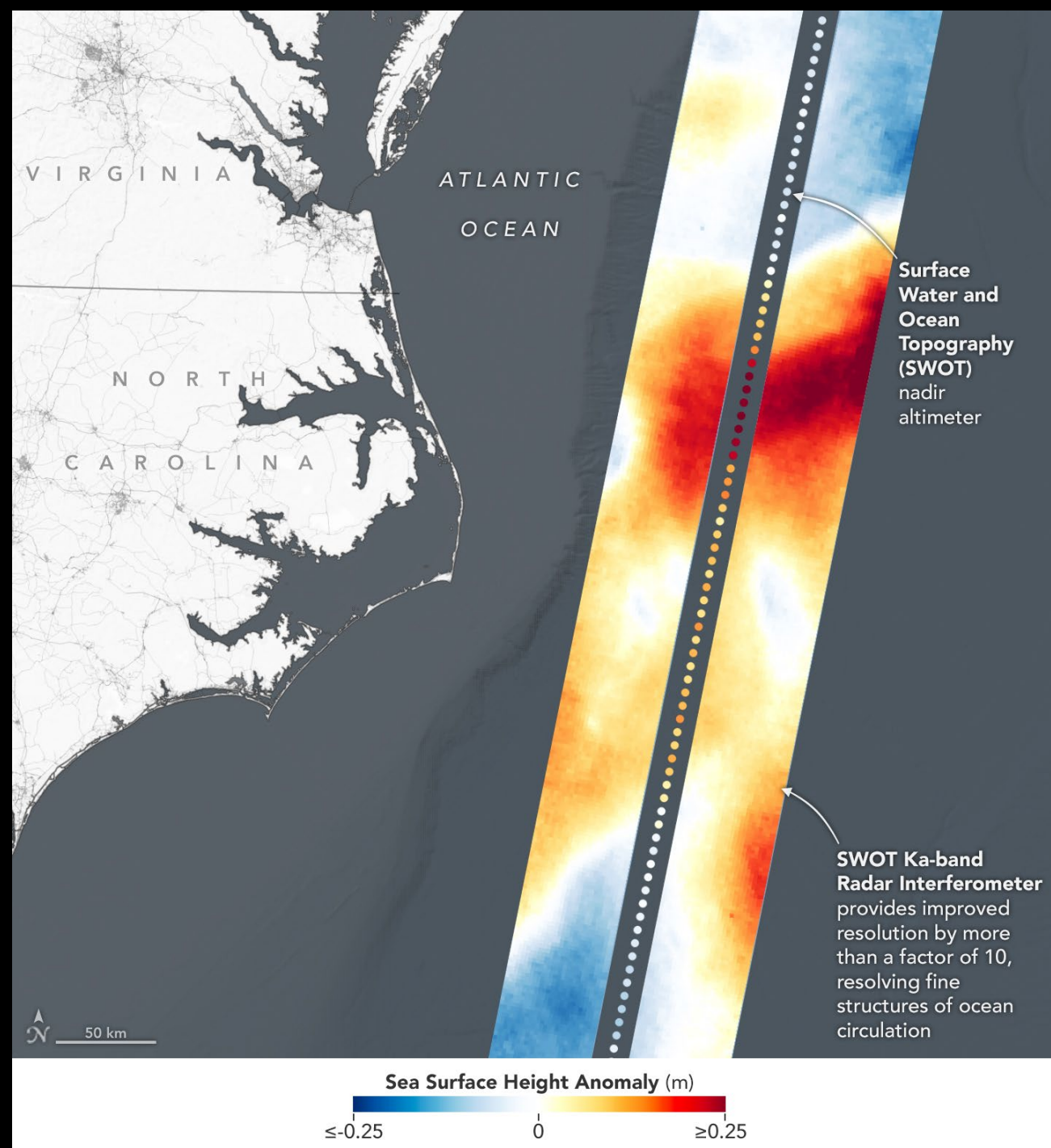


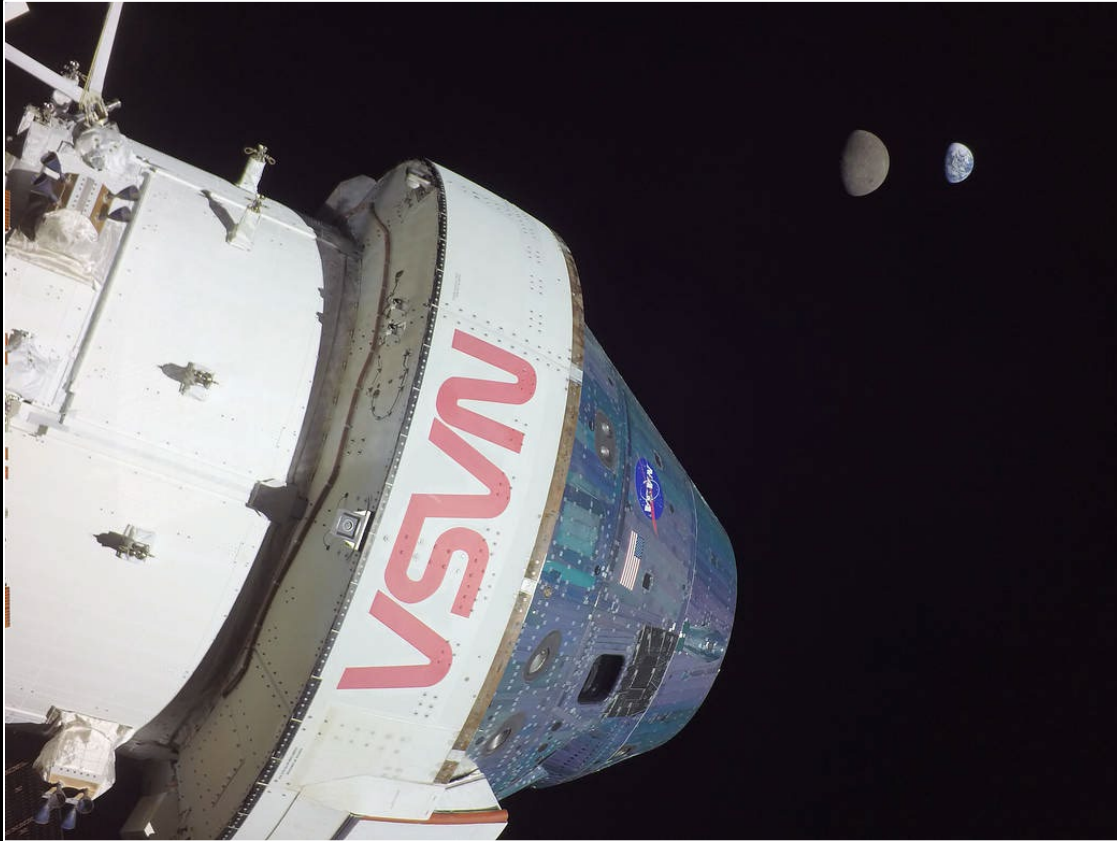
JWST



Lucy

SWOT





Orion 268,563 miles from Earth: Nov. 28, 2022



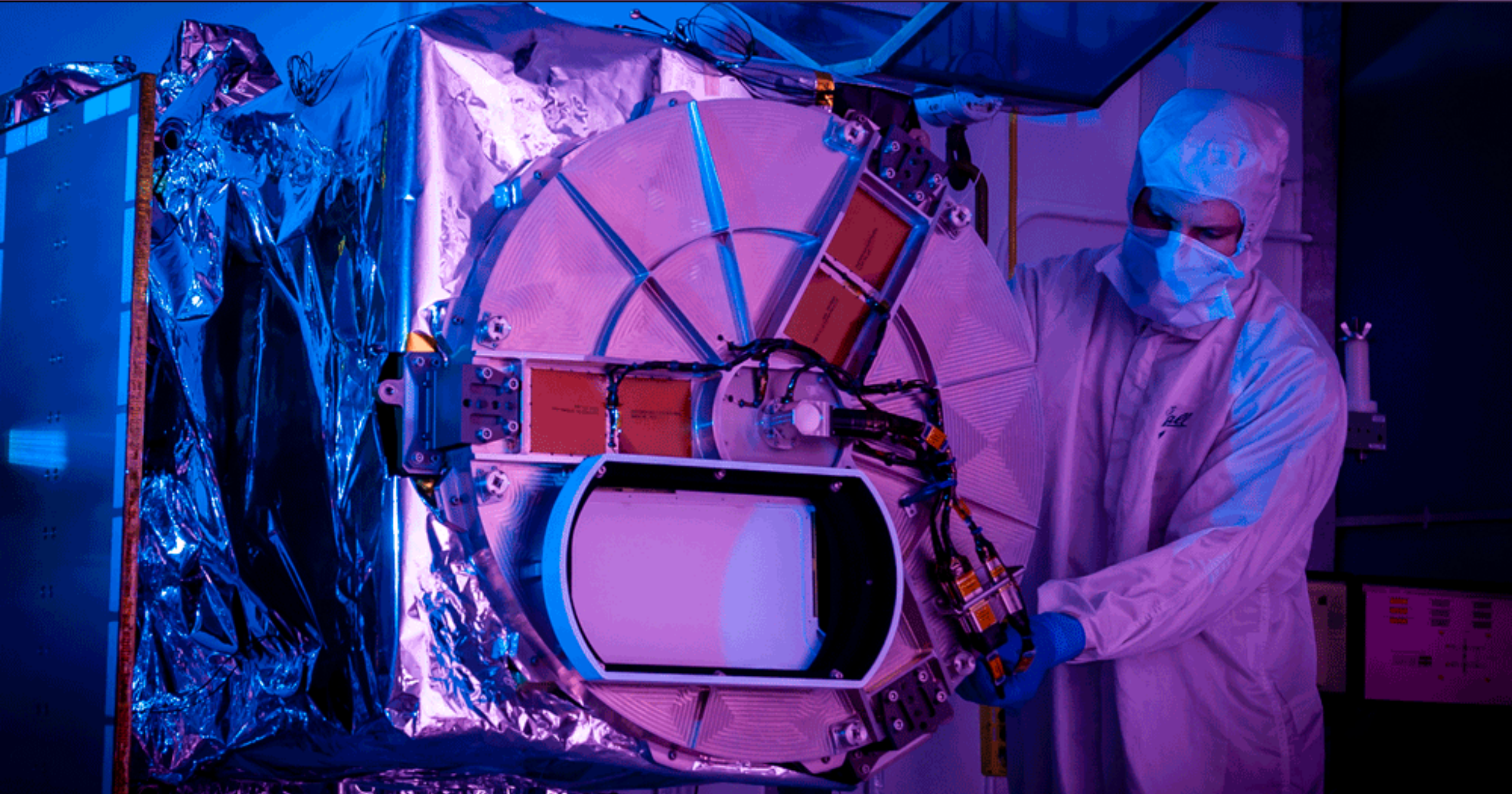
Orion splashdown in Pacific: Dec. 11, 2022

Parker Solar Probe



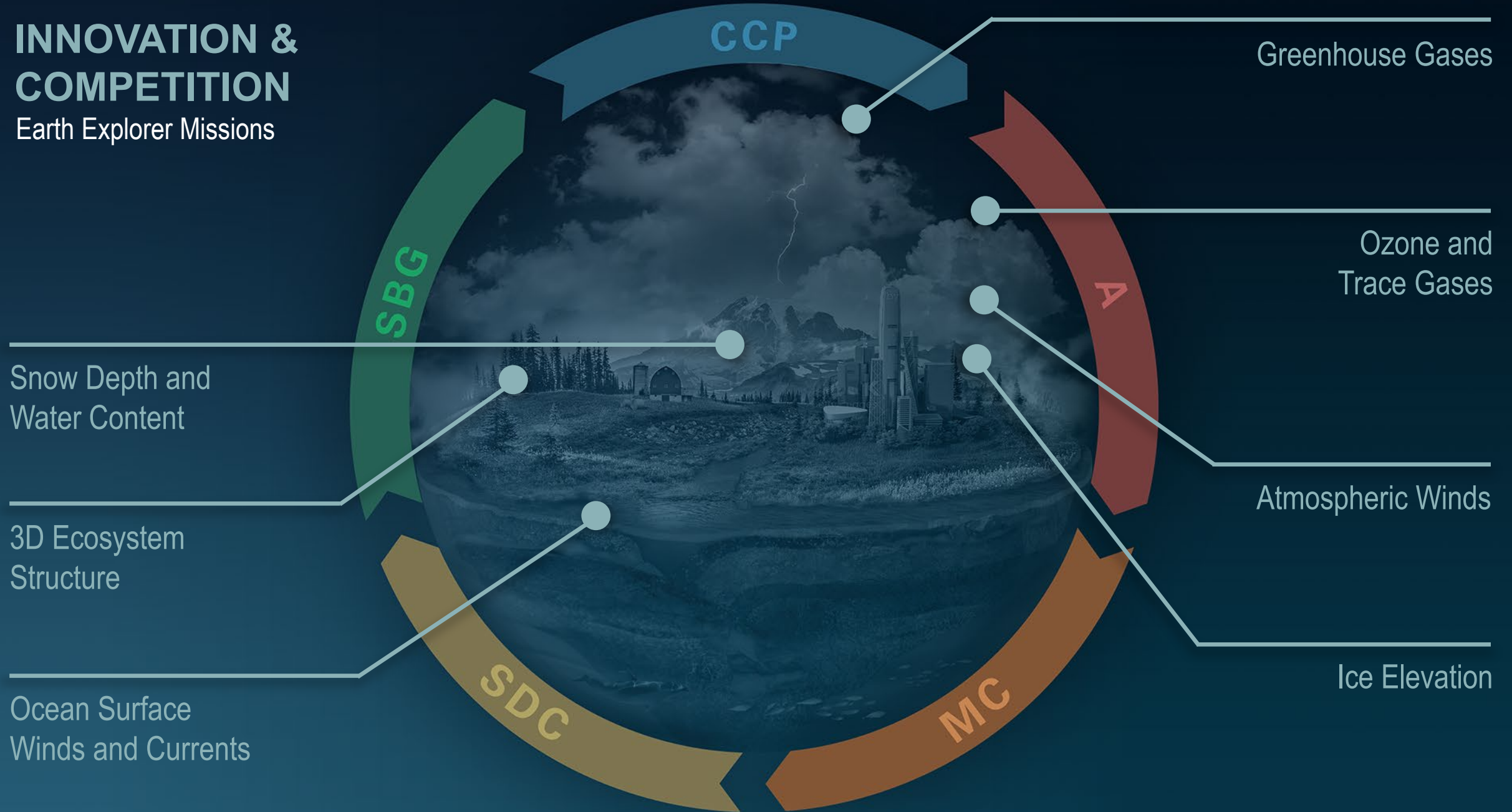
UPCOMING MILESTONES



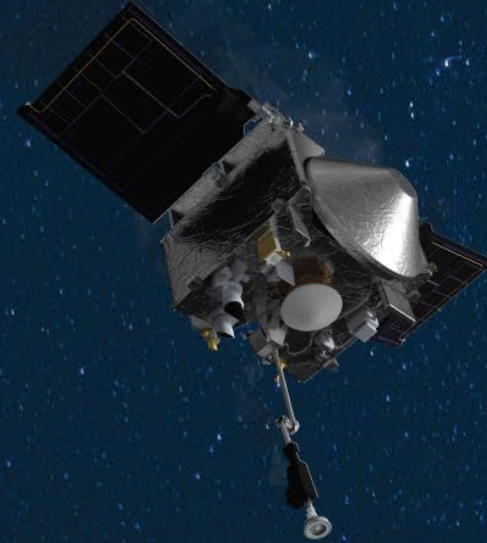
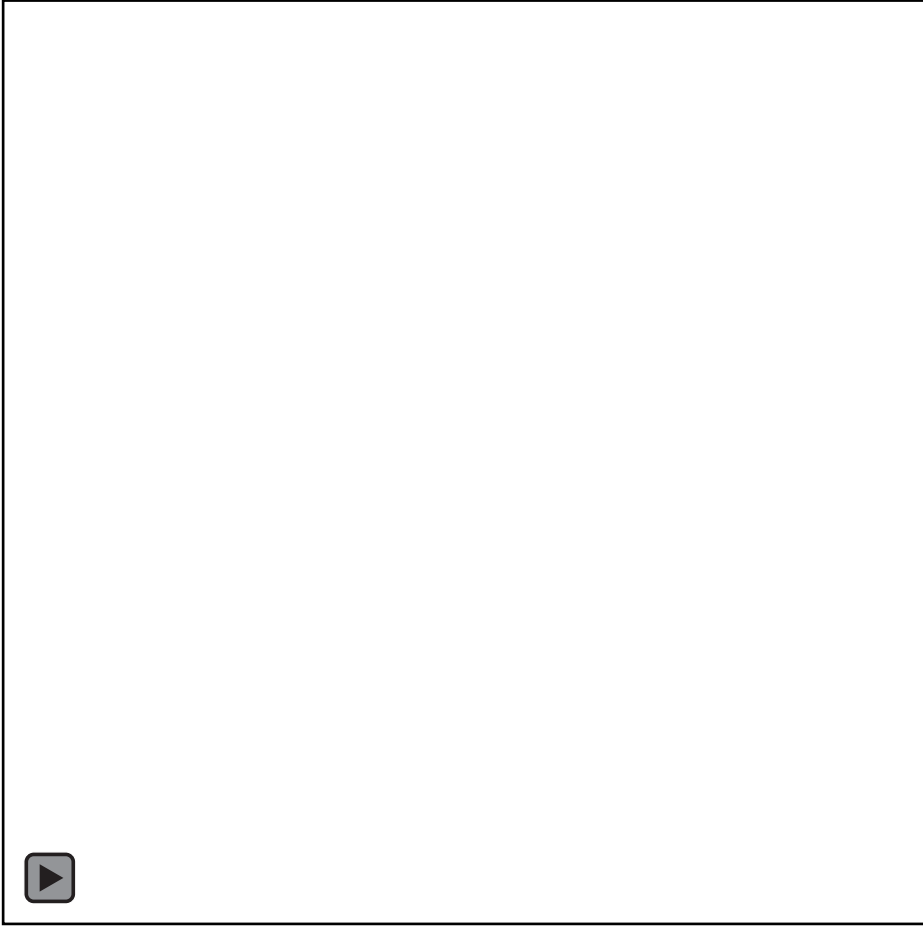


INNOVATION & COMPETITION

Earth Explorer Missions



OSIRIS-REx



CLPS Deliveries

2023-2026

Delivery Site:
Gruithuisen Domes
Provider: TBD
CP-21 | 2026

Delivery Site:
Sinus Viscositas
Provider: Astrobotic
TO2-AB | May 2023

Delivery Site:
Lunar Far Side &
Orbit Insertion
Provider: Firefly
CS-3 | 2026

Delivery Site:
Reiner Gamma
Provider: IM
CP-11 | 2024

Delivery Site:
Mare Crisium
Provider: Firefly
TO19D | 2024

Delivery Site: Malapert A
Provider: Intuitive Machines (IM)
TO2-IM | June 2023

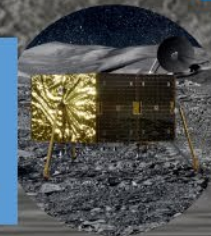
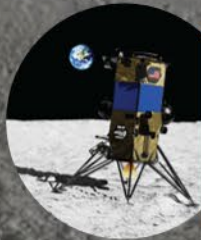
Delivery Site:
Shackleton Connecting
Ridge **Provider:** IM
TO PRIME-1 | Q4 2023

Delivery Site:
Nobile Crater
Provider: Astrobotic
VIPER | Nov 2024

Delivery Site:
Schrödinger Basin
Provider: Draper
CP-12 | 2025

Delivery Site:
South Pole Region
Provider: TBD
CP-22 | 2026

Delivery Site:
Haworth Crater
Provider: Masten
TO19C | Nov 2023



Solar Eclipses Across North America:

- Oct. 14, 2023: Annular
- April 8, 2024: Total

Parker Solar Probe:

- Parker will make its closest approach to the Sun in Dec. 2024

Solar Cycle 25:

- Solar maximum increases opportunities to experience and observe space weather



HELIOPHYSICS BIG YEAR



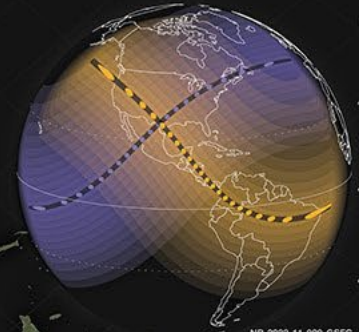
2023 Path of Annularity October 14, 2023

Along a path about 125 miles wide, the Sun will appear as a "ring of fire" in the sky. Annularity lasts up to 5 minutes depending on the viewer's location within this path.

2024 Path of Totality April 8, 2024

Along a path about 115 miles wide, the Moon will completely block the Sun in the sky. Totality lasts up to about 4 minutes and 28 seconds depending on the viewer's location within this path.

Outside of these paths, viewers within the 48 contiguous U.S. states and many other areas will see a partial solar eclipse (in the shaded areas below).



A young girl with long dark hair, wearing a red and white striped tank top with white stars, is holding a glass jar filled with glowing fireflies. She is looking down at the jar with a focused expression. The scene is set in a grassy field at night, with a starry sky and distant mountains in the background. A boy is visible in the distance, also holding a jar. A bird is flying in the sky. The overall atmosphere is magical and serene.

EXPLORE

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