Domestic Partnerships and Collaborations

Dr. Jinni Meehan
Assistant Director for Space Policy
White House Office of Science and Technology Policy
Co-Chair, Space Weather Operations, Research, and Mitigation Subcommittee

Space Weather Observations Summit
June 12, 2024

White House Space Weather Operations, Research, Mitigation Subcommittee (SWORM)

SWORM

2014 - 2016: White House charters Space Weather Operations, Research, and Mitigation (SWORM) Task Force (34 departments/agencies/offices) - develops a National Space Weather Strategy and Action Plan - releases Executive Order 13744, Coordinating Efforts to Prepare the Nation for Space Weather Events

In short - *SWORM brought together all of the scientific and the homeland security enterprises of the Federal Government, to improve preparedness for space weather events*

Key recent activities:

Promoting Research and Observations of Space Weather to Improve the Forecasting of Tomorrow Act (PROSWIFT)

PROSWIFT Act, Public Law 116–181, 116th Congress

"It shall be the policy of the United States to prepare and protect against the social and economic impacts of space weather phenomena by supporting actions to improve space weather forecasts and predictions…."

In short - *Codified into law many of the actions in the Strategy and Action Plan, and the Executive Orders - including existence of the SWORM, the new Space Weather Advisory Group, and the National Academies Space Weather Roundtable*

§ 60601 Space weather
- Role of Federal Agencies
- Interagency Working Group (SWORM)
- Interagency Agreements
- Space Weather Advisory Group (SWAG)

§ 60602 Integrated strategy

§ 60603 Sustaining and advancing critical observations

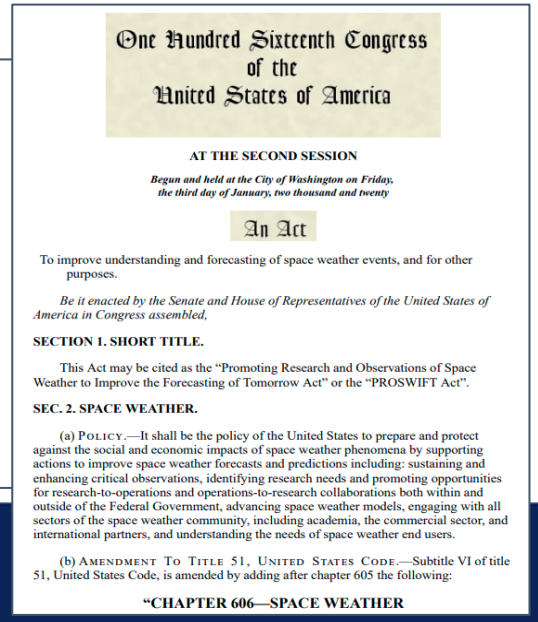
§ 60604 Research activities

§ 60605 Space weather data

§ 60606 Knowledge transfer and information exchange (NASEM Roundtable)

§ 60607 Pilot program commercial sector

§ 60608 Benchmarks



One Hundred Sixteenth Congress
of the
United States of America

AT THE SECOND SESSION

Begun and held at the City of Washington on Friday, the third day of January, two thousand and twenty

An Act

To improve understanding and forecasting of space weather events, 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".

SEC. 2. SPACE WEATHER.

(a) POLICY.—It shall be the policy of the United States to prepare and protect against the social and economic impacts of space weather phenomena by supporting actions to improve space weather forecasts and predictions including: sustaining and enhancing critical observations, identifying research needs and promoting opportunities for research-to-operations and operations-to-research collaborations both within and outside of the Federal Government, advancing space weather models, engaging with all sectors of the space weather community, including academia, the commercial sector, and international partners, and understanding the needs of space weather end users.

(b) AMENDMENT TO TITLE 51, UNITED STATES CODE.—Subtitle VI of title 51, United States Code, is amended by adding after chapter 605 the following:

"CHAPTER 606—SPACE WEATHER

PROSWIFT Act: Space Weather Advisory Group (SWAG)

§ 60601

SWAG

Advises the White House SWORM Subcommittee on: facilitating advances in the space weather enterprise of the US, improving the ability of the US to prepare for, mitigate, respond to, and recover from space weather phenomena, enabling the coordination and facilitation of R2O2R; and Developing and implementing the integrated strategy for coordinated observation

Composition - 15 members appointed by SWORM

Key Actions

- Recommendations to SWORM
  - 25 findings with 56 recommendations
- Conduct a comprehensive user needs survey of space weather products (completion expected Fall 2024)

Nongov End- User Representatives

Tamara Dickinson, SWAG Chair
Science Matters Consulting

Mark Olson
North American Electric Reliability Corporation

Michael Stills
United Airlines (retired)

Craig Fugate
One Concern (former FEMA Adm)

Rebecca Bishop
Aerospace Corp.

Commercial Representatives

Jennifer Gannon
Computational Physics, Inc.

Conrad Lautenbacher
GeoOptics, Inc. (former NOAA Adm)

Seth Jonas
Lockheed Martin

Kent Tobiska
Space Environment Technologies

Nicole Duncan
Ball Aerospace

Academic Representatives

Tomas Gombosi
University of Michigan, Ann Arbor

Delores Knipp
University of Colorado, Boulder

Scott McIntosh
National Centers for Atmospheric Research

Heather Elliott
Southwest Research Institute

George Ho
Southwest Research Institute

www.weather.gov/swag

Apply for FY 25-27 term!

PROSWIFT Act: Roundtable

§ 60606

National Academies Government-Academic-Commercial Roundtable

Facilitate communication and knowledge transfer among Government participants in the SWORM, the academic community, and the commercial space weather sector

Ex-officio members from NOAA, NASA, and NSF, also SWORM members

Topics addressed:

- Space Weather Benchmarks
- Space Weather Scales
- R2O2R (RL levels and modeling gaps)
- Cislunar support and beyond
- Ground-based observation networks

Helps educate and inform efforts to improve the ability of the United States to forecast space weather events and mitigate the effects.

1. **Geoffrey Crowley, Orion Space Solutions, Co-Chair**
2. **Sarah E. Gibson, National Center for Atmospheric Research, Co-Chair**
3. Hazel Bain, Cooperative Institute for Research in Environmental Sciences, CU
4. Anthea J. Coster, MIT Haystack Observatory
5. Janet C. Green, Space Hazards Inc.
6. Justin C. Kasper, BWX Technologies and University of Michigan
7. Delores Knipp, University of Colorado, Boulder
8. Louis J. Lanzerotti, NAE, New Jersey Institute of Technology
9. Mark H. MacAlester, Dept. of Homeland Security/CISA
10. M. Granger Morgan, NAS, Carnegie Mellon University
11. Geoffrey D. Reeves, Los Alamos National Laboratory
12. Michael Starks, Air Force Research Laboratory
13. Leonard Strachan, Jr., Naval Research Laboratory
14. Drew Turner, Johns Hopkins Univ.-Applied Physics Laboratory
15. Louis W. Uccellini, NOAA National Weather Service (ret.)
16. Shasha Zou, University of Michigan
17. Omar Nava, USAF

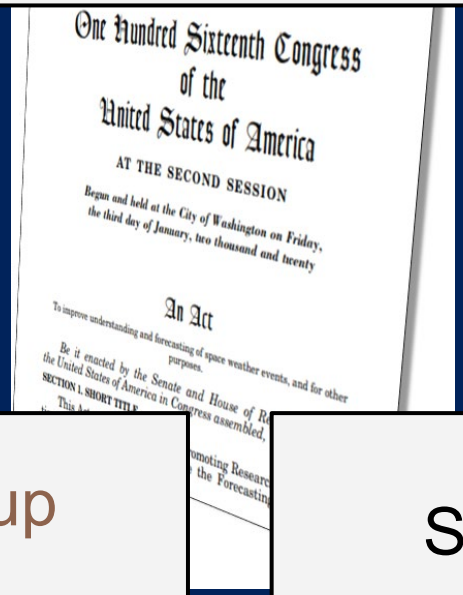
White House Space Weather Operations, Research, and Mitigation (SWORM) Subcommittee

PROSWIFT §60601

34 Federal Departments, Agencies and Offices

~ 50 principal members, 100+ SMEs

Advises the SWORM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Facilitate communication and knowledge transfer

Space Weather Advisory Group

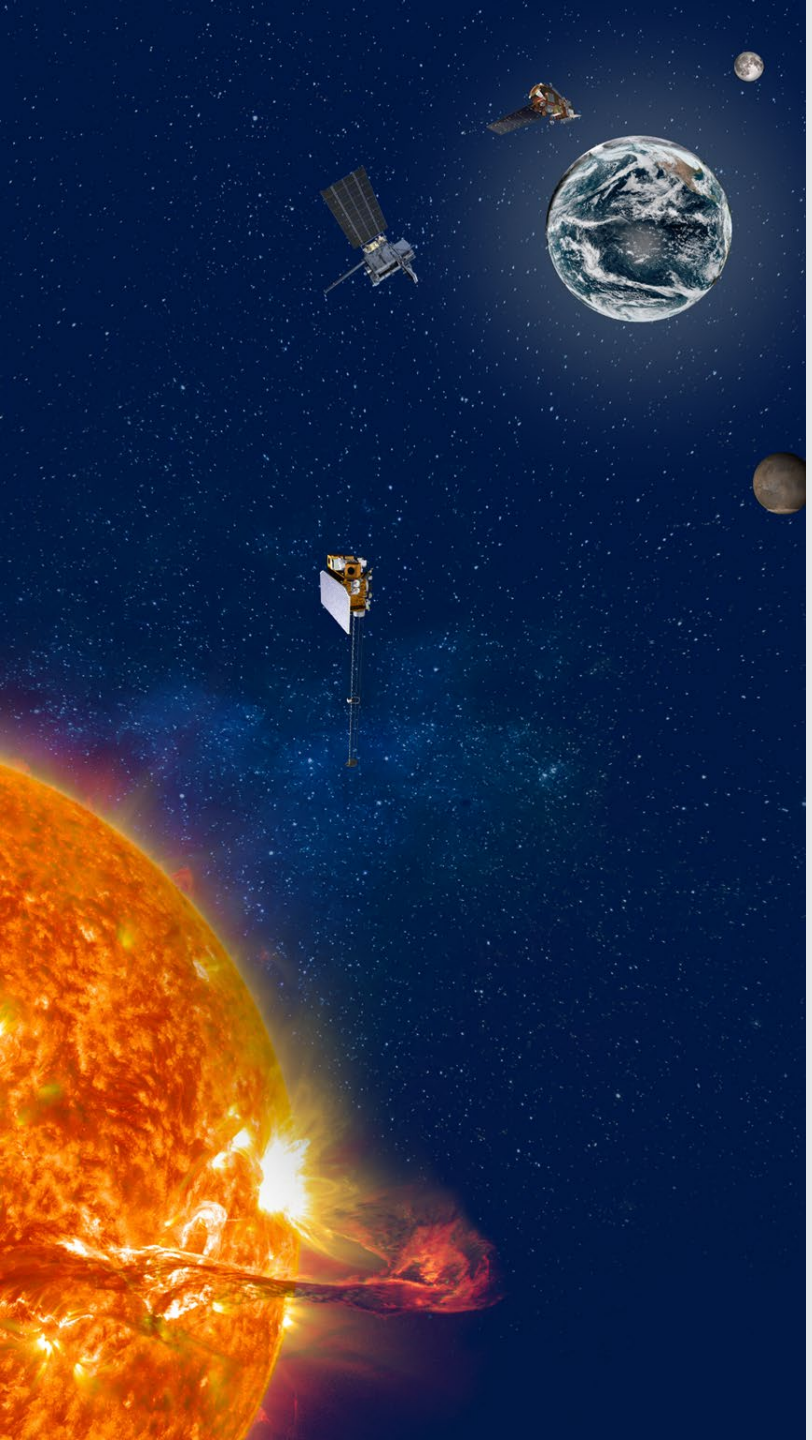
PROSWIFT §60601

15 non-governmental members: Commercial, Academic, End User

National Academy Space Weather Roundtable

PROSWIFT §60606

20 members: SWORM, Academic, and Commercial



Domestic Partnerships and Collaborations

Bill Murtagh
Program Coordinator
Space Weather Prediction Center
NOAA National Weather Service

Domestic Partnerships and Collaborations - Industry/Commercial

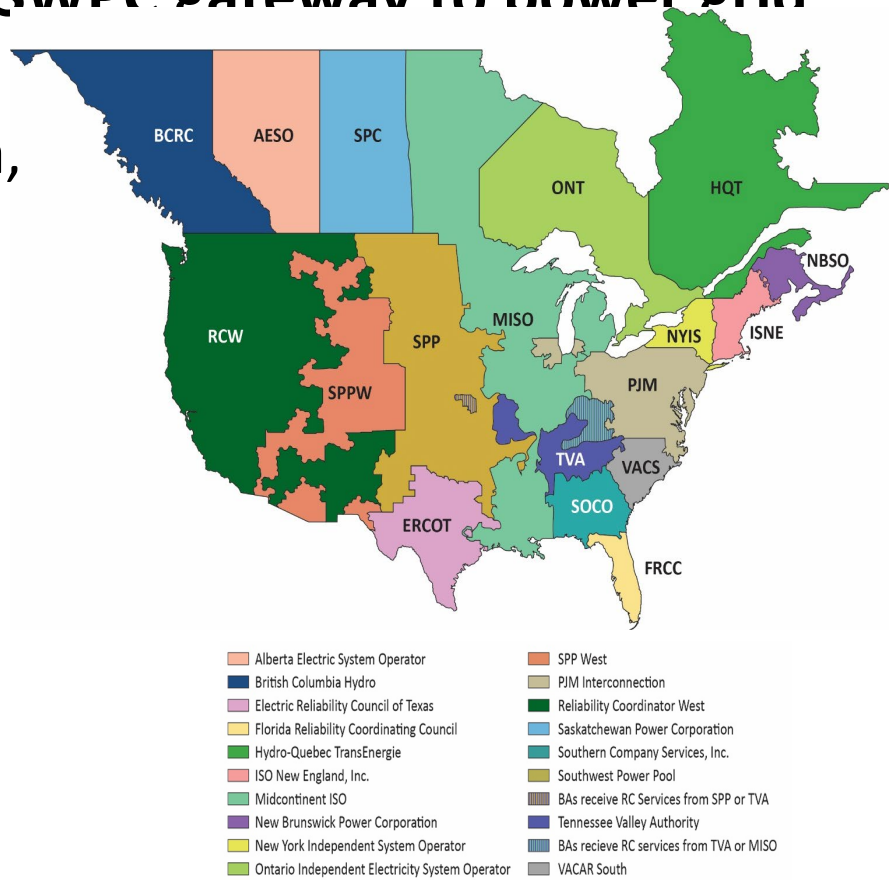
- Energy
- Aviation
- Satellites
- National Security
- NOAA Space Weather Scales

Energy Sector

North American Electric Reliability Corporation (NERC) - SWPC gateway to power grid

NERC is the electric reliability organization for North America, subject to oversight by the Federal Energy Regulatory Commission and governmental authorities in Canada

- Communications of alerts and warnings
- Feedback and observation following G3 or greater geomagnetic storms
- Facilitates engagements with Space Weather community - Hill briefings, scales revision, user needs, model development and validation



Aviation

Airlines for America (A4A) - SWPC gateway to aviation

A4A is the only trade organization of the principal U.S. airlines - members transport more than 90 percent of all U.S. airline passenger and cargo traffic

- Feedback and observation following space weather outbreaks
- Facilitates engagements with Sp Wx community - Hill briefings, Scales revision, model development and validation, user needs, training, much more

Satellites

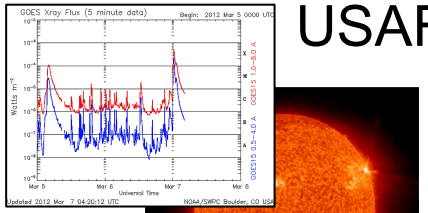
- **Space ISAC** (Information Sharing and Analysis Center)
- **DHS/CISA Space Systems Critical Infrastructure Working Group** - government and industry members that identify and develop strategies to minimize risks to space systems that support the Nation's critical infrastructure.
- **Satellite Exercise -** LEO Satellite Drag and Radiation-caused system degradations and upsets
  - Most major LEO operators attended
  - Superb discussion on processes, needs, and mitigation

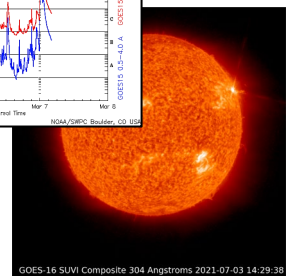
National Defence: 557 WW - SWPC Partnership

Data sharing: SWPC-USAF

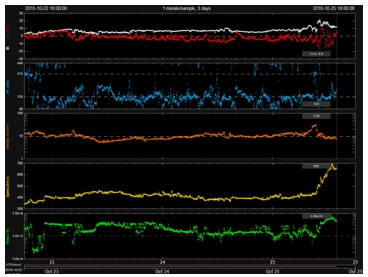
Solar Electro-Optical Network

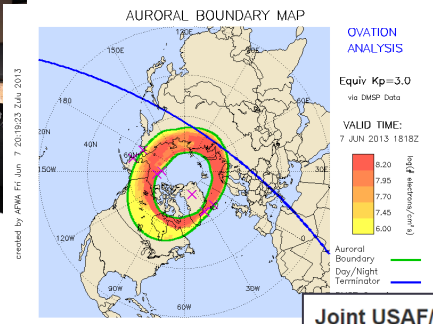
USAF-SWPC



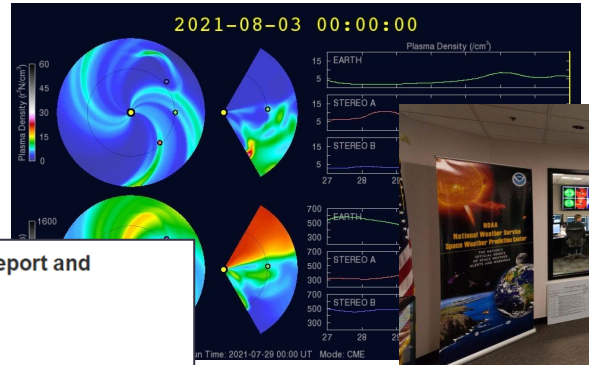


GOES *ACE/DSCOVR*





Collaboration between AF and NOAA forecasters



Joint USAF-NOAA products

Joint USAF/NOAA Solar Geophysical Activity Report and Forecast 27 July 2021

Status Report From: Space Weather Prediction Center (NOAA)
Posted: Tuesday, July 27, 2021

Joint USAF/NOAA Solar Geophysical Activity Report and Forecast
SDF Number 208 Issued at 2200Z on 27 Jul 2021

IA. Analysis of Solar Active Regions and Activity from 26/2100Z to 27/2100Z: Solar activity has been at very low levels for the past 24 hours. There are currently 2 numbered sunspot regions on the disk.

NOAA Space Weather Scales Revision

NOAA introduced the Space Weather Scales in 1999

- Communicate to the general public current and future space weather conditions and possible effects
- Unchanged since 1999, Scales are used worldwide to initiate hazard preparedness and mitigation operations
- Space weather capabilities, user base, and user needs have grown and changed dramatically over the last 25 year
- Two year effort now underway to revise the scales

NOAA Space Weather Scales

Category		Effect	Physical measure	Average Frequency (1 cycle = 11 years)
Scale	Descriptor	Duration of event will influence severity of effects		
Geomagnetic Storms			Kp values* determined every 3 hours	Number of storm events when Kp level was met; (number of storm days)
G 5	Extreme	Power systems: widespread voltage control problems and protective system problems can occur, some grid systems may experience complete collapse or blackouts. Transformers may experience damage. Spacecraft operations: may experience extensive surface charging, problems with orientation, uplink/downlink and tracking satellites. Other systems: pipeline currents can reach hundreds of amps, HF (high frequency) radio propagation may be impossible in many areas for one to two days, satellite navigation may be degraded for days, low-frequency radio navigation can be out for hours, and aurora has been seen as low as Florida and southern Texas (typically 40° geomagnetic lat.).**	Kp=9	4 per cycle (4 days per cycle)
G 4	Severe	Power systems: possible widespread voltage control problems and some protective systems will mistakenly trip out key assets from the grid. Spacecraft operations: may experience surface charging and tracking problems, corrections may be needed for orientation problems. Other systems: induced pipeline currents affect preventive measures, HF radio propagation sporadic, satellite navigation degraded for hours, low-frequency radio navigation disrupted, and aurora has been seen as low as Alabama and northern California (typically 45° geomagnetic lat.).**	Kp=8	100 per cycle (60 days per cycle)
G 3	Strong	Power systems: voltage corrections may be required, false alarms triggered on some protection devices. Spacecraft operations: surface charging may occur on satellite components, drag may increase on low-Earth-orbit satellites, and corrections may be needed for orientation problems. Other systems: intermittent satellite navigation and low-frequency radio navigation problems may occur, HF radio may be intermittent, and aurora has been seen as low as Illinois and Oregon (typically 50° geomagnetic lat.).**	Kp=7	200 per cycle (130 days per cycle)
G 2	Moderate	Power systems: high-latitude power systems may experience voltage alarms, long-duration storms may cause transformer damage. Spacecraft operations: corrective actions to orientation may be required by ground control; possible changes in drag affect orbit predictions. Other systems: HF radio propagation can fade at higher latitudes, and aurora has been seen as low as New York and Idaho (typically 55° geomagnetic lat.).**	Kp=6	600 per cycle (360 days per cycle)
G 1	Minor	Power systems: weak power grid fluctuations can occur. Spacecraft operations: minor impact on satellite operations possible. Other systems: migratory animals are affected at this and higher levels; aurora is commonly visible at high latitudes (northern Michigan and Maine).**	Kp=5	1700 per cycle (900 days per cycle)

Radio Blackouts			GOES X-ray peak brightness by class and by flux*	Number of events when flux level was met; (number of storm days)
R 5	Extreme	HF Radio: Complete HF (high frequency**) radio blackout on the entire sunlit side of the Earth lasting for a number of hours. This results in no HF radio contact with mariners and en route aviators in this sector. Navigation: Low-frequency navigation signals used by maritime and general aviation systems experience outages on the sunlit side of the Earth for many hours, causing loss in positioning. Increased satellite navigation errors in positioning for several hours on the sunlit side of Earth, which may spread into the night side.	X20 (2×10^{-3})	Fewer than 1 per cycle
R 4	Severe	HF Radio: HF radio communication blackout on most of the sunlit side of Earth for one to two hours. HF radio contact lost during this time. Navigation: Outages of low-frequency navigation signals cause increased error in positioning for one to two hours. Minor disruptions of satellite navigation possible on the sunlit side of Earth.	X10 (10^{-3})	8 per cycle (8 days per cycle)
R 3	Strong	HF Radio: Wide area blackout of HF radio communication, loss of radio contact for about an hour on sunlit side of Earth. Navigation: Low-frequency navigation signals degraded for about an hour.	X1 (10^{-4})	175 per cycle (140 days per cycle)
R 2	Moderate	HF Radio: Limited blackout of HF radio communication on sunlit side of the Earth, loss of radio contact for tens of minutes. Navigation: Degradation of low-frequency navigation signals for tens of minutes.	M5 (5×10^{-5})	350 per cycle (300 days per cycle)
R 1	Minor	HF Radio: Weak or minor degradation of HF radio communication on sunlit side of the Earth, occasional loss of radio contact. Navigation: Low-frequency navigation signals degraded for brief intervals.	M1 (10^{-5})	2000 per cycle (950 days per cycle)

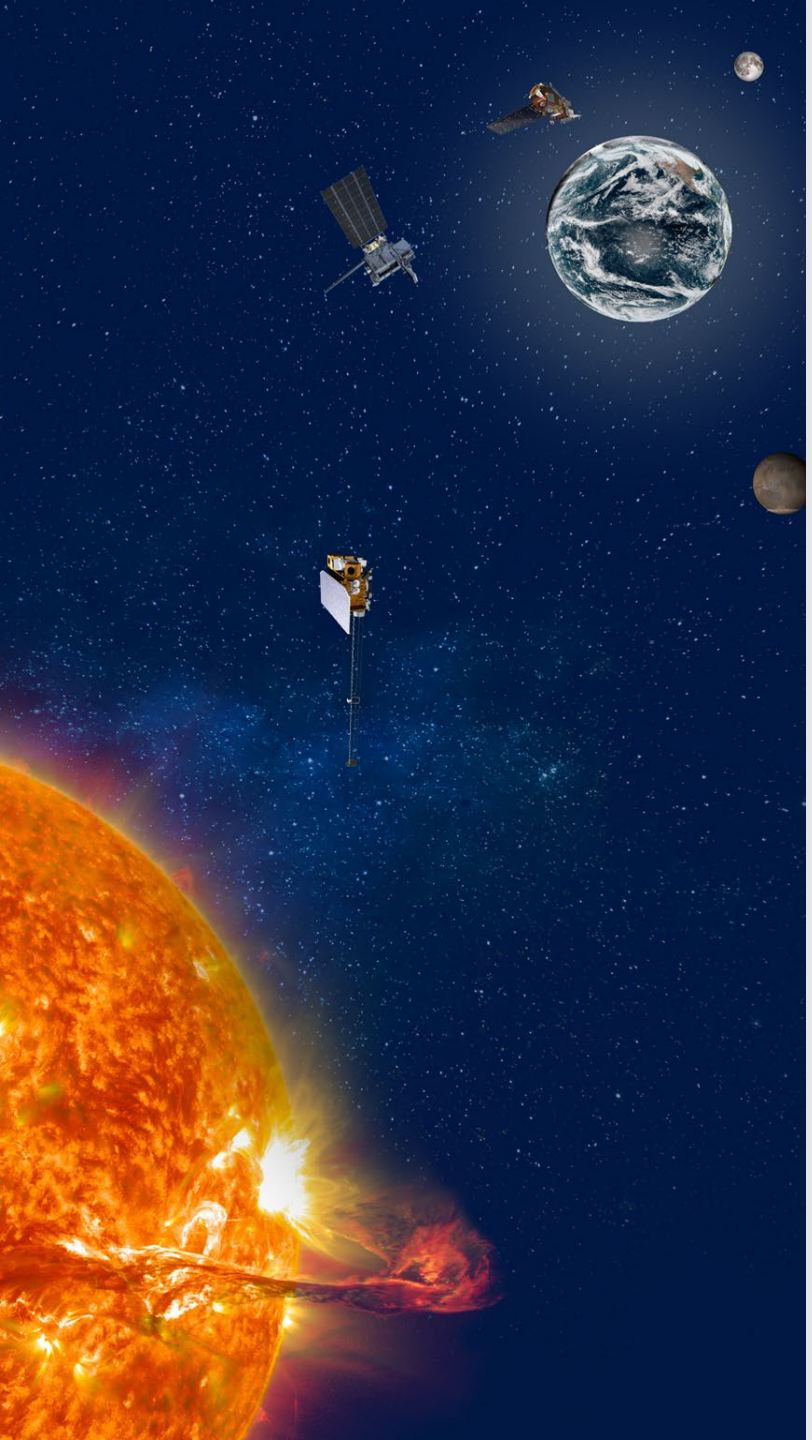
User engagement with key national and international stakeholders

Engagements conducted thus far:

- United Kingdom - Government - Sep 2023
- American Meteorological Society - Jan 2024
- Space Weather Workshop, Apr 2024
- STPI engaged 1-on-1 with multiple sectors (energy, aviation, satellites, etc.)
- Australia/New Zealand - May 2024

Coming up:

- European stakeholders (June 2024): all key European stakeholders such as the European Space Agency, as well as UN Specialized Agencies and International Organizations such as the World Meteorological Organization (WMO), the International Civil Aviation Organization (ICAO), and the North Atlantic Treaty Organization (NATO)
- COSPAR, Korea (July 2024)
- Brazilian Embassy, DC (Sep 2024)



Questions