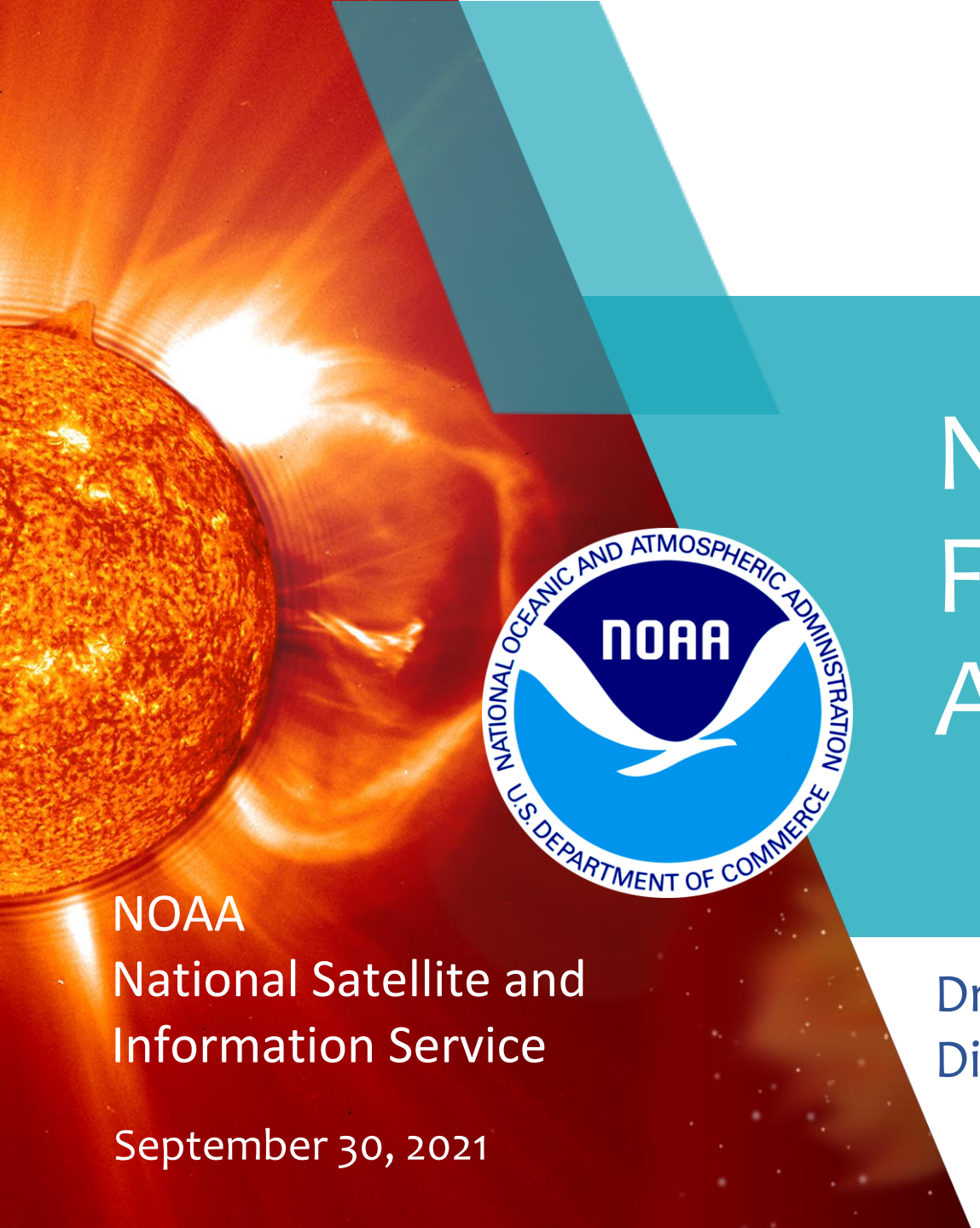


NOAA's Current and Future Space Weather Architecture

Dr. Elsayed Talaat
Director, Office of Projects, Planning, and Analysis

NOAA
National Satellite and Information Service

September 30, 2021

NOAA's Next-Gen Environmental Observation Strategy

Integrated, Adaptable, and Affordable: Orbits, Instruments & Systems

LEO

Miniaturized instruments on small, lower cost, and proliferated satellites and partner data improving forecasts through better and additional data. Better precipitation forecasts, wave height predictions, ocean currents, and more.

GEO

Continuous real-time observations supporting warnings and watches of severe weather and hour-by-hour changes. High-inclination orbits to observe northern latitude & polar regions.

Space Weather Obs.

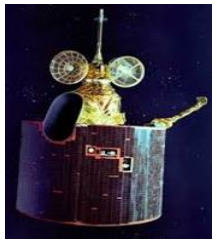
Reliably monitoring space weather from all applicable orbits (e.g., L1, GEO, LEO, HEO, L5) to protect the nation's valuable, critical infrastructure. New capabilities at L5 and high earth orbit provide additional insight and improve forecasts.

Common Ground Services

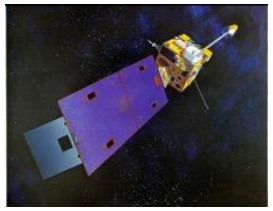
Secure ingest of data in different formats from different partners requires a flexible, scalable platform. Common Services approach integrates cloud, AI, and machine-learning capabilities to verify, calibrate, and fuse data into new and better products and services.

Space-Based Space Weather at NOAA and Partners

NASA SMS
GOES 1-3



GOES 4-7



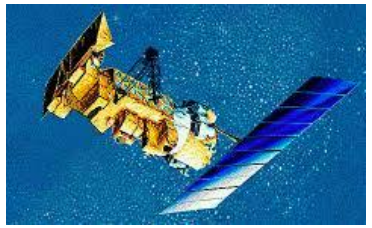
GOES 8-12

GOES-NOP

NASA SDO

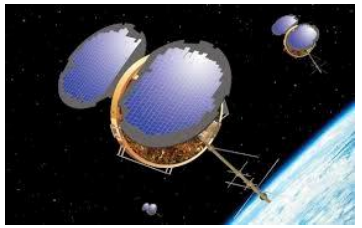
GOES-R Series

TIROS-N



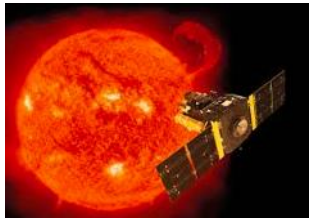
POES

EUMETSAT Metop



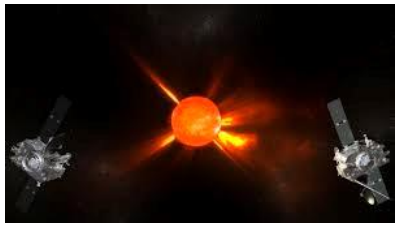
COSMIC-1

COSMIC-2

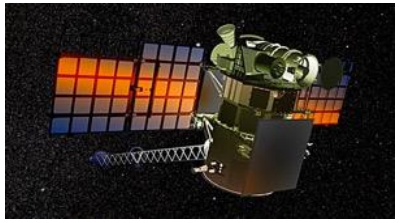


ESA/NASA SOHO

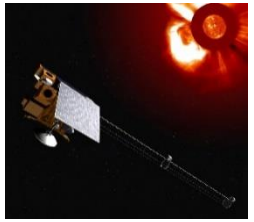
NASA ACE



NASA STEREO



DSCOVR



SWFO-L1

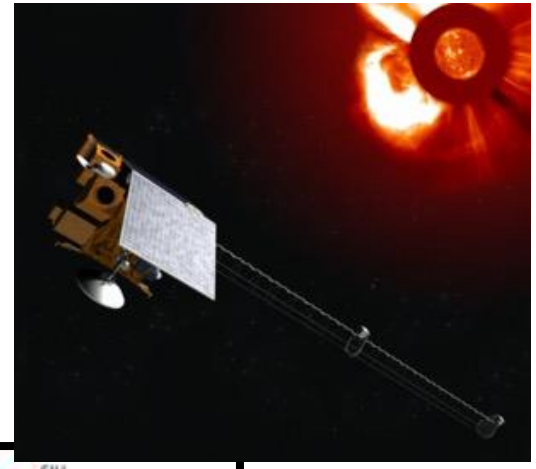
Legend:
Historical
Operational
In development

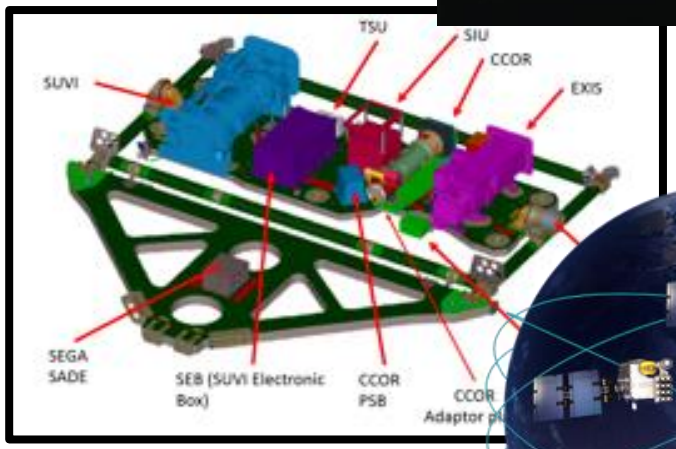
Starting Point – 2025 Program of Record

2025 NOAA Space Weather
Observing Program of Record
Starting point for NASEM Infrastructure Workshop

- SWFO – L1
- GOES–East, GOES–West (CCOR1 on 1)
- COSMIC-2
- GOLD
- Metop – C, SG A1, SG B1
- *ESA – L5 (2027)*

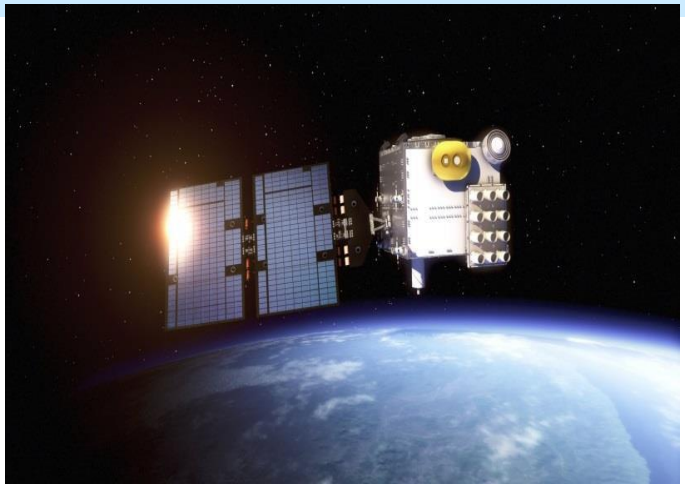
What's next for 2030 and beyond?





COSMIC-2 Mission Overview

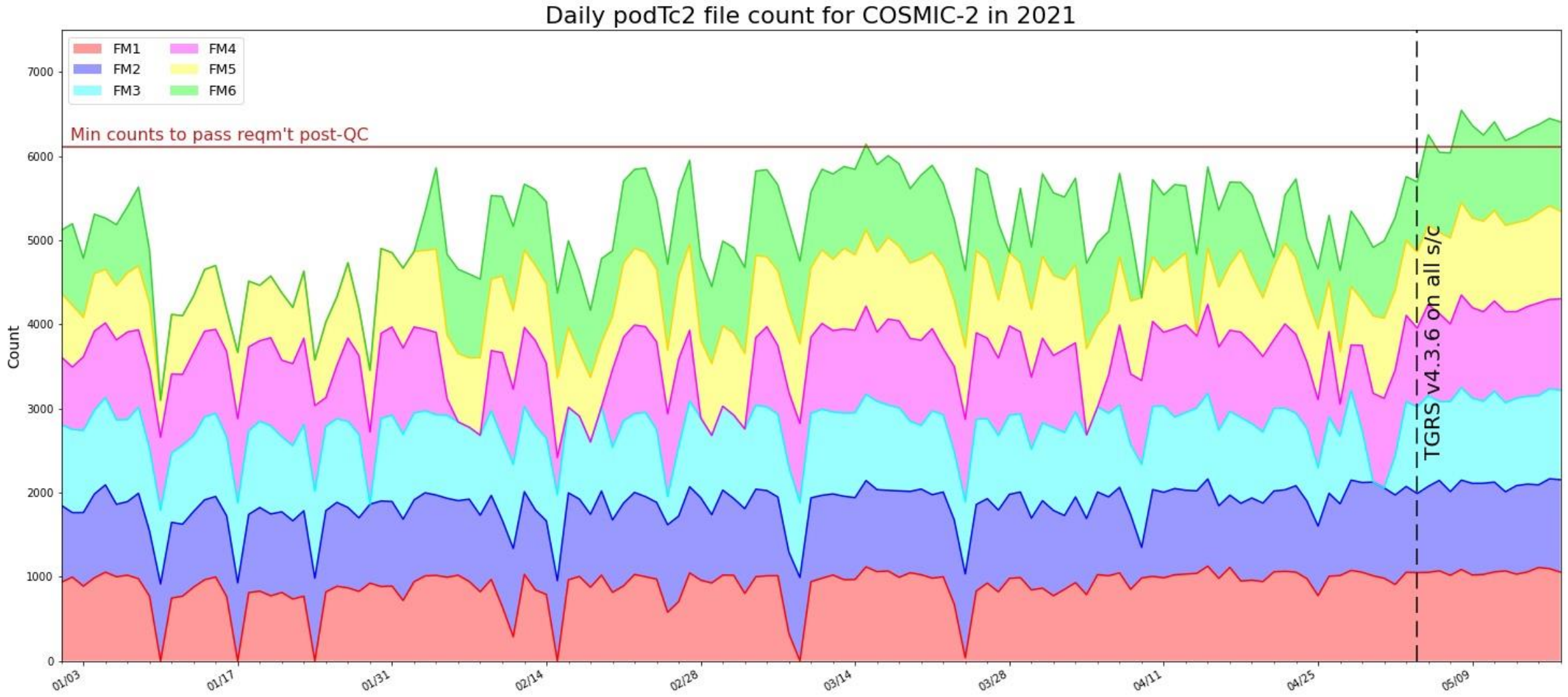
- All weather, uniform coverage between about 40° N to 40° S with 36 min average data latency
- 5 Year Mission currently provides over 4,000 Radio Occultation data per day for numerical weather prediction; to perform space weather monitoring; and to trend climate change
- 6 Satellite constellation around the equator (24 degree inclination orbit)
- Each satellite has 3 instruments provided by USAF
  - TriG GNSS-RO receiver (TGRS) –Primary Instrument
  - Ion Velocity Meter (IVM) – Secondary Instrument
  - RF Beacon – Secondary Instrument
- Launch Date: June 25th 2019
- Launch Vehicle: Falcon Heavy (STP-2 mission)



Taiwan Satellite Operation Center

UCAR Data Processing Centers

COSMIC-2 Ionospheric Profiles

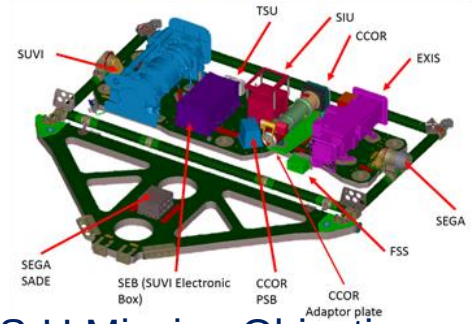


SWFO Program Overview

SWFO-L1 Mission

GOES-U Solar Pointing Platform (SPP)

CCOR + SUVI + EXIS



SWFO-L1 Mission Objectives

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

- Coronal White Light Images for detection of Coronal Mass Ejections (CMEs)
  - Observe CME parameters, shape, density, velocity
  - Produce CME characteristics for input into operational heliospheric propagation code
- In situ solar wind measurements
  - Measure solar wind magnetic field, thermal plasma, and energetic particles

CCOR on GOES-U Mission Objectives

Establish operational capability and continuity of Sun CME imaging observational requirements with multiple platforms

Primary operational objectives:

- Observe CME parameters, shape, density and velocity
- Produce CME characteristics for input into operational heliospheric propagation code
- Enable space weather watches, warnings, forecasting and predictions

SWFO-L1 Overview

- Launch: 2025; Rideshare with NASA IMAP
- Orbit: Lagrange Point 1 (L1)
- ESPA Grande compatible spacecraft bus
- CCOR, Solar Wind Instruments, ESA X-Ray Flux
- Commanding and data through SWFO Ground Segment

CCOR on GOES-U Overview

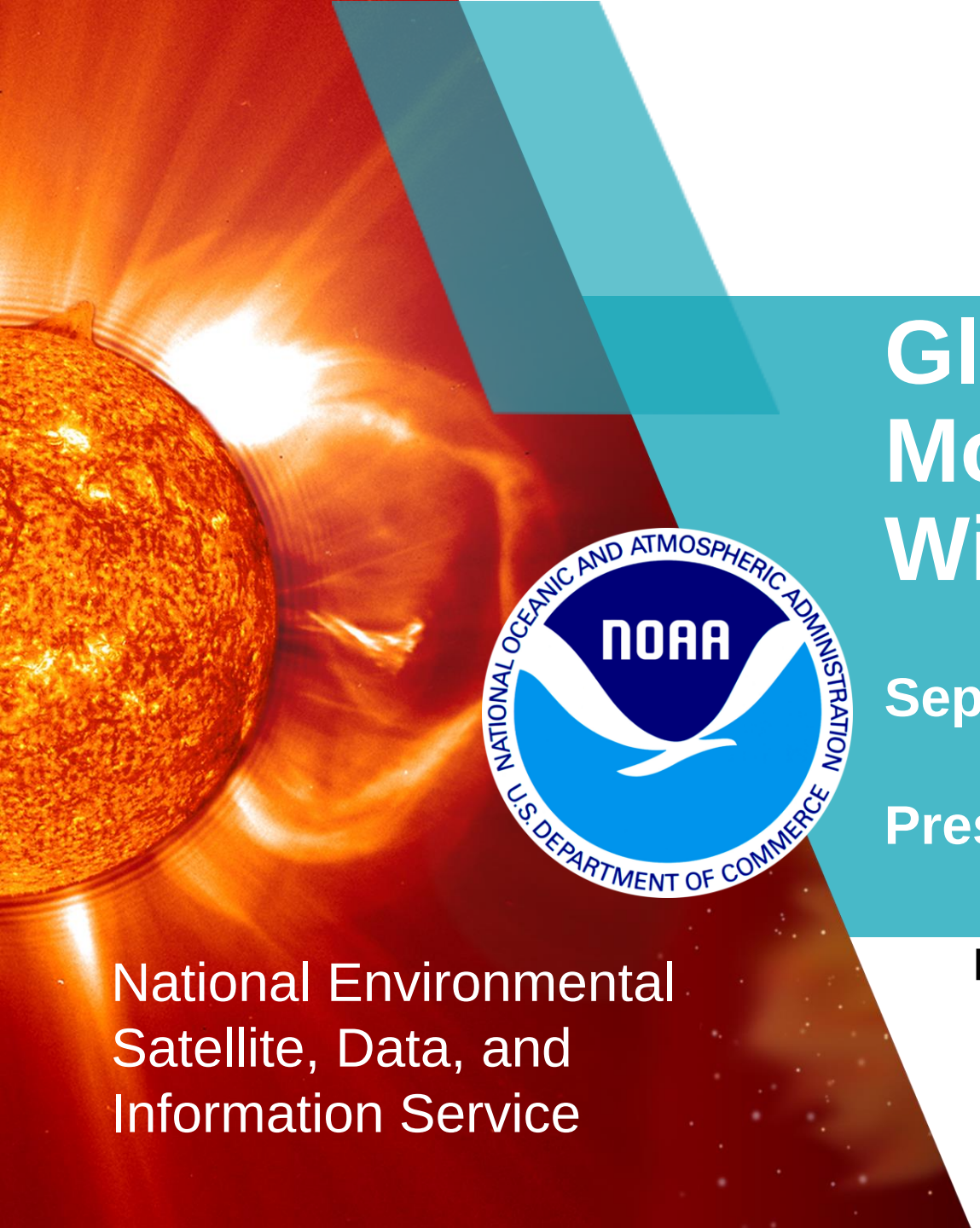
- Launch: 2024
- Orbit: GEO
- CCOR integrated onto GOES-U Solar Pointing Platform
- Commanding and data through GOES-R Ground System

NOAA/NESDIS Formulating a Space Weather Observations Program

- Diverse observing requirements must be made from diverse vantage points (LEO, GEO, Sun-Earth line, L1 and off the Sun-Earth line)
- Continuity and anticipated product improvement need dates are varied:
  - Long Lead Instrumentation
  - Next Generation L1 & off-Sun-Earth-axis
  - Space Weather Ground Operations
  - Geostationary Observations
  - Tundra/High Elliptical Orbit Observations
  - Low Earth Orbit Observations
- Program formulation will initialize a loosely coupled program with an initial set of projects.
- NOAA co-sponsoring next NASEM Solar and Space Physics Decadal Survey

NOAA Opportunities

- NOAA offers a wide range of opportunities in the STEM field and is always in search of a highly-skilled, passionate and diverse workforce
- NOAA is developing a joint NOAA-NASA program for Space Weather, and will be in need of a qualified workforce
- NOAA uses a variety of recruitment tools and is committed to advancing education within NOAA and with the public we serve
- Pathways Program
  - Intern Employment Program
  - Recent Graduates Program
  - Presidential Management Fellows Program



Global Magnetospheric Model Sensitivity to Solar Wind Drivers

September 14th, 2021

Presented by: Nick Zaremba (Pathways Intern)

Mentors: Dimitrios Vassiliadis and Richard Ullman

National Environmental Satellite, Data, and Information Service