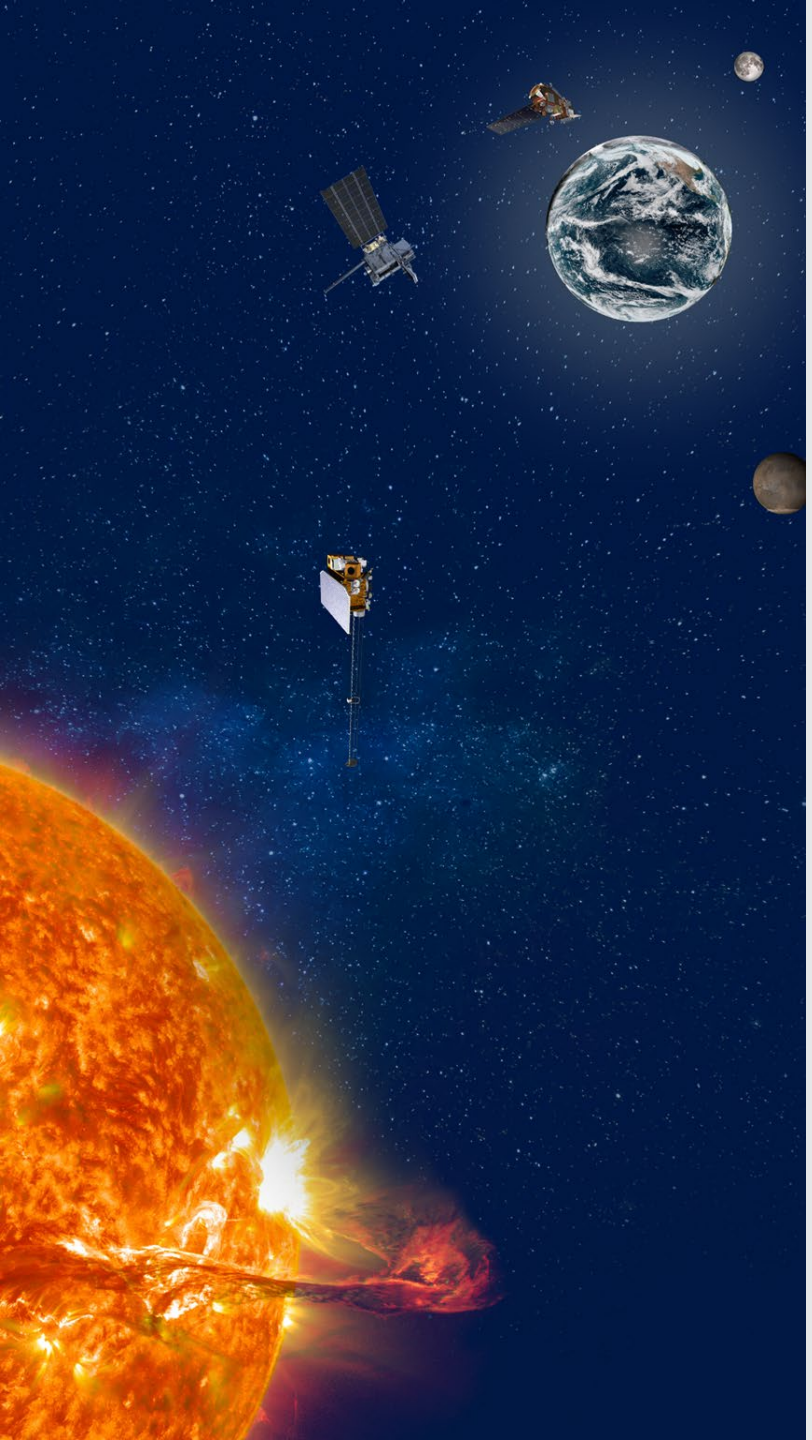


International Partnerships in SWO's Space Weather Mission

Christian Naylor - International Coordinator, SWO, Groundswell

Jennifer Clapp - Senior International Relations Specialist, NOAA-NESDIS, International and Interagency Affairs Division (IIAD) Space Weather Lead

Role of International Partnerships in SWO

- The October 2020 Promoting Research and Observations of Space Weather to Improve the Forecasting of Tomorrow (PROSWIFT) Act calls for NOAA to leverage international and interagency partnerships to enhance its space weather capabilities.
- SWO's pursuit of partnerships is also aligned with NESDIS requirements to "develop, acquire, implement, or operate environmental data sources and systems as needed to fulfill its validated user requirements".
- International partnerships present opportunities for collaborative activities including :
  - Rideshares
  - Hosted payloads (NOAA as either host or payload provider)
  - Collaboration and coordination for technology maturation
  - Data purchases or exchanges
  - New data analysis and assimilation testing
  - Research activities (algorithm development, modeling improvements)
  - Ground services (Ground entry points, networks)
  - Data distribution
  - Instrument development

NESDIS-IIAD Mission

To meet the challenge of understanding and predicting changes in climate, weather, oceans, and coasts, NESDIS IIAD facilitates the access, provision, and use of *in situ* and remote sensing data and products, and develops and implements U.S. policy by:

- **Linking** Earth observation needs to *in situ* and satellite resources;
- **Coordinating** global solutions to shared challenges in obtaining, processing, and building capacity to exploit both *in situ* and satellite data;
- **Providing insight** into international developments and partnerships; and
- **Leading** the international community in the adoption of responsible policies for satellite operation and data.

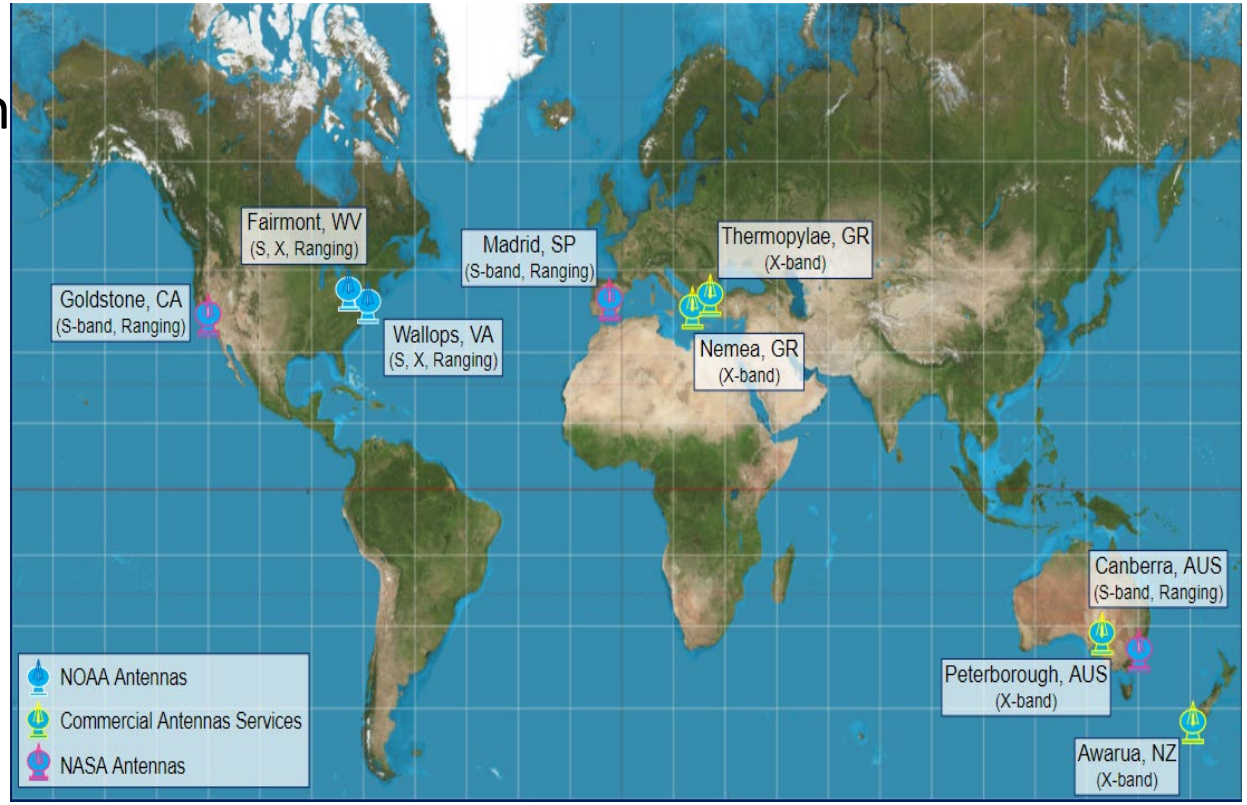

USA
JAPAN
SOUTH KOREA
INDIA
CHINA
FRANCE
RUSSIA
SPAIN
NOAA
EUMETSAT
EUROPEAN COMMISSION
TAIWAN SPACE AGENCY (TASA)
EUROPEAN SPACE AGENCY
NASA
DEPARTMENT OF DEFENSE
STEREO
DSCOVR
SOHO
ACE
GK-2A
GK-2B
HIMAWARI-8/9
FY-4
FY-2
INSAT-3D
ELECTRO-L
INSAT-3DR
KALPANA
EWS-G1
METEOSAT-8
METEOSAT-9
METEOSAT-10
METEOSAT-11
140.7°E
128.2°E
105°E
90°E
86.5°E
82°E
78°E
74°E
41.5°E
9.5°E
0°
3.4°W
180°W
137°W
135°W
105°W
89.5°W
75°W
KOMPSAT-5
PAZ
NOAA-15/18/19
GPM
SENTINEL-6 MICHAEL FREILICH
MEGHA-TROPIQUES
SENTINEL-2
JASON-3
SENTINEL-5P
GCOM
SENTINEL-3
SCATSAT-1
METEOR
FY-3
METOP A/B
DMSP-F14-18
NOAA-20
COSMIC 1/2
A-TRAIN CONSTELLATION
SUOMI NPP
GOES - WEST
GOES - 15
GOES - 14
GOES - EAST
GEOSTATIONARY ORBIT
NEAR-POLAR ORBIT
LAGRANGE POINT 1

IIAD Role working with NESDIS Offices, including SWO

- Manages overall NESDIS relationships with foreign counterpart agencies, both bilaterally and multilaterally.
- Develops an negotiates partner agreements.
- Provides input and NESDIS positions to support broader U.S. Government policies and Administration, State Department, and National Space Council initiatives.
- Coordinates participation in specialized multilateral groups such as the Coordination Group for Meteorological Satellites (CGMS).

International Partnerships in SWO Missions: SWFO-L1

- As the Earth rotates below the Sun and the SWFO-L1 spacecraft, any given ground station can only observe the spacecraft for at most 8 hours.
- The SWFO Program is therefore building a network of 6 stations (3 primary and 3 backup) in the continental US, New Zealand, Australia, and Southern Europe.
- The SWFO Program is seeking to enhance its global coverage of communications with the spacecraft through International ground station partnerships



International Partnerships in SWO Missions: SWFO-L1

- SWO has finalized Space Weather Cooperation agreements providing for the establishment of partner SWFO-L1 Ground Stations with the Japan National Institute of Information and Communications Technology (NICT) and the Republic of Korea Radio Research Agency (RRA).
- Work is ongoing to complete additional agreements with prospective international partners for SWFO-L1
- SWO hopes to build upon established partnerships to continue cooperation through future missions at L1.

NICT

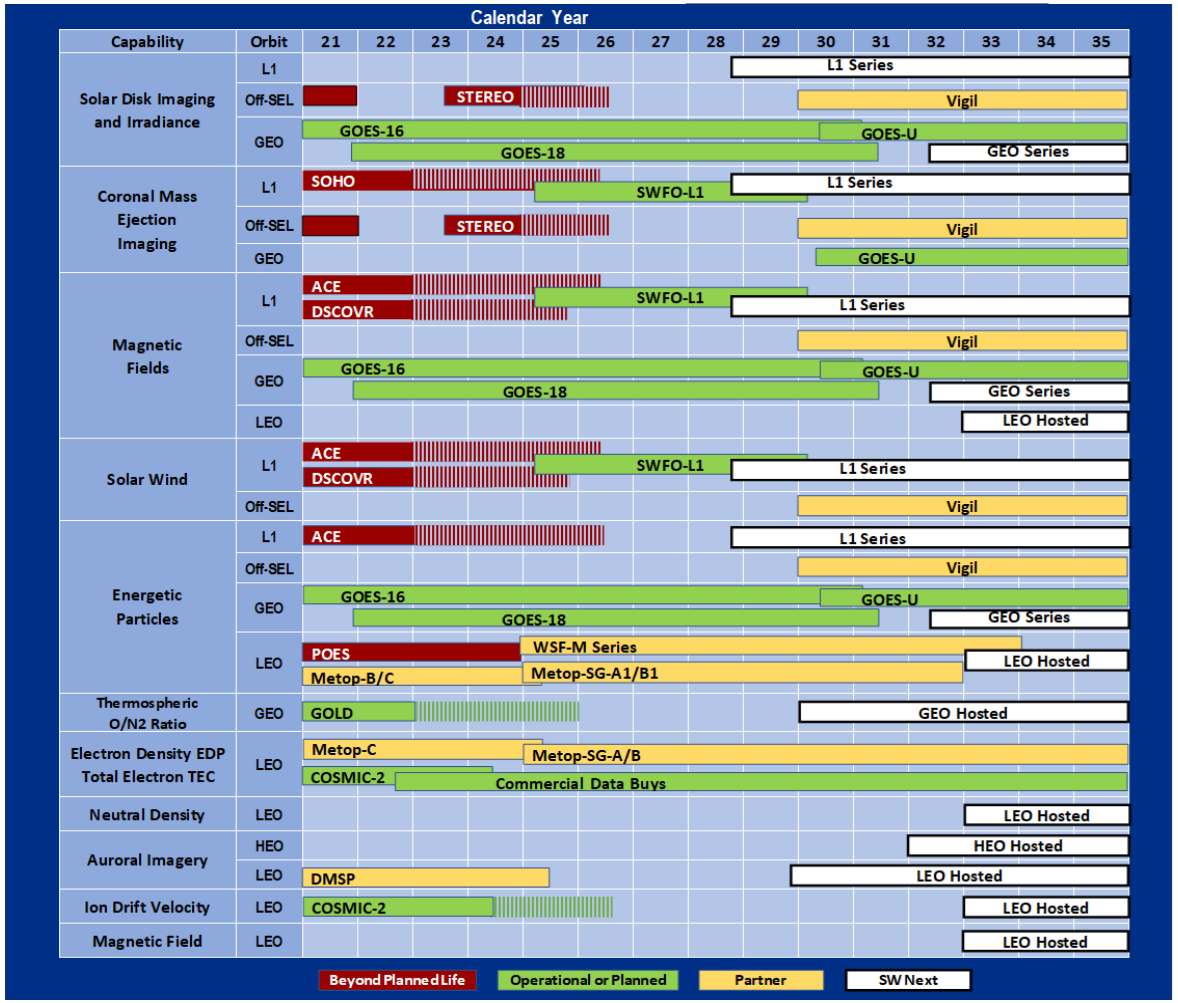
National Radio Research Agency

Role of International Partner Missions in the Space Weather Next Program

- Space Weather Next Program Objectives call for partnerships to contribute in fulfilling observation objectives:

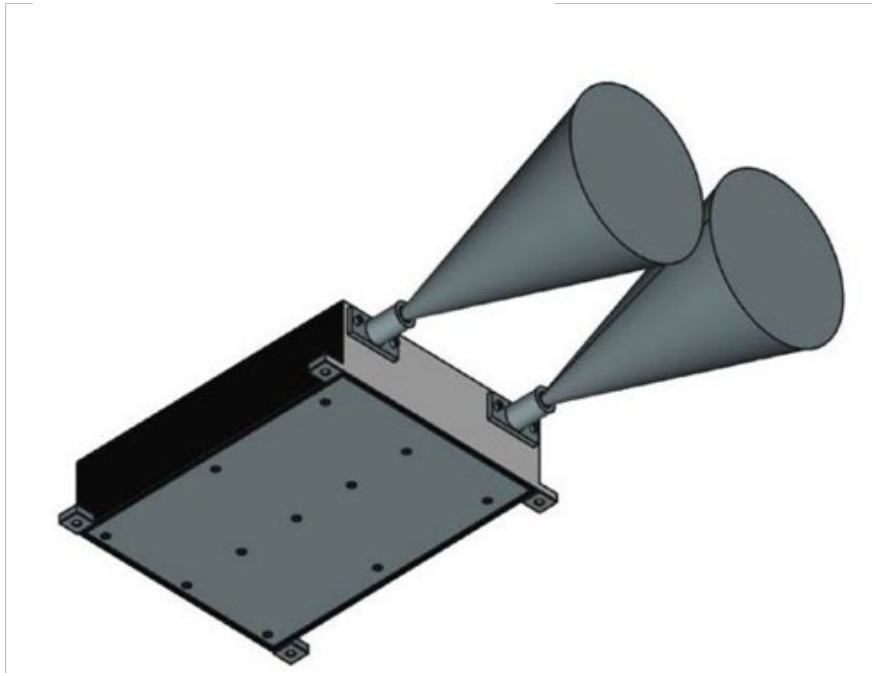
  “The SW Next program will seek interagency, international, and commercial partnerships to augment its ability to meet space weather mission requirements”.

- SWO is engaging with a wide variety of established and prospective partners to obtain desired observations.



International Partnerships in SWO Missions: Space Weather Next L1

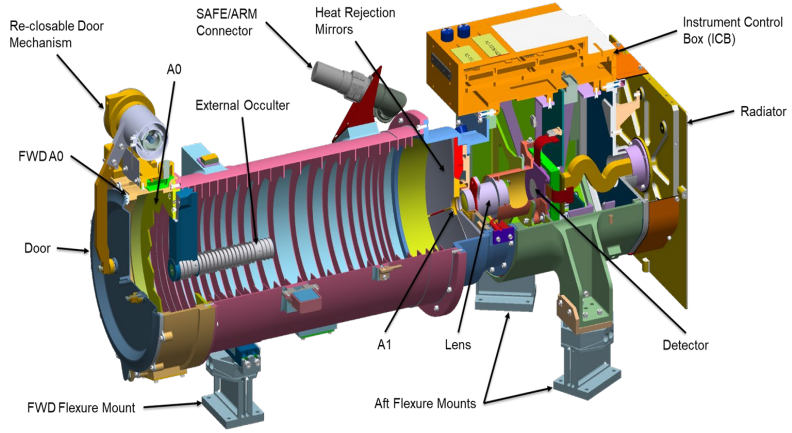
- The European Space Agency (ESA) signed an agreement with NOAA in February 2022 for Cooperation on Space-based Space Weather Observations.
- A key component of this agreement: ESA's provision of an X-ray Flux Monitor to be flown by NOAA at L1 for measurements of the integrated X-ray flux and spectrum of the whole visible part of the Sun and corona.
- The Instrument is planned to be flown on SW Next L1-A for launch in 2029.



X-Ray Flux Monitor

International Partner Mission Highlight: ESA Vigil - SWO L5 Project Collaboration

- An additional element of the 2022 NOAA-ESA Space Weather agreement: NESDIS Provision of a Compact Coronagraph to fly on ESA Vigil mission to L5. The agreement includes:
  - NESDIS provision of a Compact Coronagraph to fly on Vigil mission to L5
    - Compact Coronagraph (CCOR-3) being built by NRL as a near-copy of the CCOR-2 on SWFO-L1.
    - SW Next is defining CCOR-3 Level 0 data receipt and processing requirements.
  - Exchange of data from all SWFO and Vigil instruments
    - SW Next is defining product interface and distribution requirements.
- During L5 Project Level Setting Meeting **2024 Project Milestones were approved to proceed**
- **L5 Formulation Authorization Document (FAD)** signed December 2023
- SWO and ESA teams are collaborating to develop a Project Implementation plan to further guide cooperation on the mission.



NRL CCOR

SWO Engagement in Multilateral Organizations

- SWO staff are active in international multilateral organizations which act to coordinate the activities of different agencies in environmental satellites and space weather including:
  - World Meteorological Organization (WMO) Expert Team on Space Weather.
  - Coordination Group for Meteorological Satellites (CGMS).
  - International Radio Occultation Working Group (IROWG).
- SWO Director, Dr. Elsayed Talaat acts as co-chair of CGMS Space Weather Coordination Group (SWCG).

Vision for Continued Engagement with International Partners

- Successfully implement existing partnerships.
- Build on established partnerships for future missions.
- Establish new partnerships.
- Increase engagement and coordination with global space weather community through multilateral platforms.