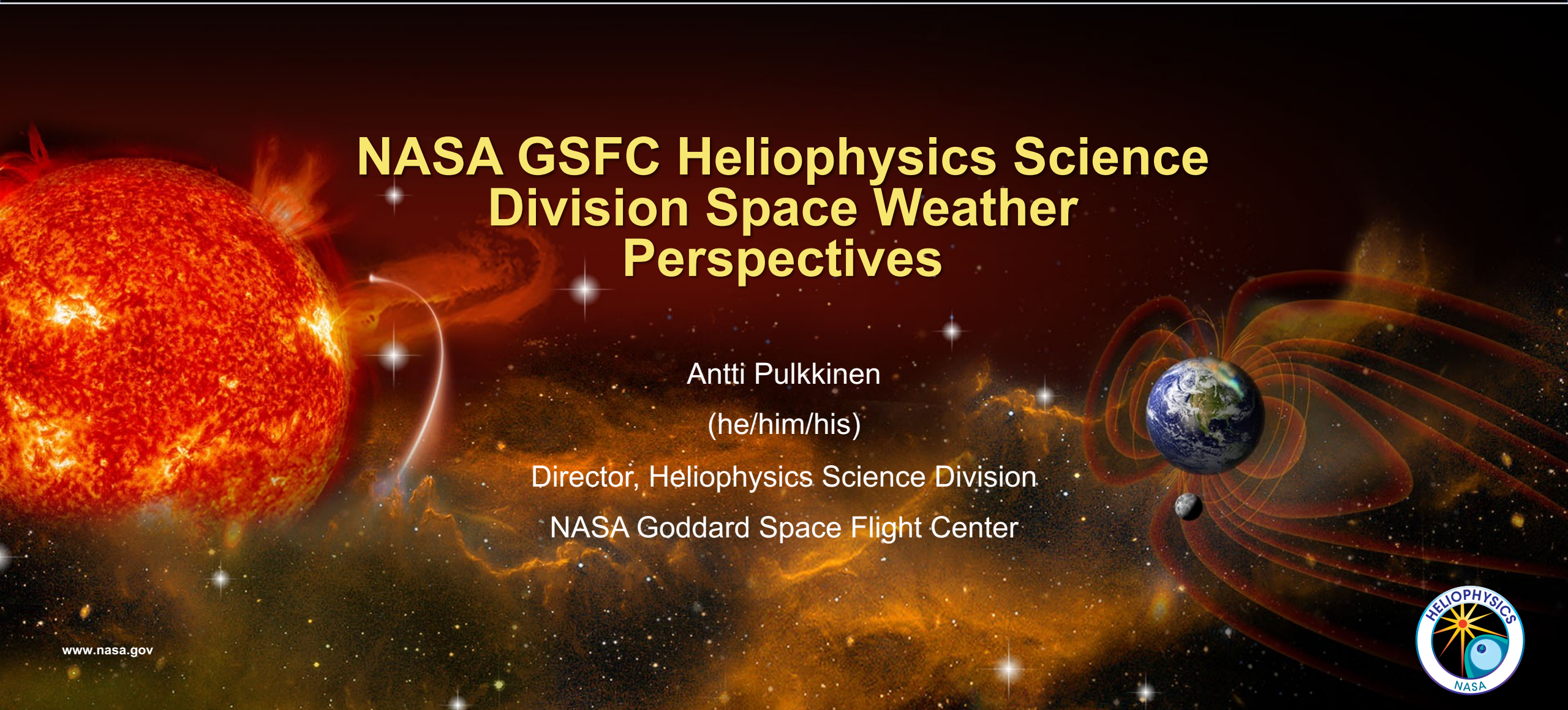
National Aeronautics and Space Administration



NASA GSFC Heliophysics Science Division Space Weather Perspectives

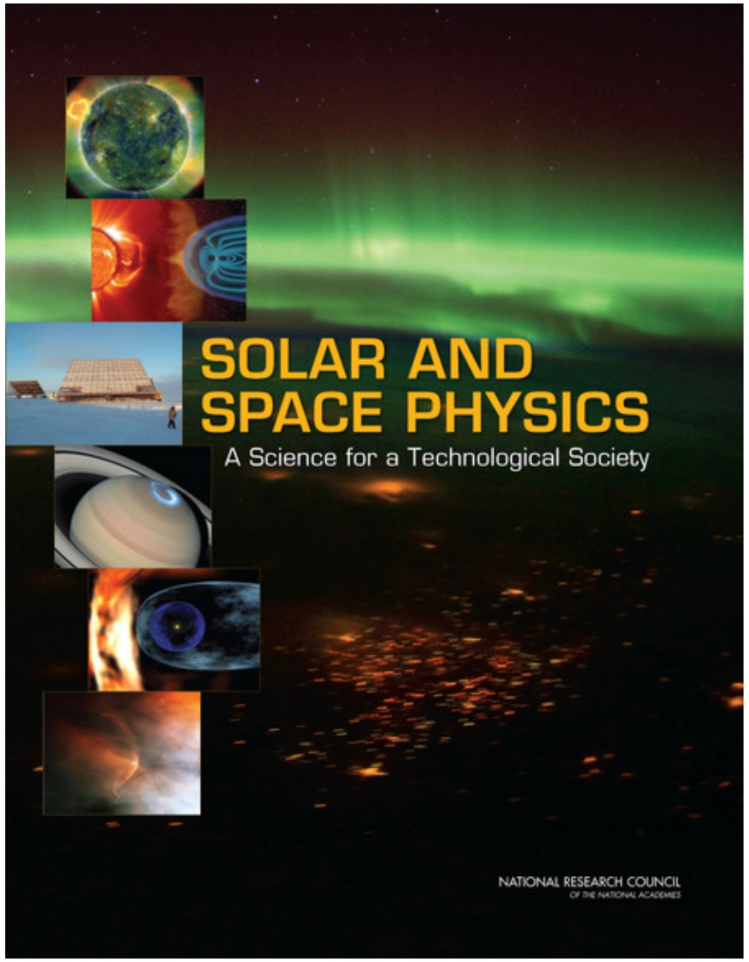
Antti Pulkkinen

(he/him/his)

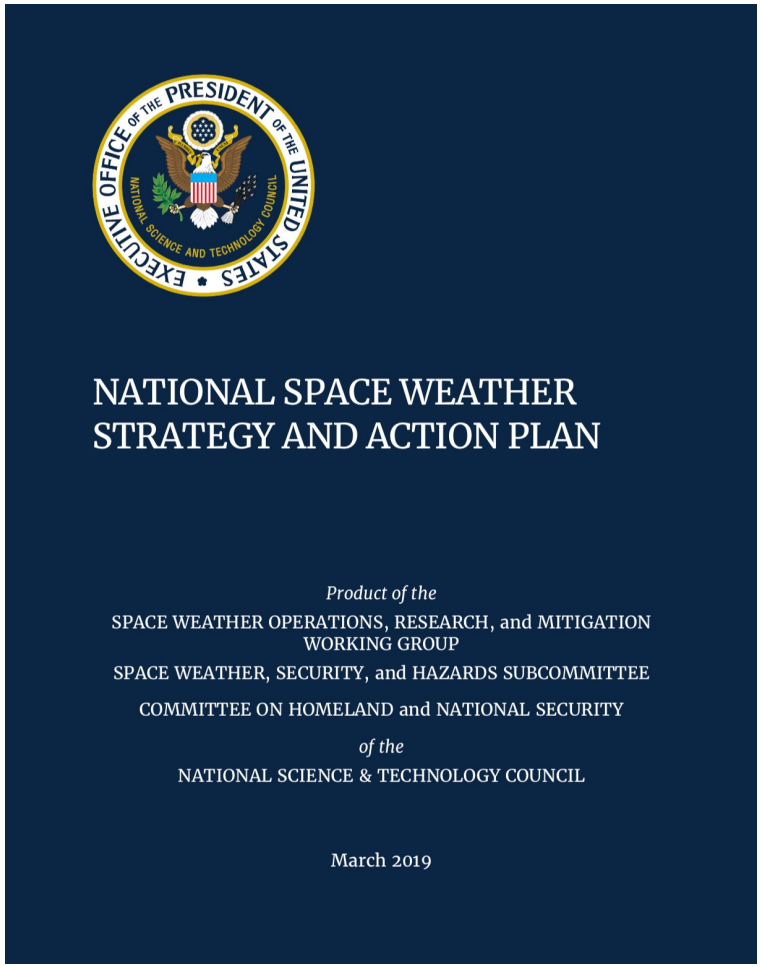
Director, Heliophysics Science Division

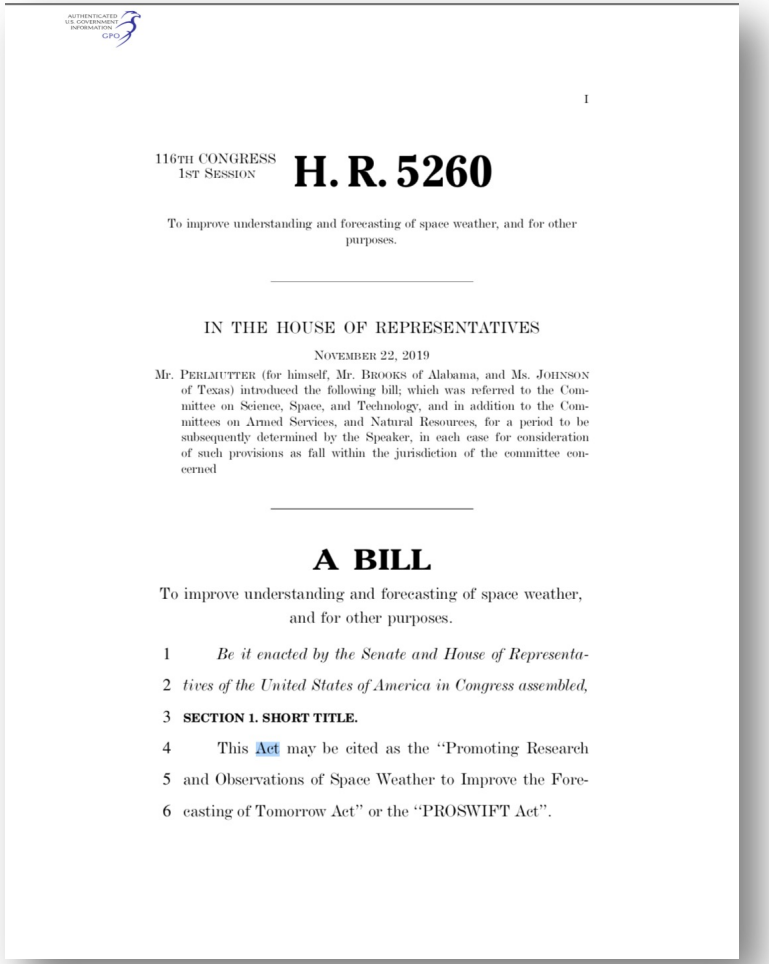
NASA Goddard Space Flight Center

NASA heliophysics & space weather objectives



Heliophysics Decadal Survey 2013-2022





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116TH CONGRESS
1ST SESSION

H. R. 5260

To improve understanding and forecasting of space weather, and for other purposes.

IN THE HOUSE OF REPRESENTATIVES

NOVEMBER 22, 2019

Mr. PERLMUTTER (for himself, Mr. BROOKS of Alabama, and Ms. JOHNSON of Texas) introduced the following bill; which was referred to the Committee on Science, Space, and Technology, and in addition to the Committees on Armed Services, and Natural Resources, for a period to be subsequently determined by the Speaker, in each case for consideration of such provisions as fall within the jurisdiction of the committee concerned

A BILL

To improve understanding and forecasting of space weather, and for other purposes.

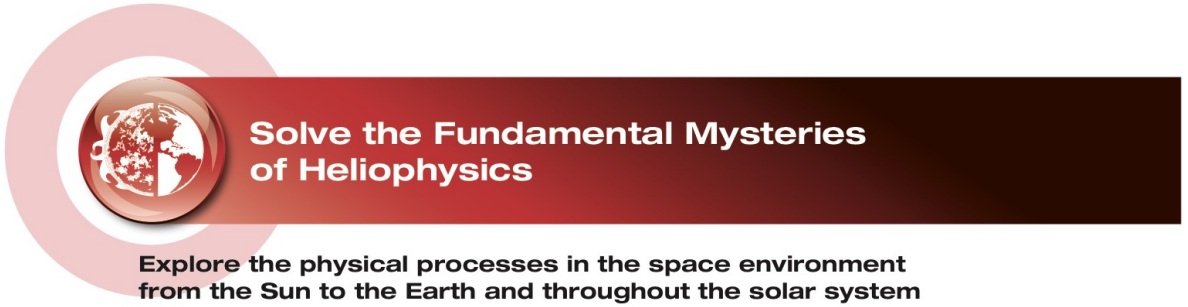
Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled,

SECTION 1. SHORT TITLE.

This Act may be cited as the "Promoting Research and Observations of Space Weather to Improve the Forecasting of Tomorrow Act" or the "PROSWIFT Act".

PROSWIFT Act 2020

NASA heliophysics & space weather objectives

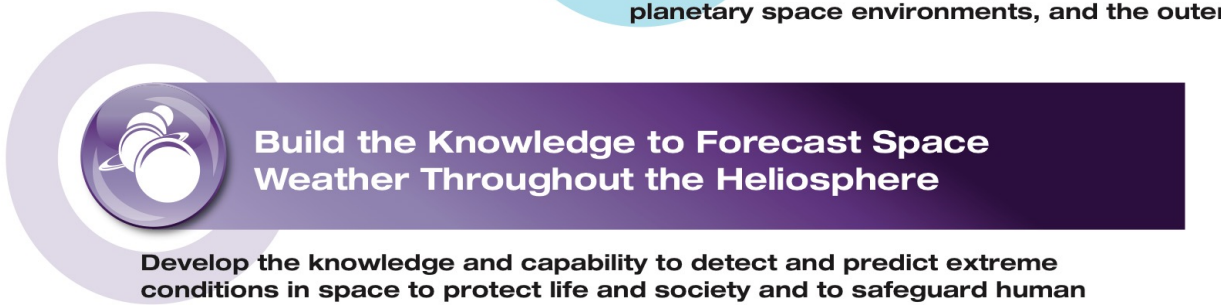


Solve the Fundamental Mysteries of Heliophysics

Explore the physical processes in the space environment from the Sun to the Earth and throughout the solar system

Understand the Nature of Our Home in Space

Advance our understanding of the connections that link the Sun, the Earth, planetary space environments, and the outer reaches of our solar system



Build the Knowledge to Forecast Space Weather Throughout the Heliosphere

Develop the knowledge and capability to detect and predict extreme conditions in space to protect life and society and to safeguard human and robotic explorers beyond Earth

Heliophysics Science Division (HSD) vision & mission

Our vision:

"To discover and innovate in heliophysics for the benefit of those on Earth and those exploring the solar system."

- Benefits include scientific discovery and applied sciences advances.
- Our physical domain of interest is the heliosphere, and beyond.
- Solar system exploration pertains to both human and robotic space exploration.

Our core values

Our interlinked core values are:

- promoting scientific excellence
- ensuring the well-being of all our people
- providing an equitable, inclusive, and diverse workforce and environment
- supporting the heliophysics community.

Our mission:

We utilize data analysis, theory, scientific modeling, instrument development, mission development, and other technological innovations to achieve new understanding of the heliophysics system. We partner with the wider heliophysics community and pursue full systems understanding by excelling in all heliophysics subdomains and inter-disciplinary connections to other Agency science areas.

HSD goals

Goal 1: High-quality and innovative science

- (1.1) Maintain world-leading expertise in all key heliophysics subdomains.
- (1.2) Pursue cross-Divisional and cross-disciplinary science investigations with the wider scientific community.
- (1.3) Actively engage and provide leadership for space weather activities, including applications and services. Keep strengthening our ties to human space exploration efforts.
- (1.4) Establish a strong **culture of innovation** that facilitates investigations and technologies stretching the boundaries of our imagination.

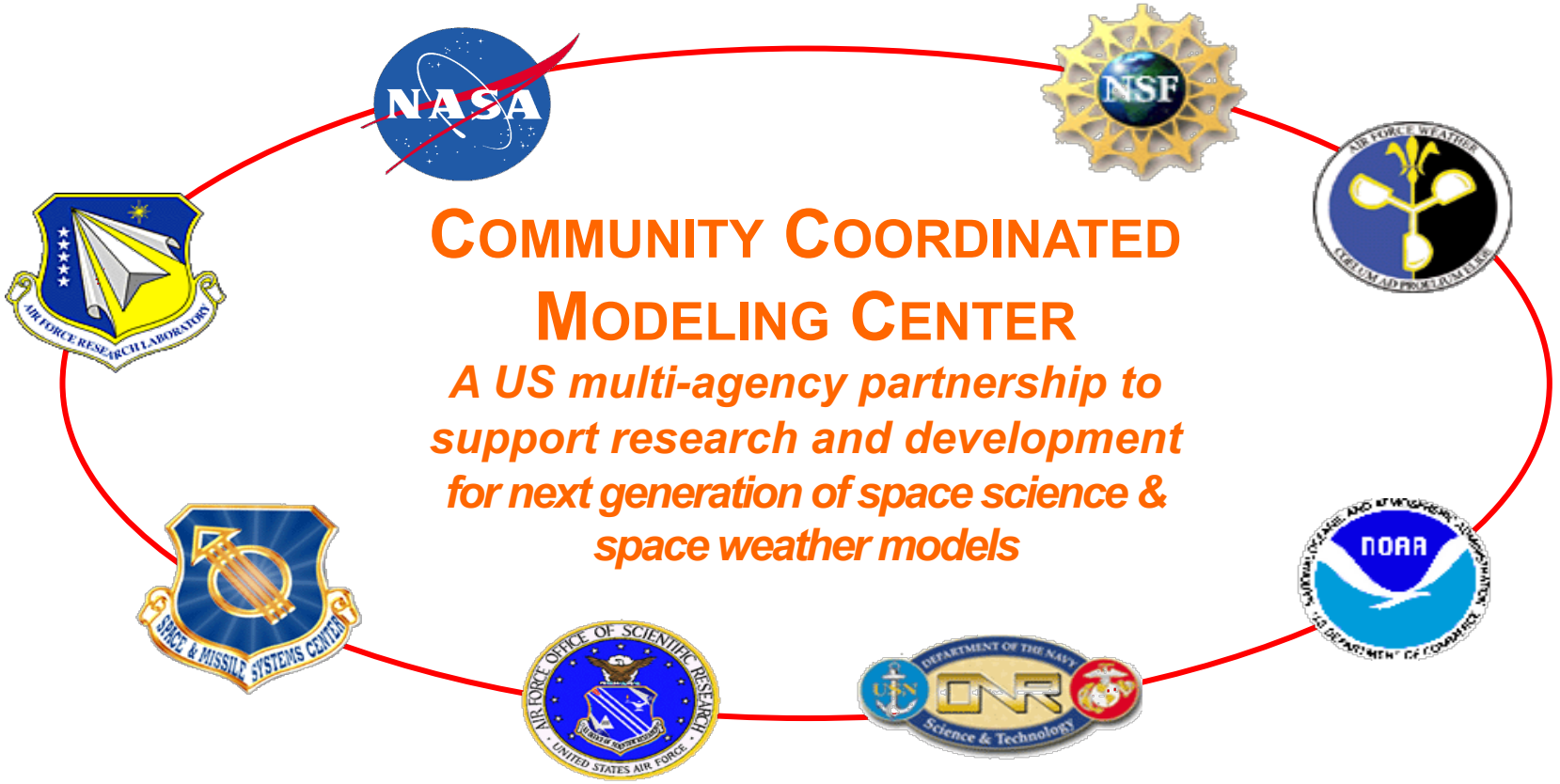
Goal 2: Well-being of all our Division personnel

- (2.1) Establish an even more diverse, equitable and inclusive workplace.
- (2.2) Ensure maximum possible organizational transparency allowing information flow, communications paths and opportunities to all individuals in the organization.
- (2.3) Ensure sustainable and healthy work-life balance for all individuals in the organization.
- (2.4) Support personnel professional growth to allow all to reach their full potential.

Goal 3: Partnering and service to our community

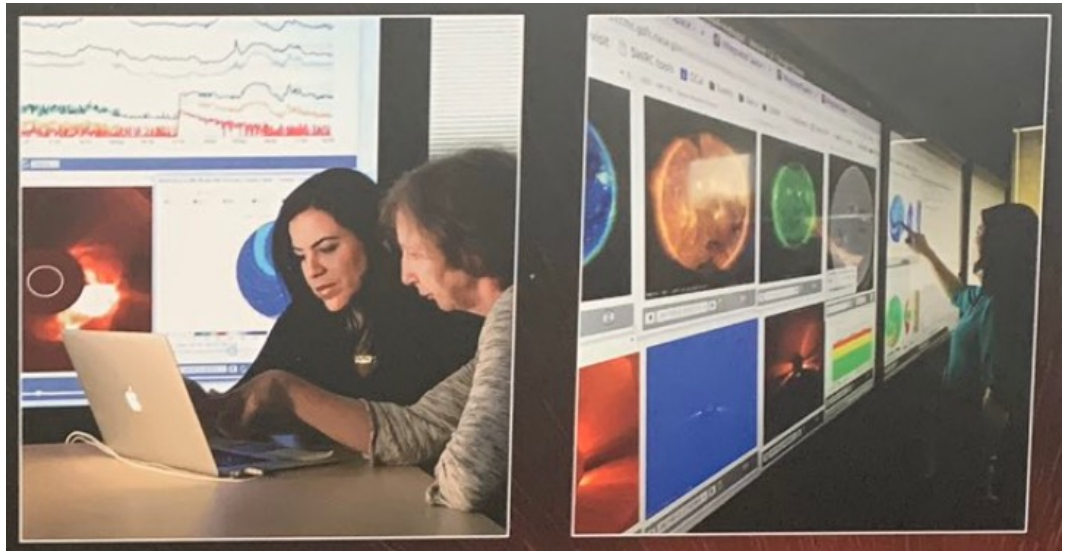
- (3.1) Provide scientific leadership in the community, including in the Decadal Survey process.
- (3.2) Partner with academic and commercial entities in basic and applied science investigations.
- (3.3) Partner with other federal agencies and help facilitate R2O.
- (3.4) Support and partner with HQ across the full spectrum of activities.
- (3.5) Supply comprehensive data products and innovative services to the community.
- (3.6) Educate and inform the public and other key stakeholders about heliophysics science and technology.

Community Coordinated Modeling Center



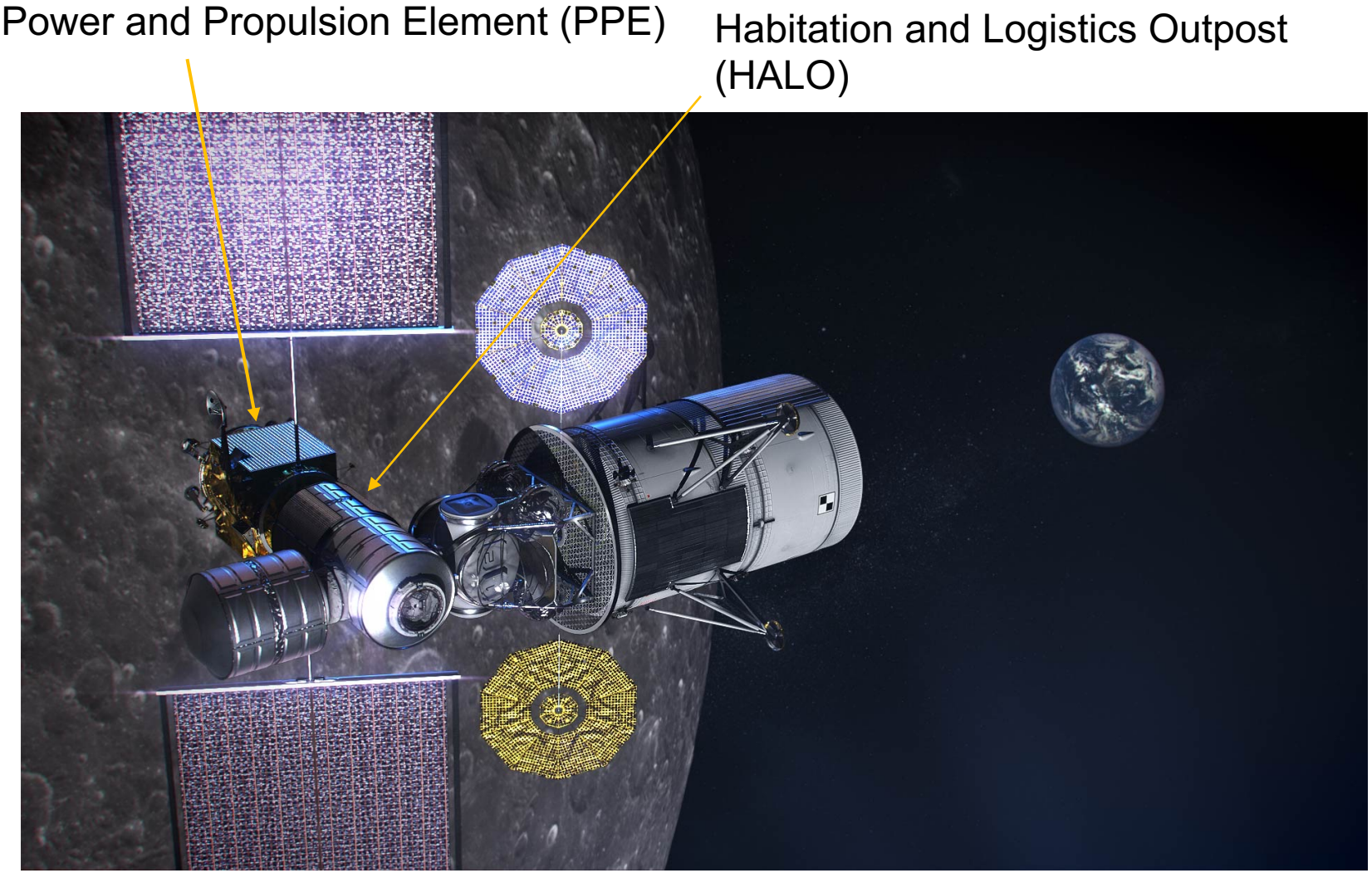
Moon to Mars (M2M) Space Weather Analysis Office

- Given the new challenges with deep space exploration missions, additional support is needed in analyzing the space weather environment especially beyond the Sun-Earth line.
- The M2M Office will support the JSC SRAG console operators by providing the necessary state-of the-art tailored space weather information.



M2M Office Chief Dr Collado-Vega (left) with Ms Chulaki

HERMES space weather suite(s)



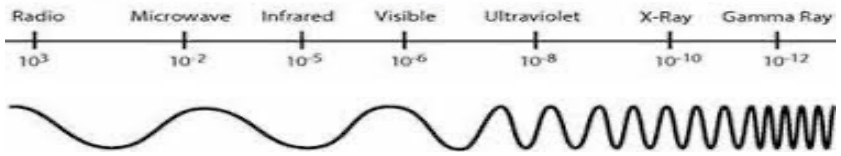
Instrument	PI
EEA, Electron Spectrometer (low energy electrons)	D. Gershman, GSFC
SPAN-i, Ion Spectrometer (low energy ions)	R. Livi, UC Berkeley
MERiT, Ion and Electron Telescope (energetic particles)	S. Kanekal, GSFC
Fluxgate and Magneto-Inductive Magnetometers	E. Zesta, GSFC; M. Moldwin, U. Michigan

Science Operations Center (SOC)	S. Christe, GSFC (Lead)

GSFC Heliophysics FY22 Tech Portfolio

Sensors and Instruments (TX08)

Remote Sensing Instruments & Sensors (8.1)



- UV Slit Spectrograph EUNIS
- Sodium Laser Spectrometer
- HEXITEC Detector Electronics
- HELENA X-rays
- CALISTE Detector Electronics
- LOONS Gamma rays

Observatories (8.2)

Mirror Systems (8.2.1)

- X-ray Diffractive Optics
- EUV Photon Sieve
- Lobster Eye X-ray Optics
- Microfabricated Pixelated Attenuator for X-rays

Structures and Antennas (8.2.2)

- ISS Solar Pointing Platform
- Laser Deflection Sensor for the Upper Atmosphere
- Compact Autodeploying Sunshade

In-Situ Instruments and Sensors (8.3)

Field and Particle Sensors (8.3.1)

Field Sensors

- B
  - MAG
  - NEMISIS
- E
  - VEFI

Particle Sensors

- e-
  - EEA
  - MERIT
  - APES 0.1 to 10KeV
  - TECHS 0.1 to 10KeV
  - SMACs
- Ions
  - IMS
  - MOSAIC Winds/ions
  - Tandem-IMS
  - HIT
  - IVMS
- Neutrals
  - HELENA Solar ENA
  - Laser Deflection Sensor for the Upper Atmosphere
  - LOONS neutrons

Existing | Maturing

Summary

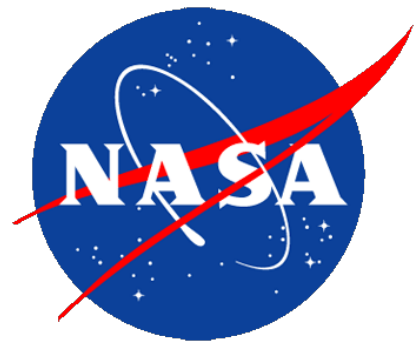
- While we are primarily a science organization, supporting the Agency's exploration activities and transitioning space weather capabilities into ops is an important focus area for NASA Goddard's Heliophysics Science Division.
- Addressing the space weather challenge requires not only Agency-level coordination but also close collaboration between government, academic and commercial entities.
- Partnering is another key focus area for us and we look forward to continue collaborating with the wider space weather community!

National Aeronautics and Space Administration

Follow Us Everywhere Under the Sun

HELIOPHYSICS

www.nasa.gov


NASA