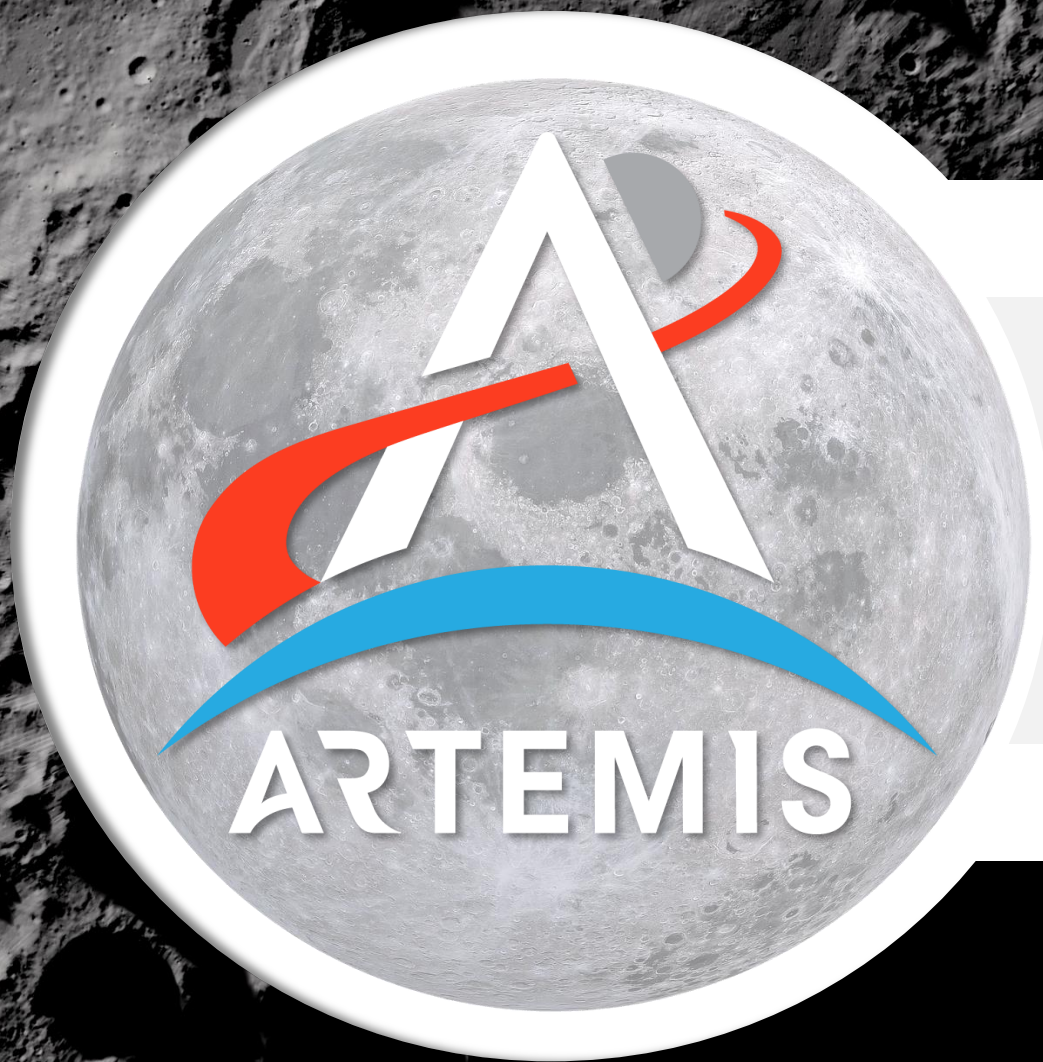


National Aeronautics and Space Administration



Artemis II Lunar Science Overview

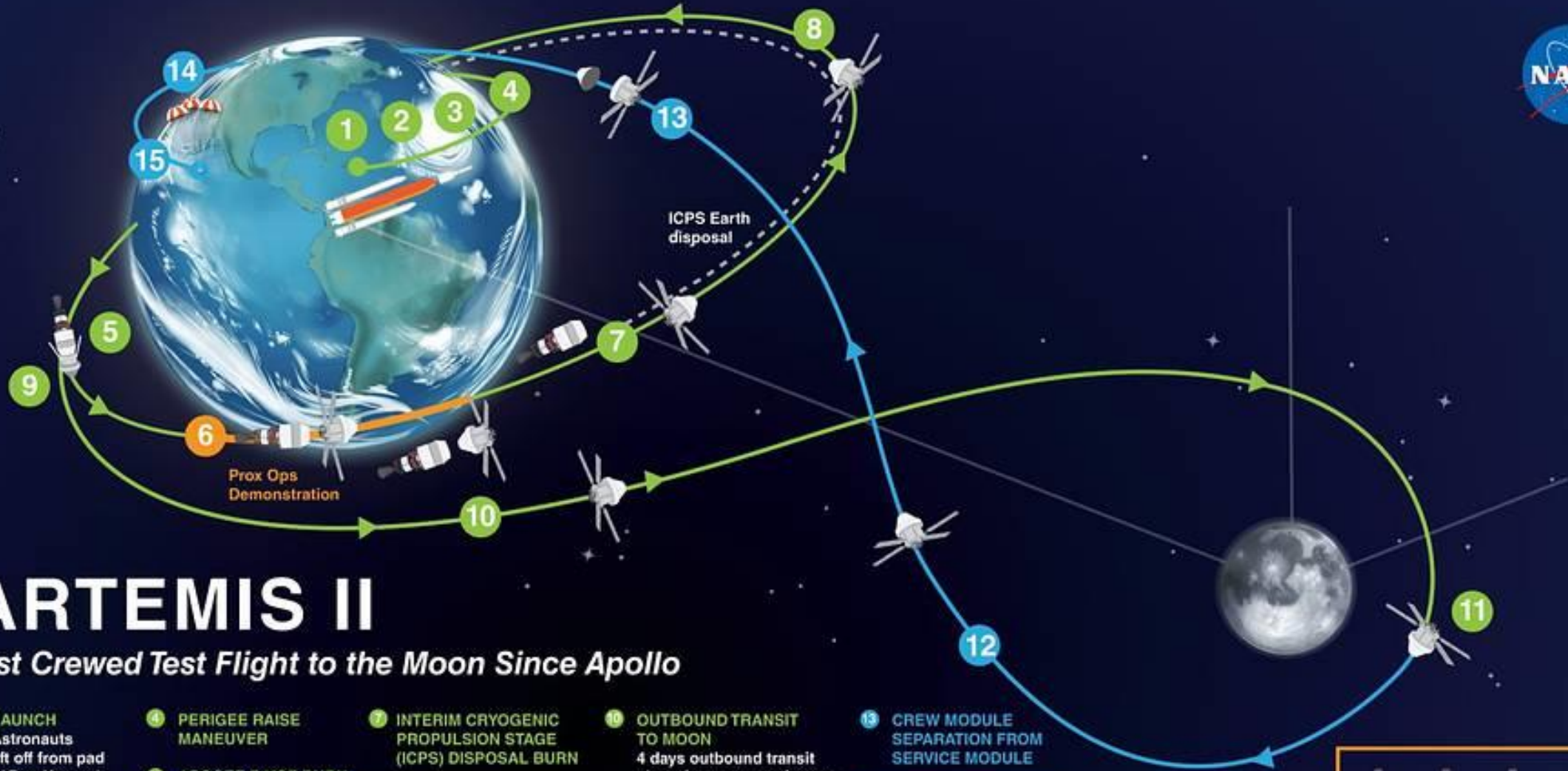
Kelsey Young, Ph.D., Artemis II Lunar Science Lead
and Lead Science Officer
NASA Goddard Space Flight Center
May 7th, 2025
Lunar Surface Science Workshop

ARTEMIS II

Lunar Science on Artemis II

- Crew will capture images, observations, and annotations
- Crew Images: Handheld Nikon
- Crew Verbal Descriptions: Captured via crew tablet and Crew-to-Earth communications
- Vehicle Cameras
- First integration of lunar science/geology into this generation of human exploration





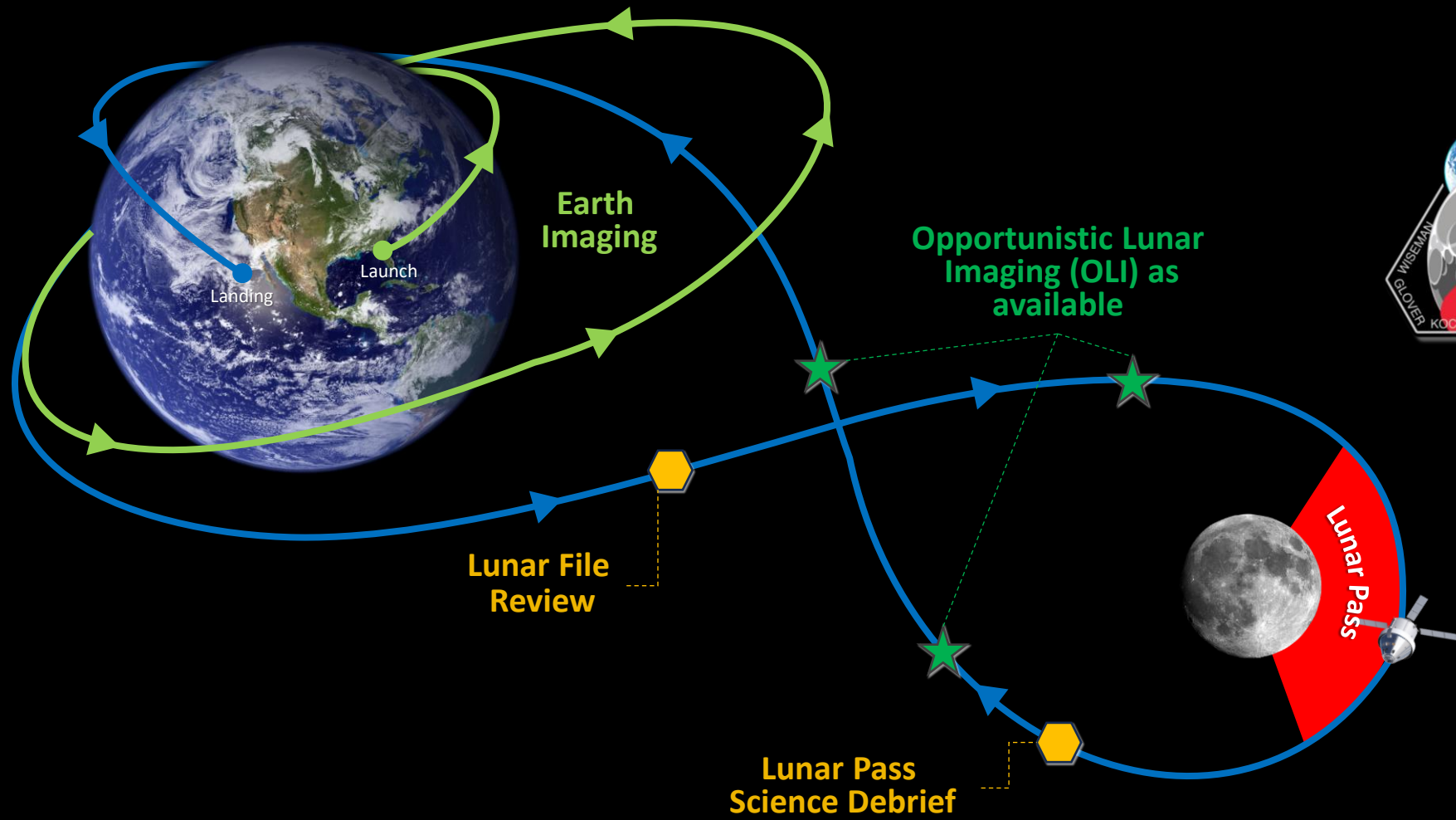
ARTEMIS II

First Crewed Test Flight to the Moon Since Apollo

- 1 LAUNCH**
Astronauts lift off from pad 39B at Kennedy Space Center.
- 2 JETTISON ROCKET BOOSTERS, FAIRINGS, AND LAUNCH ABORT SYSTEM**
- 3 CORE STAGE MAIN ENGINE CUT OFF**
With separation.
- 4 PERIGEE RAISE MANEUVER**
- 5 APOGEE RAISE BURN TO HIGH EARTH ORBIT**
Begin 24 hour checkout of spacecraft.
- 6 PROX OPS DEMONSTRATION**
Orion proximity operations demonstration and manual handling qualities assessment for up to 2 hours.
- 7 INTERIM CRYOGENIC PROPULSION STAGE (ICPS) DISPOSAL BURN**
- 8 HIGH EARTH ORBIT CHECKOUT**
Life support, exercise, and habitation equipment evaluations.
- 9 TRANS-LUNAR INJECTION (TLI) BY ORION'S MAIN ENGINE**
Lunar free return trajectory initiated with European service module.
- 10 OUTBOUND TRANSIT TO MOON**
4 days outbound transit along free return trajectory.
- 11 LUNAR FLYBY**
4,000 nmi (mean) lunar farside altitude.
- 12 TRANS-EARTH RETURN**
Return Trajectory Correction (RTC) burns as necessary to aim for Earth's atmosphere; travel time approximately 4 days.
- 13 CREW MODULE SEPARATION FROM SERVICE MODULE**
- 14 ENTRY INTERFACE (EI)**
Enter Earth's atmosphere.
- 15 SPLASHDOWN**
Ship recovers astronauts and capsule.



PROXIMITY OPERATIONS DEMONSTRATION SEQUENCE



- Lunar Science Objectives (Priority*)

- 1.1 – Color Provinces/Albedo Variations investigation (1)
- 1.2 – Impact Flash Observations investigation (1)
- 1.3 – Dust/Exosphere/Deep Space/Lunar Environment investigation (2)
- 1.4 – Photometric Observations investigation (2)
- 1.5 – Impact History investigation (2)
- 1.6 – Tectonic features investigation (2)
- 1.7 – Future Sites and Poles (2)
- 1.8 – Limb and Terminator Morphology investigation (3)
- 1.8 – Volcanic History investigation (3)
- 1.9 – Earth Observations from Deep Space investigation (3)

- Exploration Capability Objectives

- 2.1 – Exercise crew lunar imagery/observation product development and execution processes
- 2.2 – Exercise science flight team support
- 2.3 – Exercise science data capture methods
- 2.4 – Exercise science data archiving methods

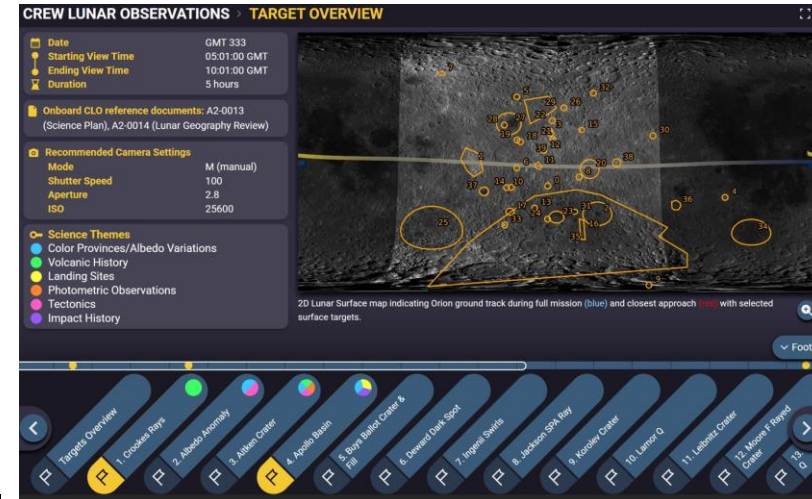
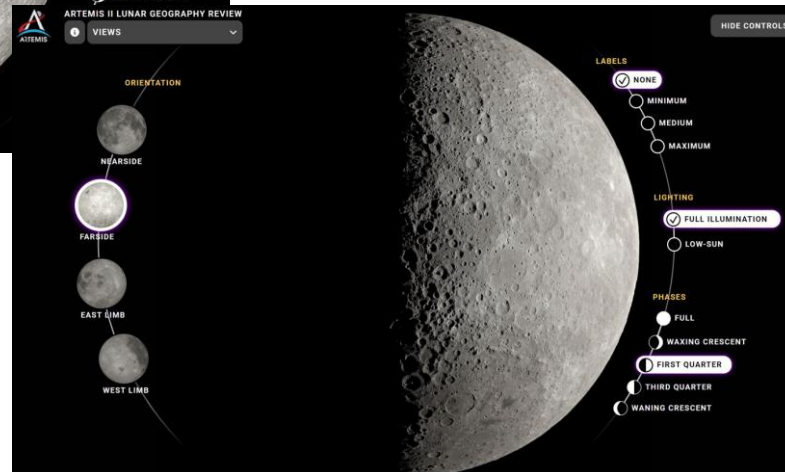
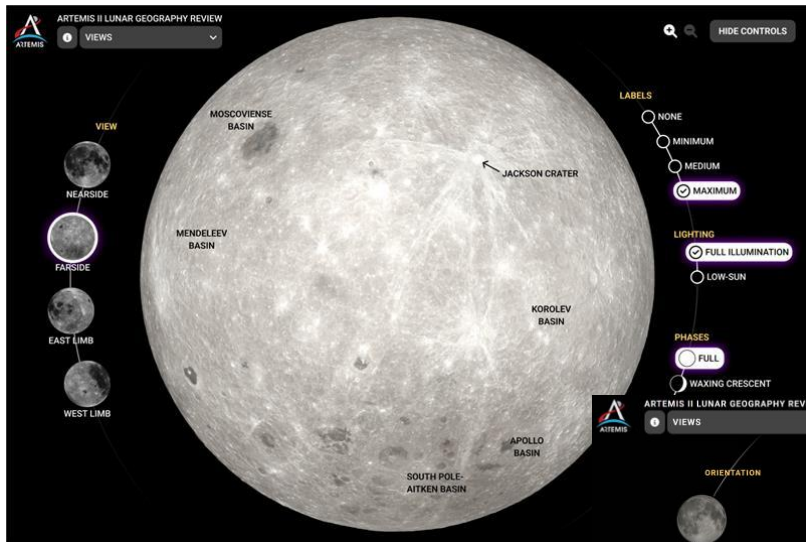
**Priority 1: What can humans uniquely do at the Moon?*

Priority 2: Accomplishable under wide range of illumination

Priority 3: Nice to have

Lunar Geography Review: support for lunar science objectives and other utilization objectives; description cue card

Lunar Targeting Plan: trajectory-specific lunar imaging and observation plan



- Classroom Training
 - Lunar Fundamentals: May 2023
 - Mission-specific classroom training approaching in June and December 2025
- Field Training
 - Kamestastin Impact Crater (3 crew): September 2023
 - Icelandic Highlands (6 crew): Summer 2024
- Simulations
 - Lunar content integration starting soon



Artemis II crew in Iceland with NASA instructors
(Photos: R. Markowitz/JSC)

Lunar Science Lead: Kelsey Young
 Deputy Lunar Science Lead: Noah Petro
 Data/Software Lead: Matthew Miller
 Science Coordinator: Kiarre Dumes
 Project Management Support: Nastassja Koellein-DeWaele

Science Officers

- Kelsey Young
- Angela Garcia
- Trevor Graff

Data/ Software Team

- Data Archiving Lead: David Hollibaugh-Baker
- Others TBD

Visualization Lead:
Ernie Wright

Science SMEs

- AIST (Cindy Evans, Ryan Ewing, Juliane Gross, Andy Needham, Barbara Cohen)
- Ariel Deutsch, Marie Henderson, Jacob Richardson, Jen Heldmann, Maria Banks, Tony Colaprete

Additional Support

- Amber Turner
- Cherie Achilles
- Alexandra Constantinou
 - Jose Hurtado
 - Ben Feist
- Marco Lozano, Michael McLehany

CLO Team

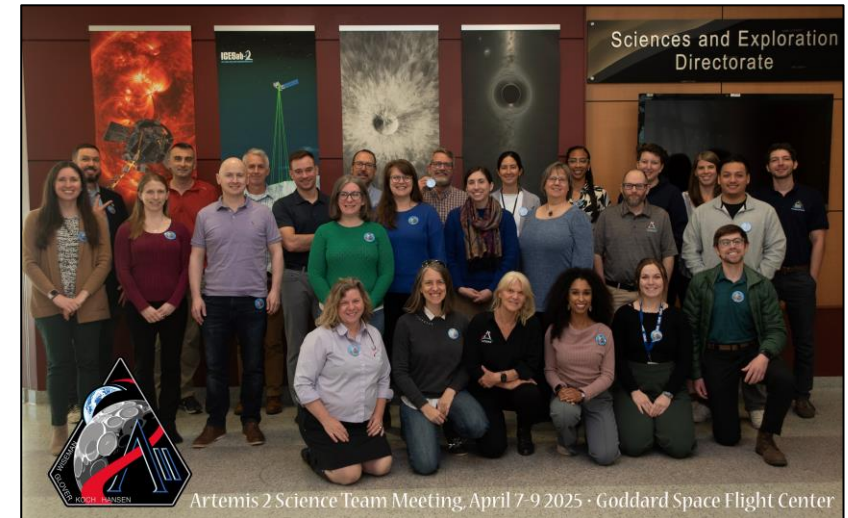
- Sara Schmidt, Wilfredo Garcia Lopez, Alex Stoken, Cody Boyer, Dave Charney, Matthew Miller

Image Analysis Team

- Erica Miles, Dan Smith, Kevin Beaulieu, Others

Headquarters Reps:

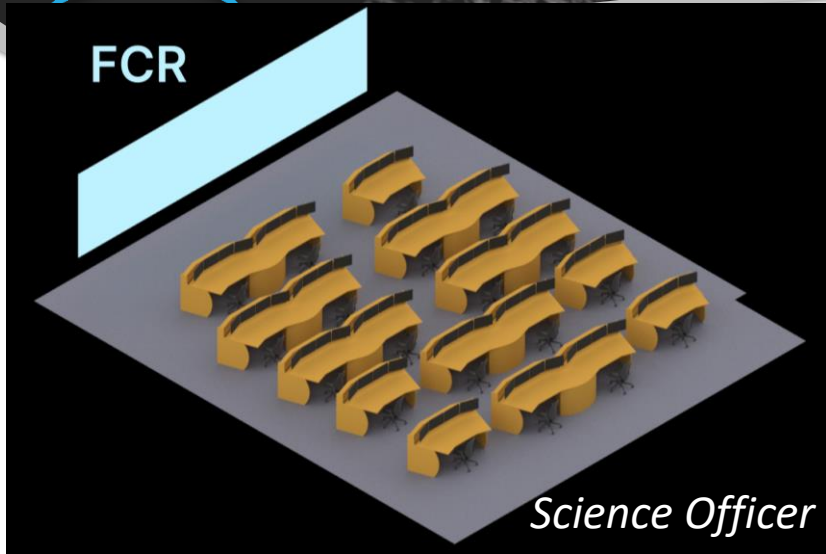
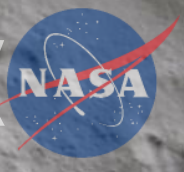
- Sarah Noble, Debra Needham, Amanda Nahm, Ryan Watkins, Kennda Lynch



Mini simulation with Artemis II Lunar Science Team, April 8th, 2025



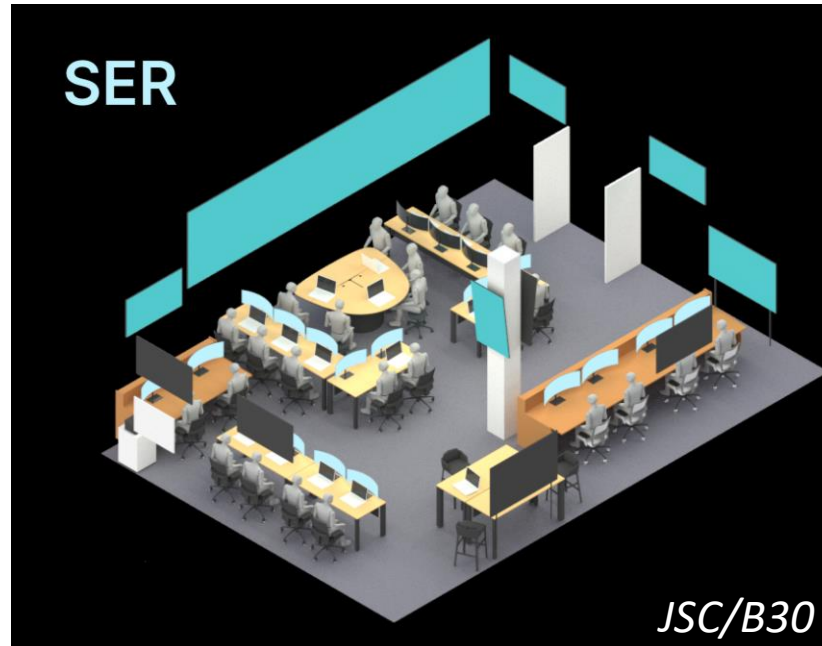
Artemis II Lunar Science Operations Structure



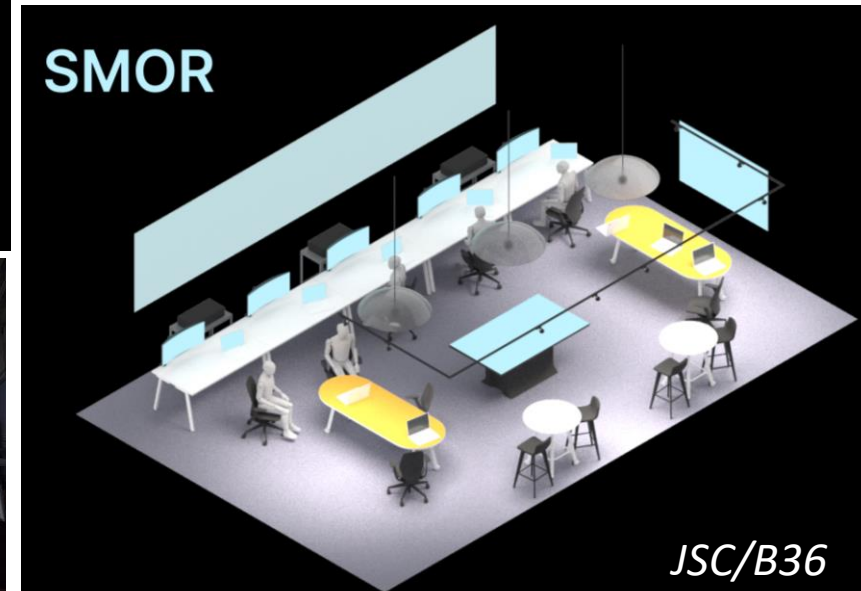
FCR: Flight Control Room (Mission Control 'Front Room')

SER: Science Evaluation Room

SMOR: Science Mission Operations Room



- Science Officer (JSC/MCC Front Room): SMD Position staffed by lunar scientists/geologists
- SER: Science Evaluation Room (JSC/B30 MCC): Primary science backroom for lunar science objectives
- SMOR: Science Mission Operations Room (JSC/B36) operated by JSC/XI
- Key Artemis II lunar science objective is to test this operational flow





- Lunar science will be a part of humanity's return to the Moon
- Artemis II will enable crewed observations and images, as well as vehicle camera imaging, of the Moon
- 10 lunar science objectives; 4 exploration capability objectives
- First integration of Science Officer, Science Evaluation Room, and Science Mission Operations Room