

National Aeronautics and
Space Administration



Heliophysics Division

HERMES Instrument Update

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National Aeronautics and
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Artemis Science Objectives

Objective 1: Understanding Planetary Processes

Objective 2: Understanding Volatiles Cycles

Objective 3: Interpreting the Impact History of the Earth-Moon system

Objective 4: Revealing the Record of the Ancient Sun

Objective 5: Observing the Universe from a Unique Location

Objective 6: Conducting Experimental Science in the Lunar Environment

Objective 7: Investigating and Mitigating Exploration Risks to Humans





Gateway Utilization Program Strategic Goals

1. Enable Lunar related science
2. Prepare for Mars and Deep Space Exploration
3. **Conduct Science/Research unique to Gateway's Deep Space Location**
4. Engage with the Public and Inspire Future Generations

A vibrant space-themed background featuring a curved blue arc on the left side. The background is filled with a starry field, a bright yellow sun in the bottom left corner, and several celestial bodies: a yellow planet with rings (Saturn), a reddish planet (Mars), and a grey cratered planet (the Moon).

Heliophysics and the Gateway

3. Conduct Science/Research unique to Gateway's Deep Space Location

• 3.1 Study Natural Environment at Gateway

- Study the ambient plasma environment outside of the Earth's magnetosphere as a proxy for deep space
- Study and characterize SEPs & GCRs environment at the gateway
- Study and characterize the ambient plasma environment resulting from the vicinity of the Moon
- Study and characterize the local ambient plasma and radiation environment to support human exploration
- Provide operational Space Weather measurements at Gateway (real time)
- Study the local dust environment

• 3.2 Characterize Induced Environment at Gateway

- Study and characterize the local plasma environment induced by the Gateway
- Study local dust environment and contrast result of LEO and lunar orbit related to cosmic dust flux and impact of anthropogenic activity.

The background of the slide is a vibrant space scene. It features a bright yellow sun in the lower-left corner, partially obscured by the blue and white horizon of Earth. Above the Earth, the dark grey, cratered surface of the Moon is visible. Further out, the reddish-brown surface of Mars is shown. In the upper-left, the yellow planet Saturn with its prominent rings is depicted. The background is filled with a starry field of blue and white points of light.

Heliophysics and the Gateway (cont.)

- **3.3 Heliophysics Investigations**

- Study and characterize the ambient plasma environment outside of the Earth's magnetosphere as a driver for the dynamics of the terrestrial magnetosphere and associated boundaries
- Study and characterize the ambient plasma environment outside of the Earth's magnetosphere as a driver for terrestrial & lunar exospheres, lunar surface sputtering & charging
- Study and characterize SEPs & GCR as lunar surface sputtering sources
- Study and characterize the global response of the terrestrial magnetosphere to the solar wind
- Study solar wind interaction with lunar exosphere, regolith & magnetic anomalies
- Study the global terrestrial plasmasphere, ionosphere, exosphere & lunar exosphere
- Study and characterize the ambient plasma environment inside the Earth's magnetosphere and its associated boundaries
- Determine the multiscale plasma and magnetic field properties of CMEs and shocks and how the dynamic inner heliosphere controls the transport of transients to Earth and beyond.
- Study the fluxes, composition and sources of cometary, asteroidal and interstellar dust particles

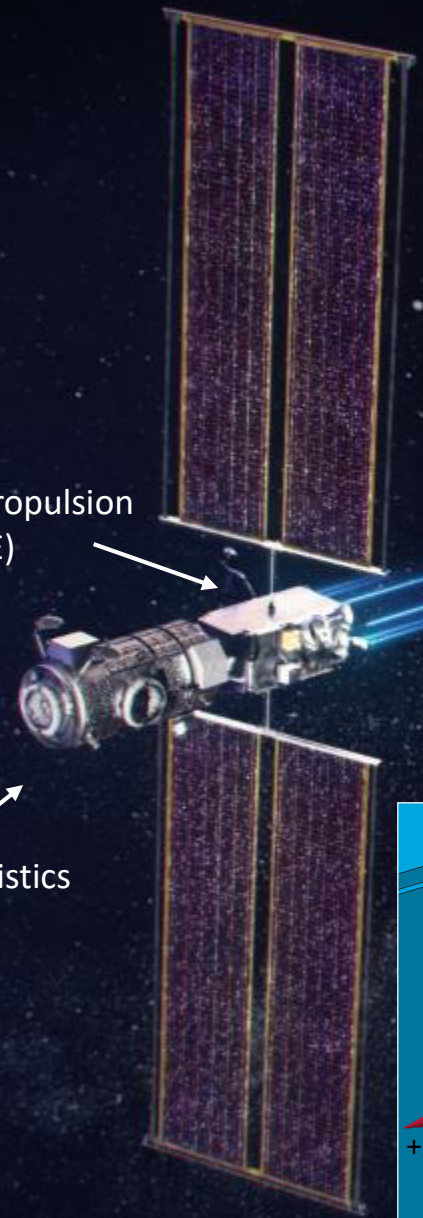
Gateway

Initial Gateway Modules
LRD NET late 2023

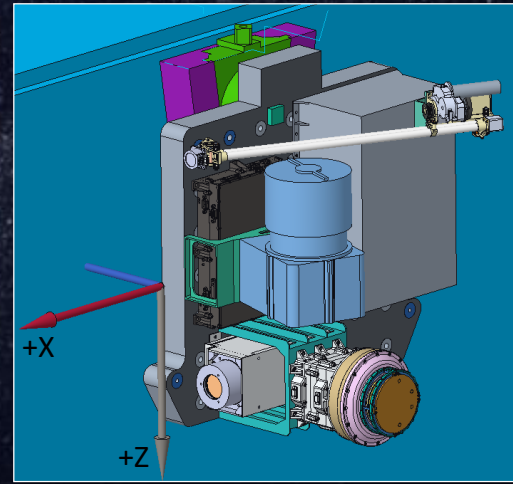


Power and Propulsion
Element (PPE)

Habitation and Logistics
Outpost (HALO)



HERMES (Heliophysics Environmental and Radiation Measurement Experiment Suite)



Instrument	Measurement	PI
EEA, Electron Spectrometer (low energy electrons)	Electrons < 30 KeV Flux, Density, Speed, Temperature	D. Gershman, GSFC
SPAN-i, Ion Spectrometer (low energy ions)	Ions < 40 KeV Flux, Density, Speed, Temperature, Species	R. Livi, UC Berkeley
MERiT, Ion and Electron Telescope (energetic particles)	0.3 – 9 MeV Electrons, 1 – 190 MeV Ions Flux	S. Kanekal, GSFC
Fluxgate and Magneto-Inductive Magnetometers	Magnetic Field Vector	E. Zesta, GSFC; M. Moldwin, U. Michigan

The background of the slide is a dark blue space scene. On the left side, there is a vertical strip showing a yellow planet with rings (Saturn), a reddish planet (Mars), and a grey planet (Moon) against a starry sky. At the bottom left, the blue and white horizon of Earth is visible. The main content area is a semi-circular shape on the right side of the slide.

HERMES Goals

Goal A: Determine mechanisms of solar wind mass and energy transport

Goal B: Characterize energy, topology, and ion composition in the deep magnetotail.

Goal C: Establish observational capabilities of an on-board pathfinder payload measuring local space weather to support deep-space and long-term human exploration.



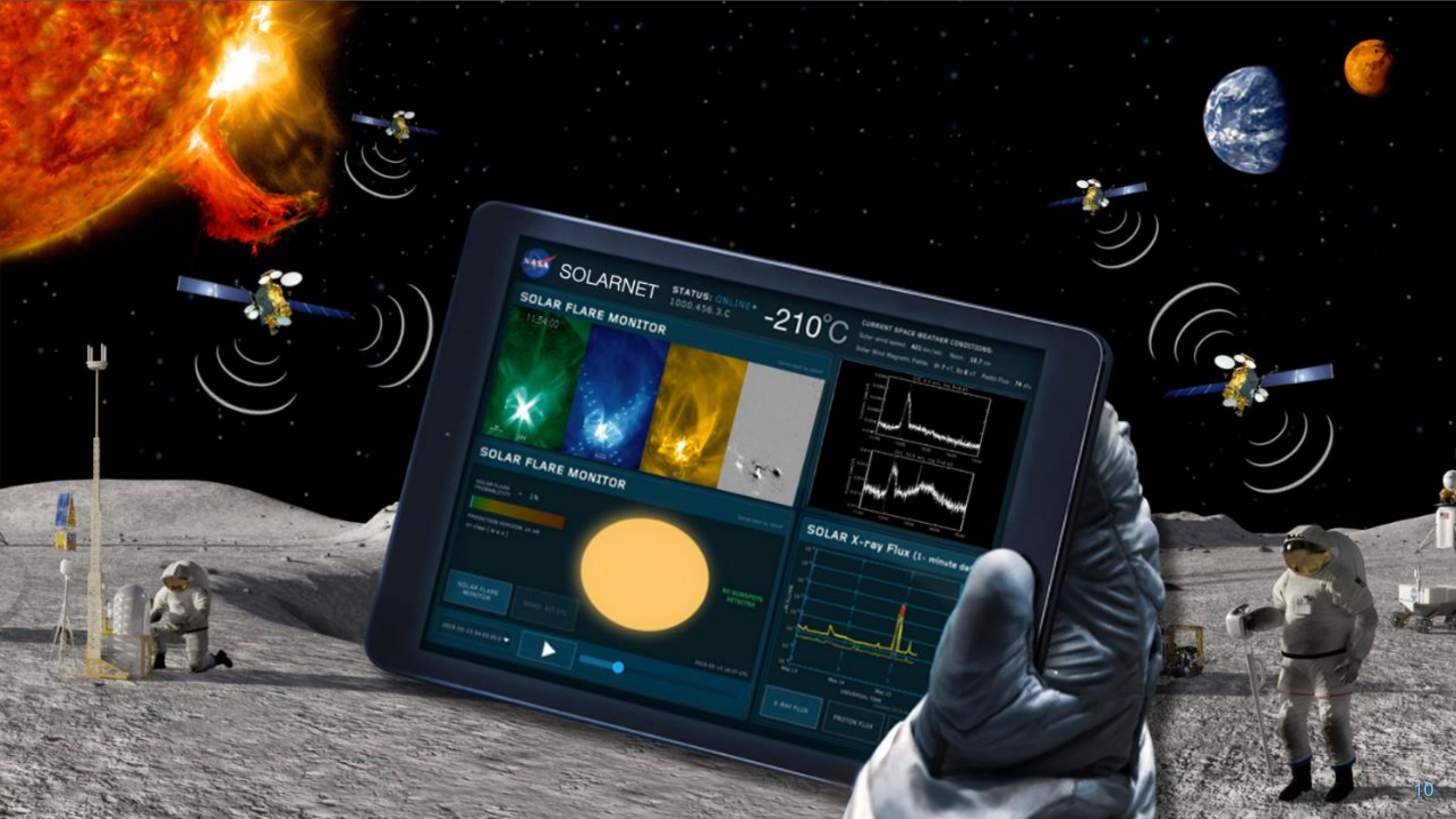
HERMES (Heliophysics Environmental and Radiation Measurement Experiment Suite)

- HERMES concentrates on understanding the causes of space-weather variability as driven by the Sun and modulated by the magnetosphere.
- In coordination with the Heliophysics two-spacecraft mission THEMIS/ARTEMIS already in lunar orbit, the Gateway observations will initiate a heliophysics lunar constellation to conduct science investigations into what drives change in our near-Earth space environment that have never before been possible.
- **Milestones**
 - Instrument Concept Reviews: Summer 2020
 - Single Design Review: November 2020
 - Interdisciplinary Science (IDS) Team release: November 2020
 - Step 1 proposals due: 01/07/21; Step 2 proposals due: 02/25/21
 - KDP C: NET March 2021
 - Payload Delivery: July 2023

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HERMES Interdisciplinary Science Teams

- A solicitation for the Heliophysics Environmental and Radiation Measurement Experiment Suite (HERMES) Interdisciplinary Science Teams (HIDS) is released
- Investigations must address HERMES Objectives using HERMES data products and from other sources
- Proposed HIDS objectives beyond the HERMES Objectives are allowed so long as they complement those of HERMES
- International PI's are allowed





Heliophysics Division is poised like never before to:

- Capitalize on our unique opportunity to study the Sun and its effects throughout the Heliosphere
- Fulfill our responsibility for the Nation enabling advances in space weather
- Play a critical role in Exploration supporting the Artemis mission in partnership with HEOMD, to develop Earth-independent observational and model assessment capabilities needed for on-board space environment forecasting, for long-duration deep-space exploration missions.

