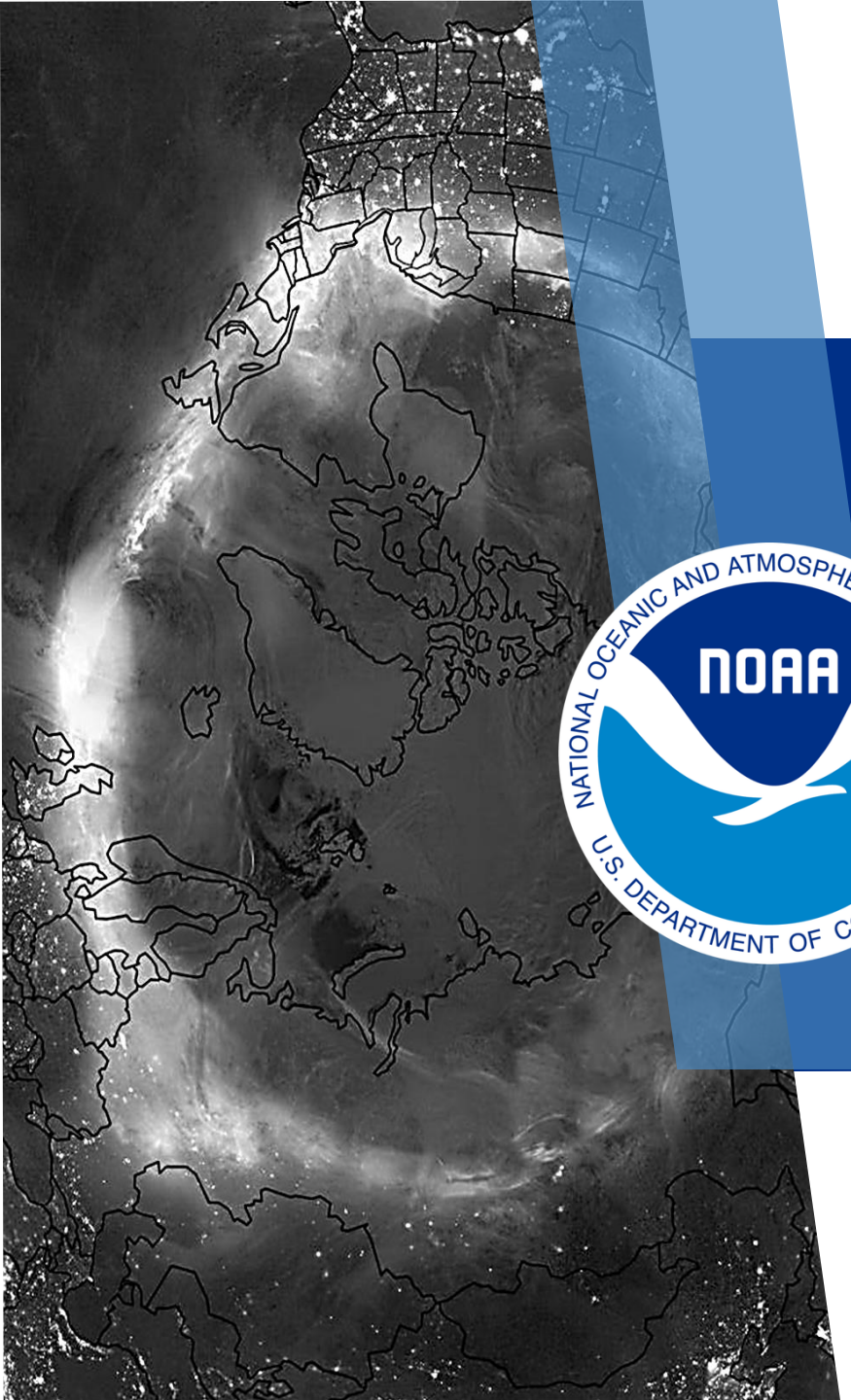
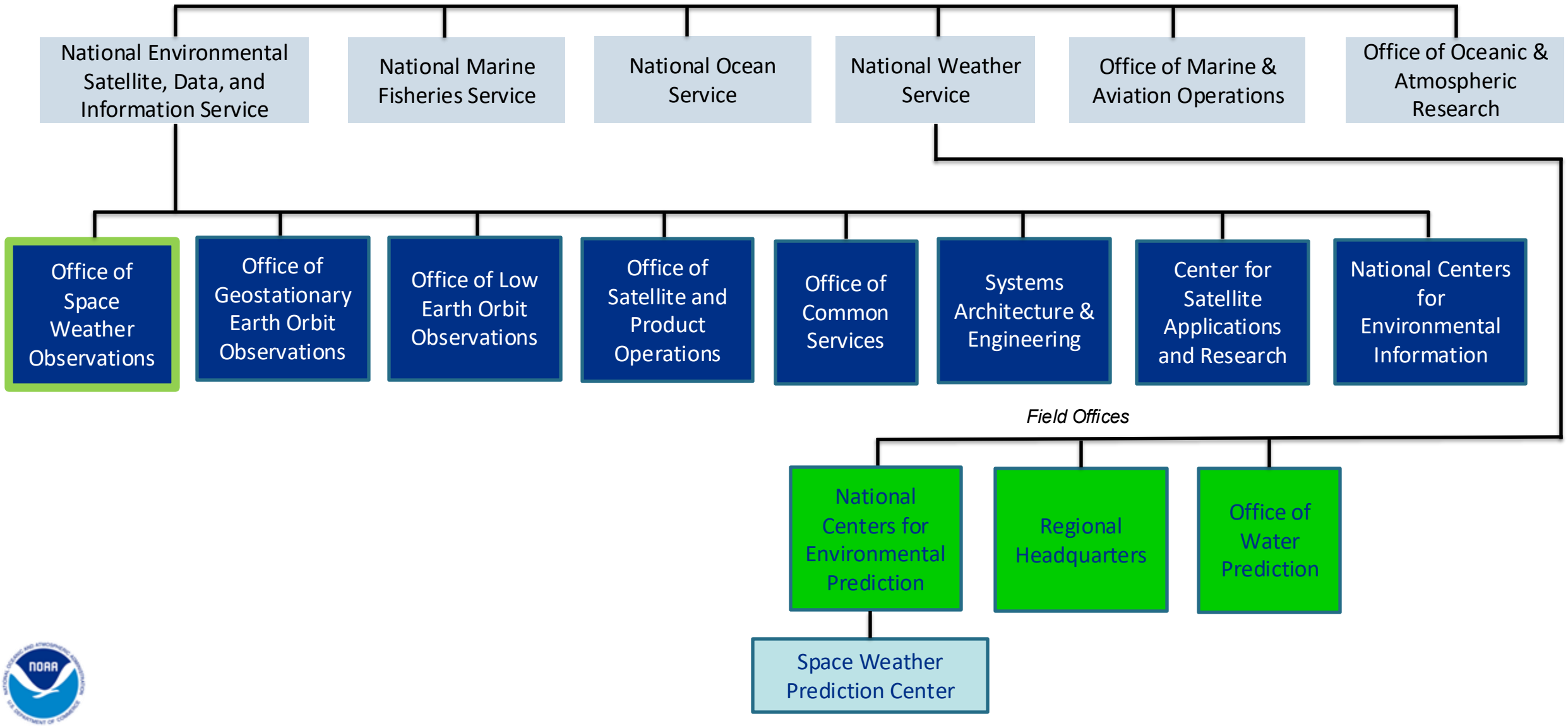


2025 Joint CEDAR / GEM Workshop

NOAA Space Weather Observations Program

Irfan Azeem
Division Chief, Science and Engineering
Office of Space Weather Observations (SWO)
NOAA/NESDIS

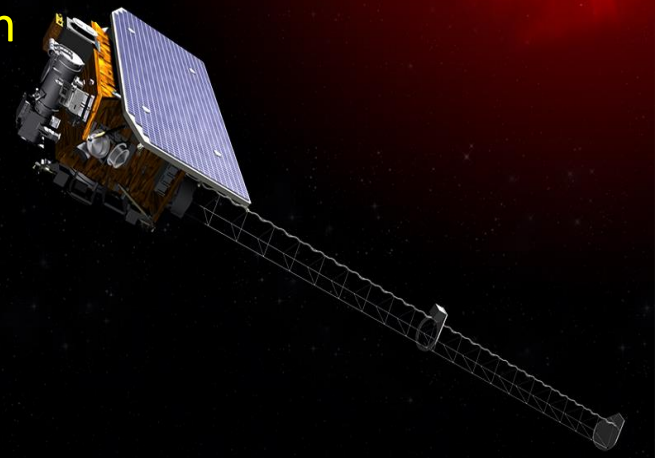
Space Weather @ NOAA



Space Weather Observations (SWO) Portfolio

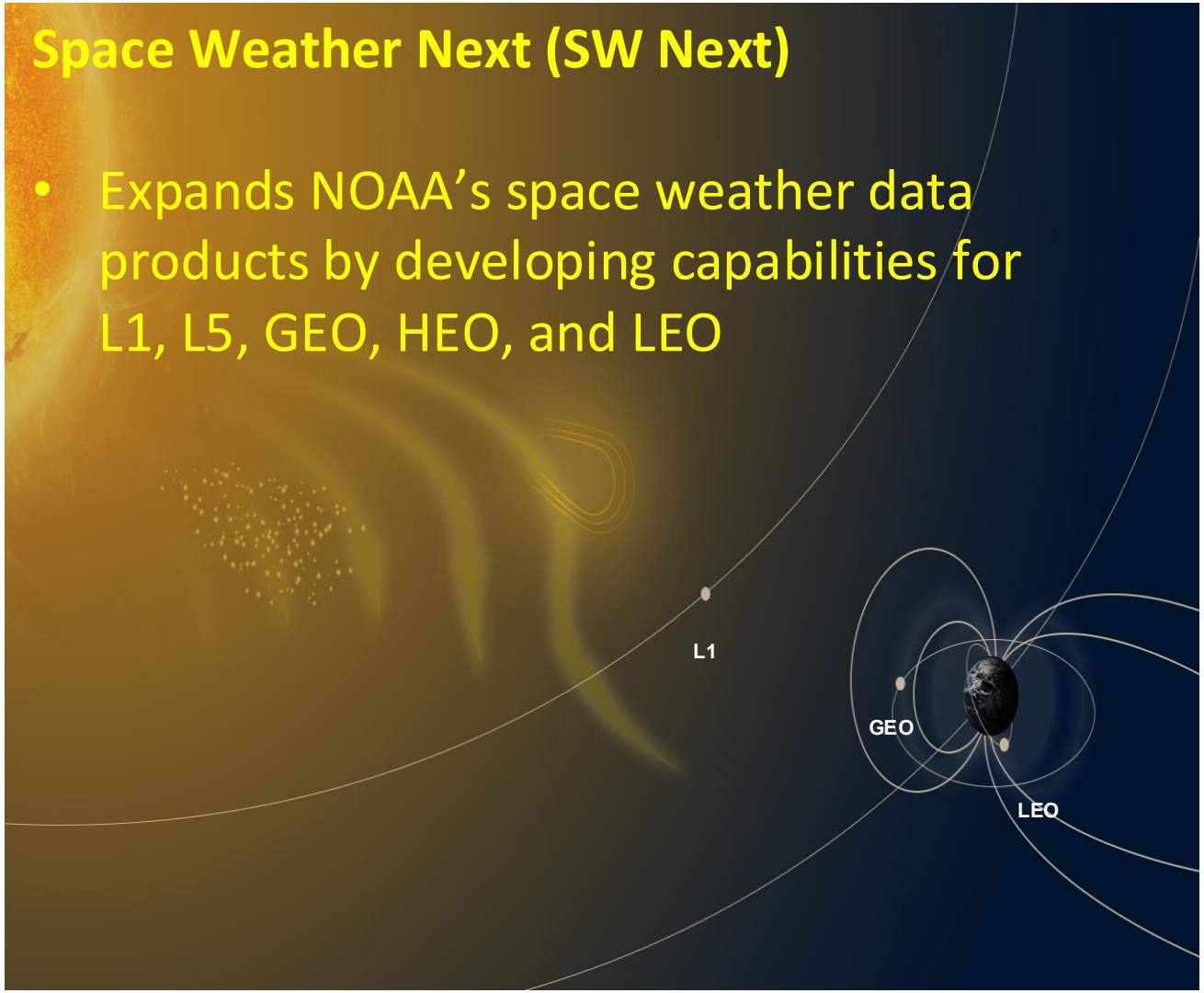
Space Weather Follow On (SWFO)

- Two program elements
  - SWFO-L1 mission and GOES-U coronagraph



Space Weather Next (SW Next)

- Expands NOAA's space weather data products by developing capabilities for L1, L5, GEO, HEO, and LEO



GOES-19 Space Weather Data

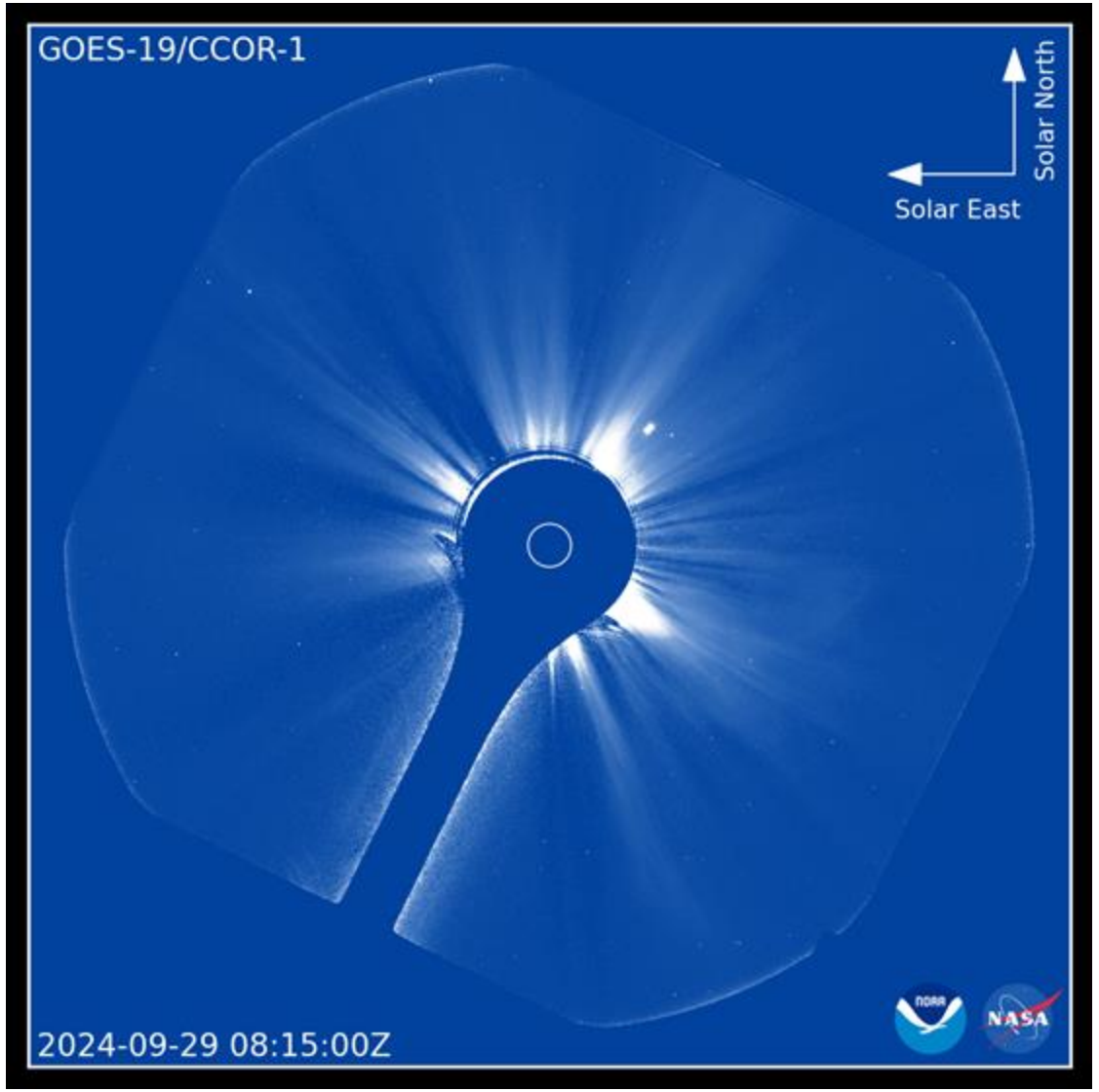
- GOES-U launched on June 25, 2024, and was renamed GOES-19 upon reaching geostationary orbit on July 7, 2024.
- All space weather instruments providing science data

GOES-R data can be found at:

- https://www.ncei.noaa.gov/products/space-weather/satellites

GOES-19 CCOR-1 data can be found at:

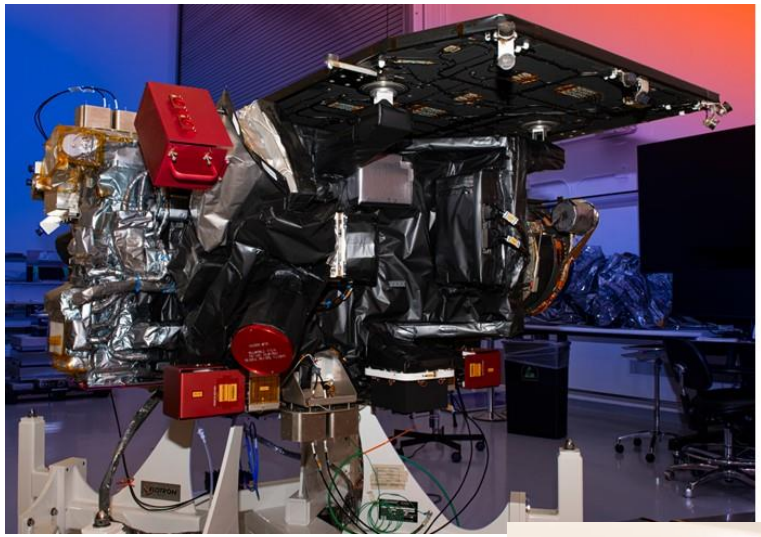
- https://www.ncei.noaa.gov/access/metadata/landing-page/bin/iso?id=gov.noaa.ncei.swx:ccor1-l1b-swfo

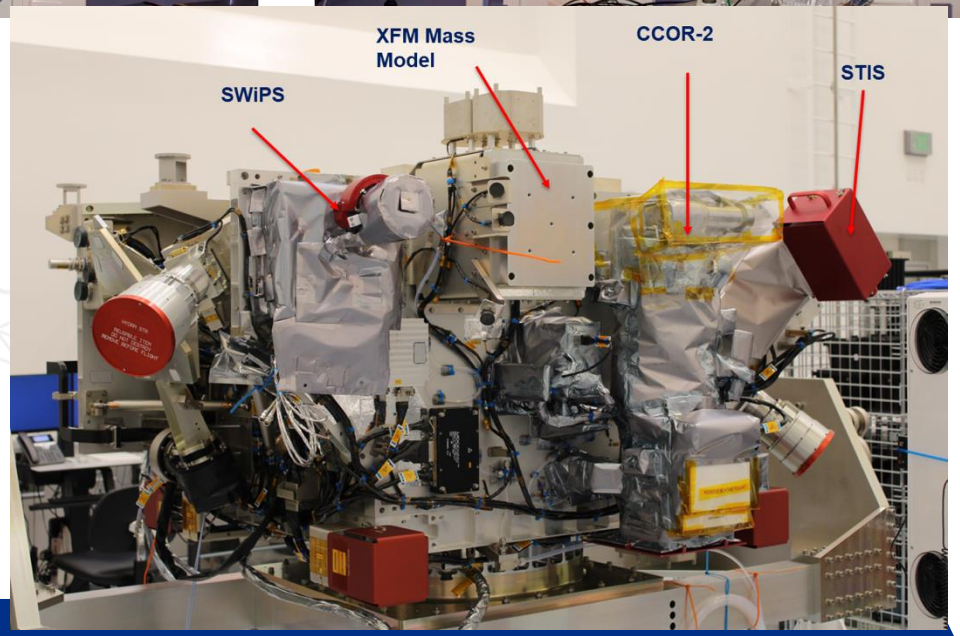


SWFO L1 Mission

SWFO-L1 Mission Objectives

Establish operational capability and continuity of space weather observational requirements. Enable space weather watches, warnings, forecasting and predictions

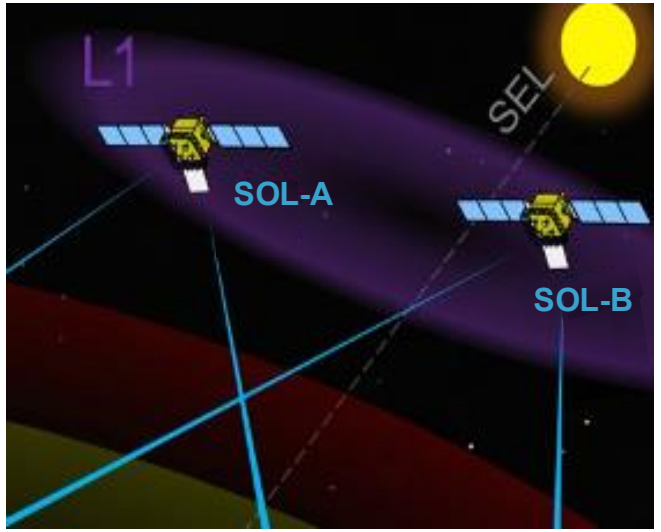




- Launch: 2025; Orbit: Lagrange Point 1 (L1)
- Rideshare with NASA IMAP; ESPA Grande compatible spacecraft bus
- CCOR-2 (NRL), MAG (UNH/SwRI), SWiPS (SwRI), STIS (UC Berkeley)

What's Next: Space weather Observations at L1 (SOL)

- The Space Weather Next L1 mission formerly referred to as L1 Series is now **Space weather Observations at L1 (SOL)**
- SOL observational requirements provide continuity with SWFO-L1
  - SOL-A includes ESA-contributed X-ray Flux Monitor plus an instrument of opportunity
  - SOL-B includes an X-ray Irradiance Sensor (XRIS) plus an instrument of opportunity
- SOL consists of two independently launched spacecraft on dedicated launch vehicles
  - Targeting SOL-A launch in 2029
  - Targeting SOL-B launch in 2032



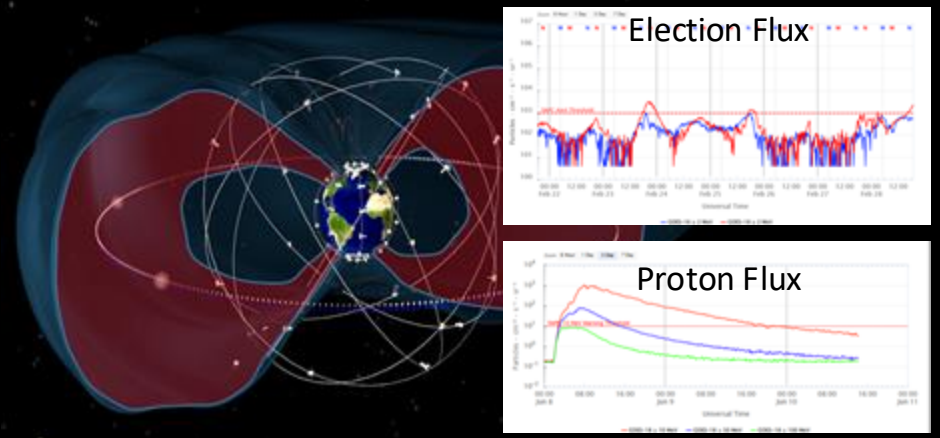
Instrument	Selections
Coronagraph	Contract awarded to SwRI
Solar Wind Plasma Sensor	Contract awarded to UNH
Suprathermal Ion Sensor	Contract awarded to APL
Magnetometer	Contract awarded to SwRI
X-ray Flux Monitor	ESA-contributed, flown on SOL-A only
X-ray Irradiance	Solicitation to be developed for SOL-B

SW Next GEO is in Pre-Formulation to provide continuity for critical measurements and transition new capabilities to operations

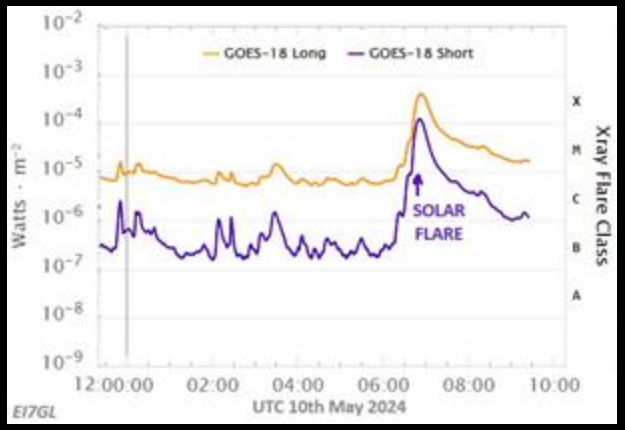
Pre-formulation activities:

- Instrument studies to assess technology readiness
- Analysis of alternatives to assess requirements and develop mission concept
- Draft RFP for GEO magnetograph Phase A Study released on 06/16/2025

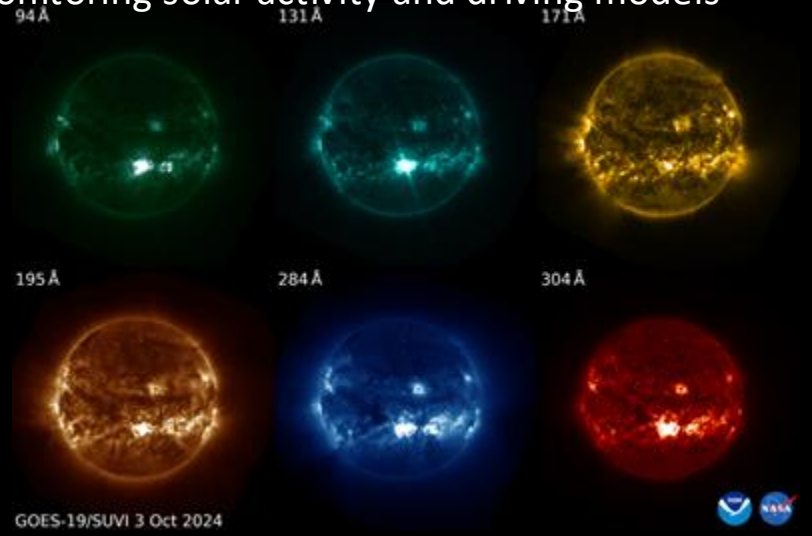
In situ energetic particles and magnetic fields for characterizing radiation environment



Solar X-ray Irradiance for flare detection



Solar EUV Imagery and Irradiance for monitoring solar activity and driving models



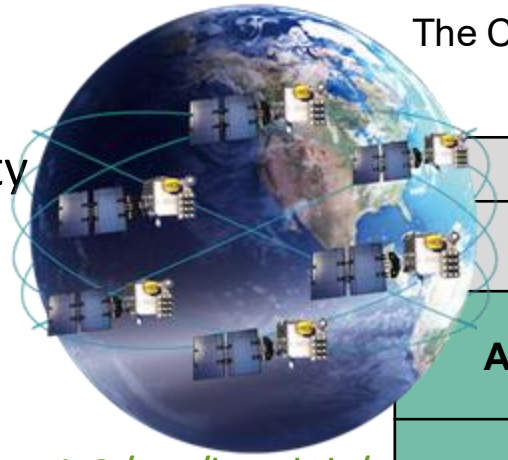
Capability enhancements under consideration

Photospheric Magnetograph Imagery NASA SDO/HMI

COSMIC-2 Space Weather Data Products

FORMOSAT-7/COSMIC-2

- Achieved full operational capability on October 12, 2021



TEC data:
https://data.cosmic.ucar.edu/gnss-ro/cosmic2/nrt/level1b/

EDP data:
https://data.cosmic.ucar.edu/gnss-ro/cosmic2/provisional/spaceWeather/level2/

Scint./IVM data:
https://data.cosmic.ucar.edu/gnss-ro/cosmic2/rapid/

The C2 mission requirements include the following data products

COSMIC-2 Space Weather Products		
Product Name		**Instrument**
Absolute TEC	**GPS**	TGRS
	GLO	TGRS
Electron Density Profiles		TGRS
Scintillation Amplitude Index (S4)		TGRS
Scintillation Phase Index (σ_φ)		TGRS
Scintillation High-Rate Data		TGRS
Plasma In-situ Density		IVM
Plasma Drift		IVM
Plasma Composition and Temp		IVM

Operational products are absolute TEC and plasma in-situ density. Products shaded in green have been verified and released.

NOAA Commercial Data Program

- **Commercial Weather Data Pilots:** NOAA concluded a pilot study exploiting commercial GNSS-RO data for space weather parameters. ***The final report is now available***

- **Commercial Data Purchases:** Supports operational weather forecasting and space environment applications.
  - DO4 18 Sept. 2024 – 18 Sept. 2025, DO5 and DO6 to follow
  - DO4 PlanetiQ and Spire products include TEC
    - https://data.cosmic.ucar.edu/gnss-ro/planetiq/noaa/nrt/level1b
    - https://data.cosmic.ucar.edu/gnss-ro/spire/noaa/nrt/level1b (mostly topside TEC)

- **CDP Request for Information (RFI)**: NOAA NESDIS Commercial Satellite Data-as-a-Service (Including Weather and Space Environmental Data)
  - Received commercial vendors' interest in providing space weather data products
  - CDP program making recommendations for data pilots

NOAA SBIR Program

Six critical challenges that highlight important NOAA mission and research priorities, including Effects of Space Weather

AMERICA'S SEED FUND SBIR

POWERED BY NOAA

NOAA Office of Education Opportunities

- **Ernest F. Hollings Undergraduate Scholarship**
  - Application period: September 1 - January 31
  - https://www.noaa.gov/office-education/hollings-scholarship

- **William M. Lapenta Student Internship Program**
  - Application period: October 1, 2025 - December 10, 2025
  - https://vlab.noaa.gov/web/lapenta-internship-program

Other NOAA Office of Education internship opportunities

- Student opportunity database with an option to filter for space weather related events, internships, and fellowships
  - https://www.noaa.gov/education/opportunities/students