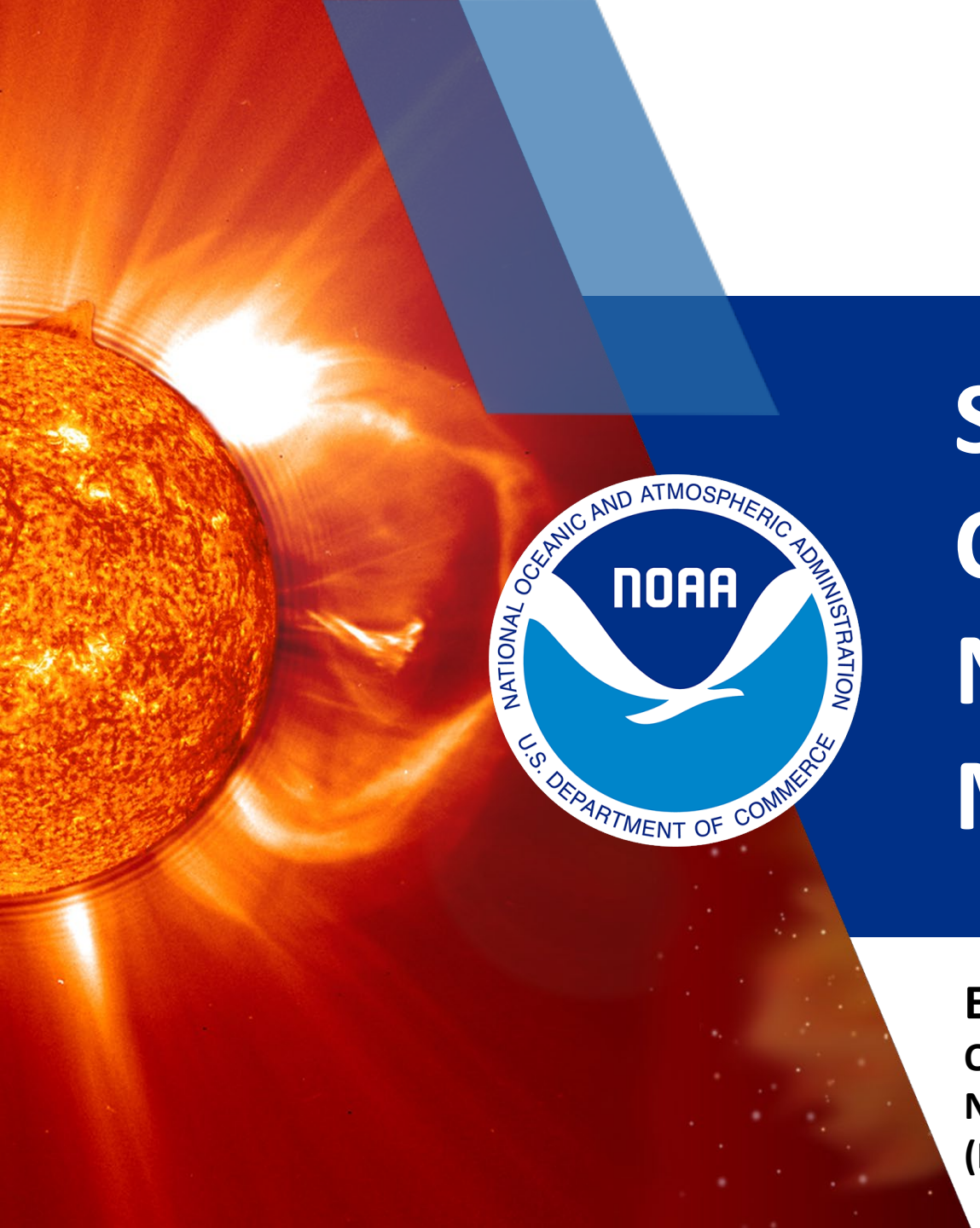
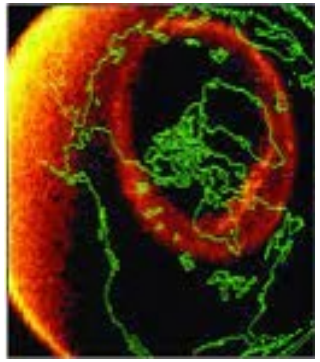
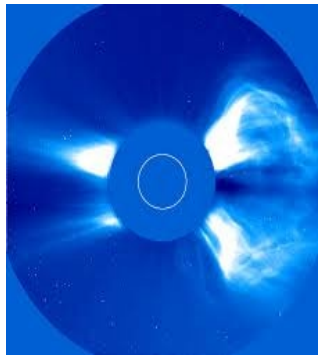


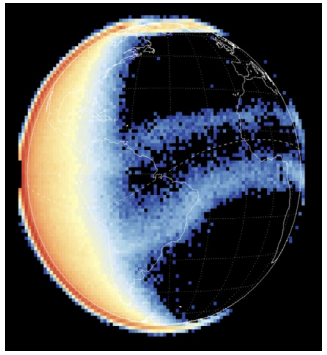
Sustaining Operational Capabilities to Meet NOAA's Space Weather Mission

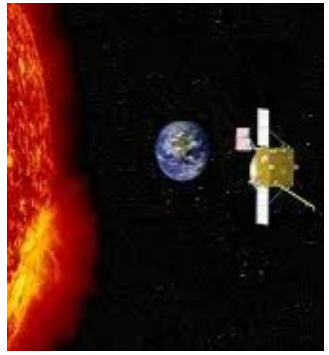
Elsayed Talaat, Ph.D.
Office of Space Weather Observations (SWO)
National Environmental Satellite, Data, and Information Service (NESDIS)

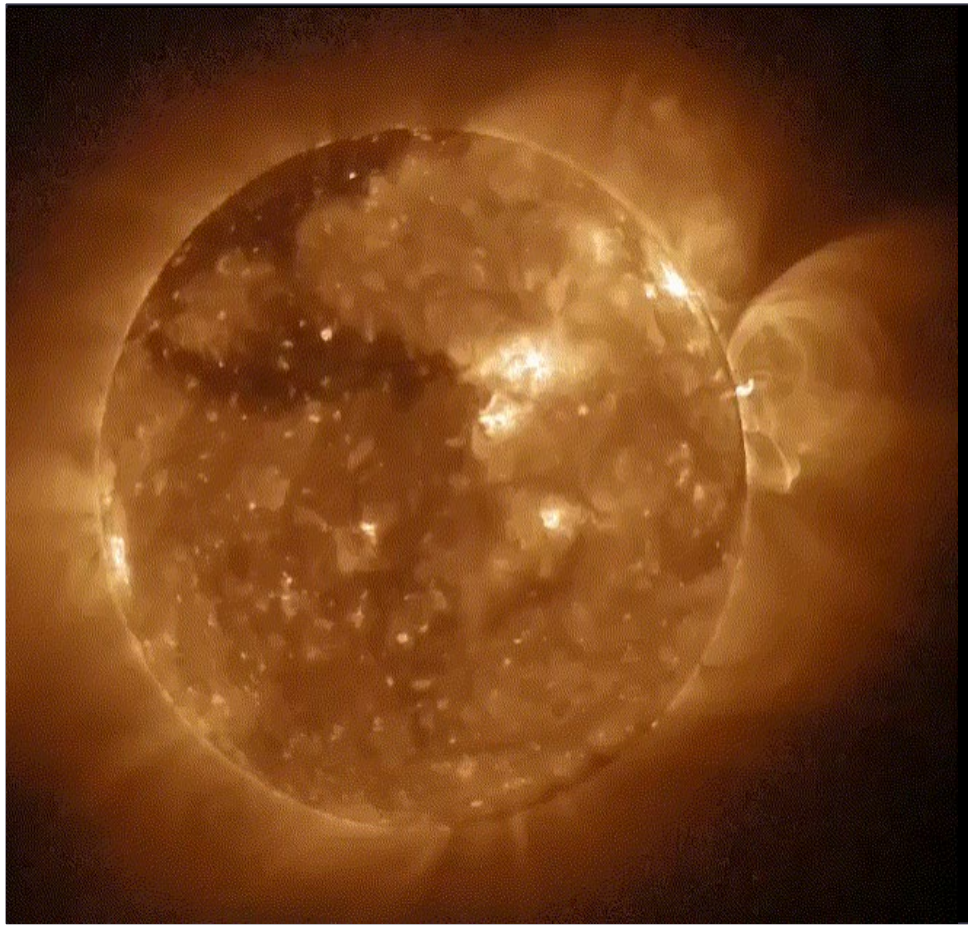
NOAA is a Trusted Source of Space Weather Data & Services











NOAA provides:

- Observational Data
- Storm Forecasting
- Data Management

Space Weather impacts infrastructure and activities vital to the Nation's security and economy

Space weather-induced electricity blackout: **Daily** domestic economic loss in the U.S. equal to **$41.5 billion**, plus an additional **$7 billion** loss through the international supply chain.

Critical Ground- and Space-based Observation Capabilities

CRITICAL OBSERVATIONS FOR OPERATIONS

GONG – NSF/NSO-NWS
NOAA now supporting operations

Ground-based Magnetometers – USGS
Critical input to SWPC's geomagnetic storm products

Neutron Monitors – NSF and Academia

Solar Electro-Optical Network (SEON) – USAF

DSCOVR – NOAA

GOES – NOAA
GOES U - NRL Coronagraph in 2024

Solar Dynamics Observatory – NASA

Advanced Composition Explorer – NASA

Solar & Heliospheric Observatory mission (SOHO) – NASA-ESA

Vigil L5 (Future) – ESA (TBD)

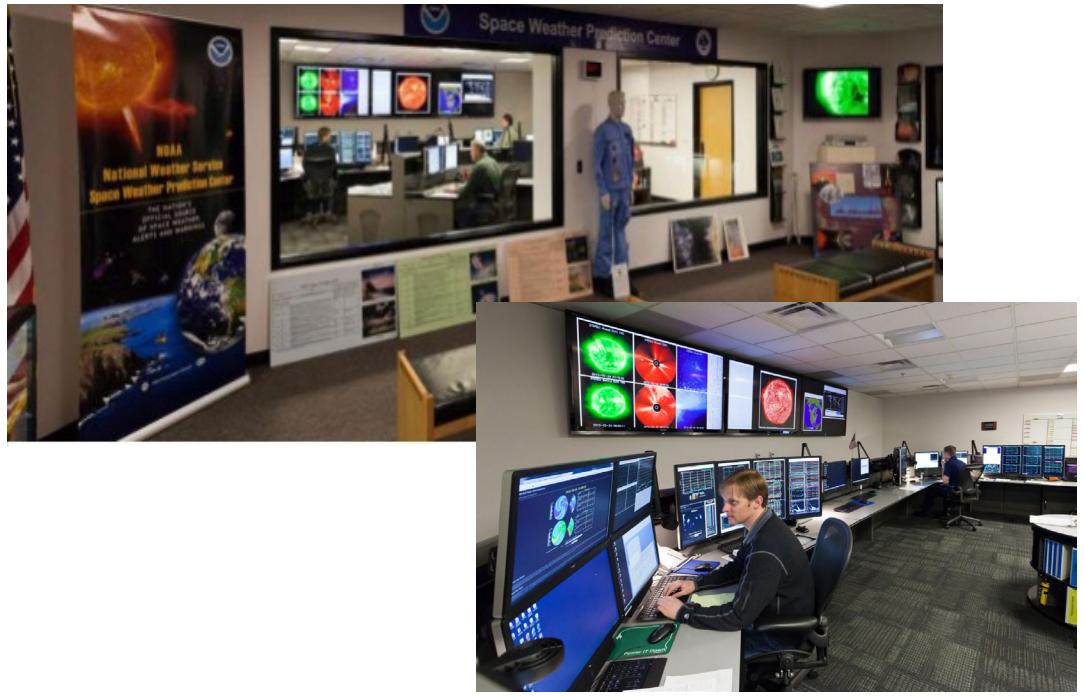
Space Weather Follow-On and Space Weather Next (Future) – NOAA
Rideshare to L1 with NASA's IMAP in 2025

Space Weather Prediction Center (SWPC)
National Weather Service

- The Nation's official source of space weather decision support services, forecast, watches, and warnings, and alerts
- Provides 24x7 analysis and forecasting of space weather storms

Space Weather Watches and Warnings are based on the Space Weather Scales:

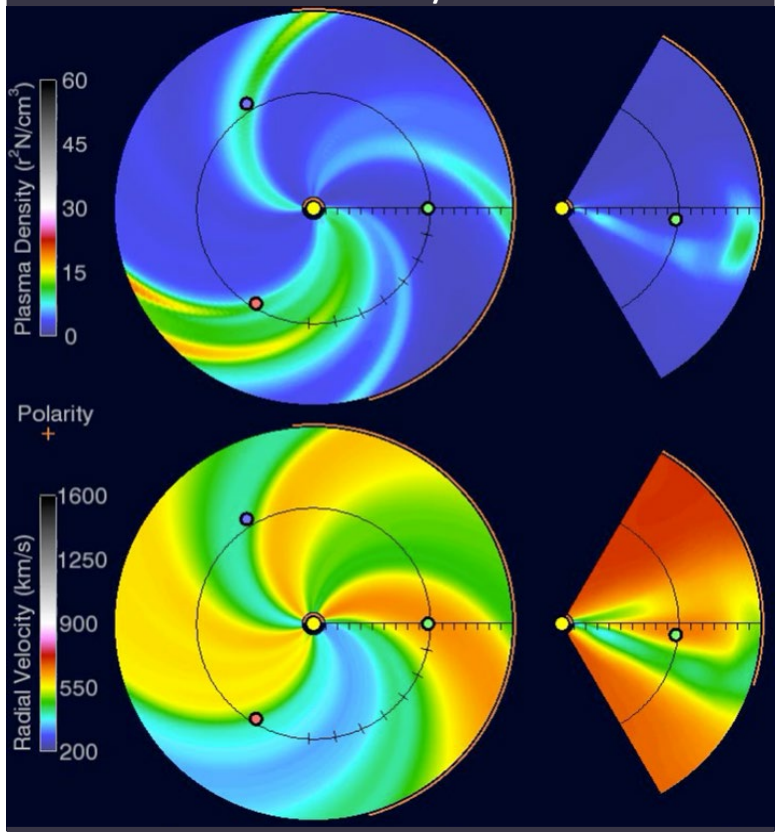
- **Geomagnetic Storms (G-scale)** (Magnetic field)
- **Solar Radiation Storms (S-scale)** (Energetic charged particles)
- **Radio Blackouts (R-scale)** (Electromagnetic radiation)



Investment Needed

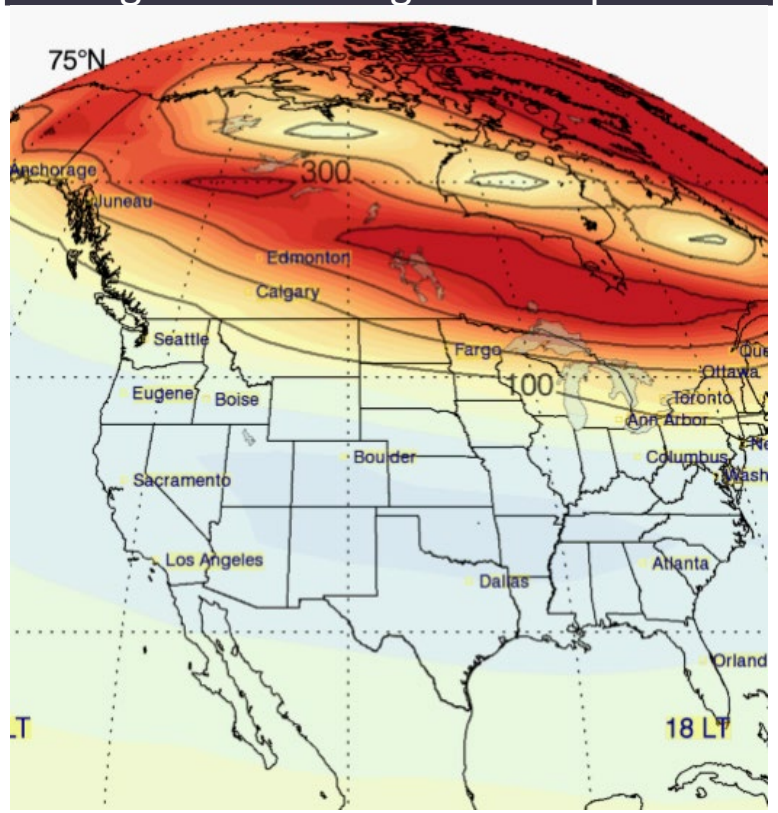
Space Weather Modeling

WSA-Enlil
Solar Wind/CMEs



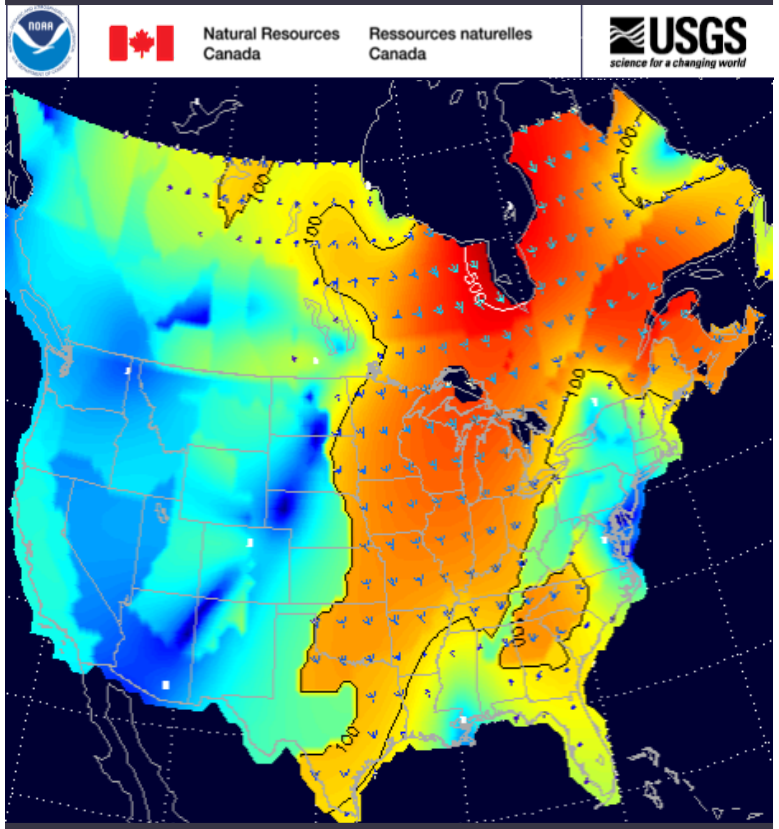
Version 3 and On-Demand

Geospace
Regional Geomagnetic Response



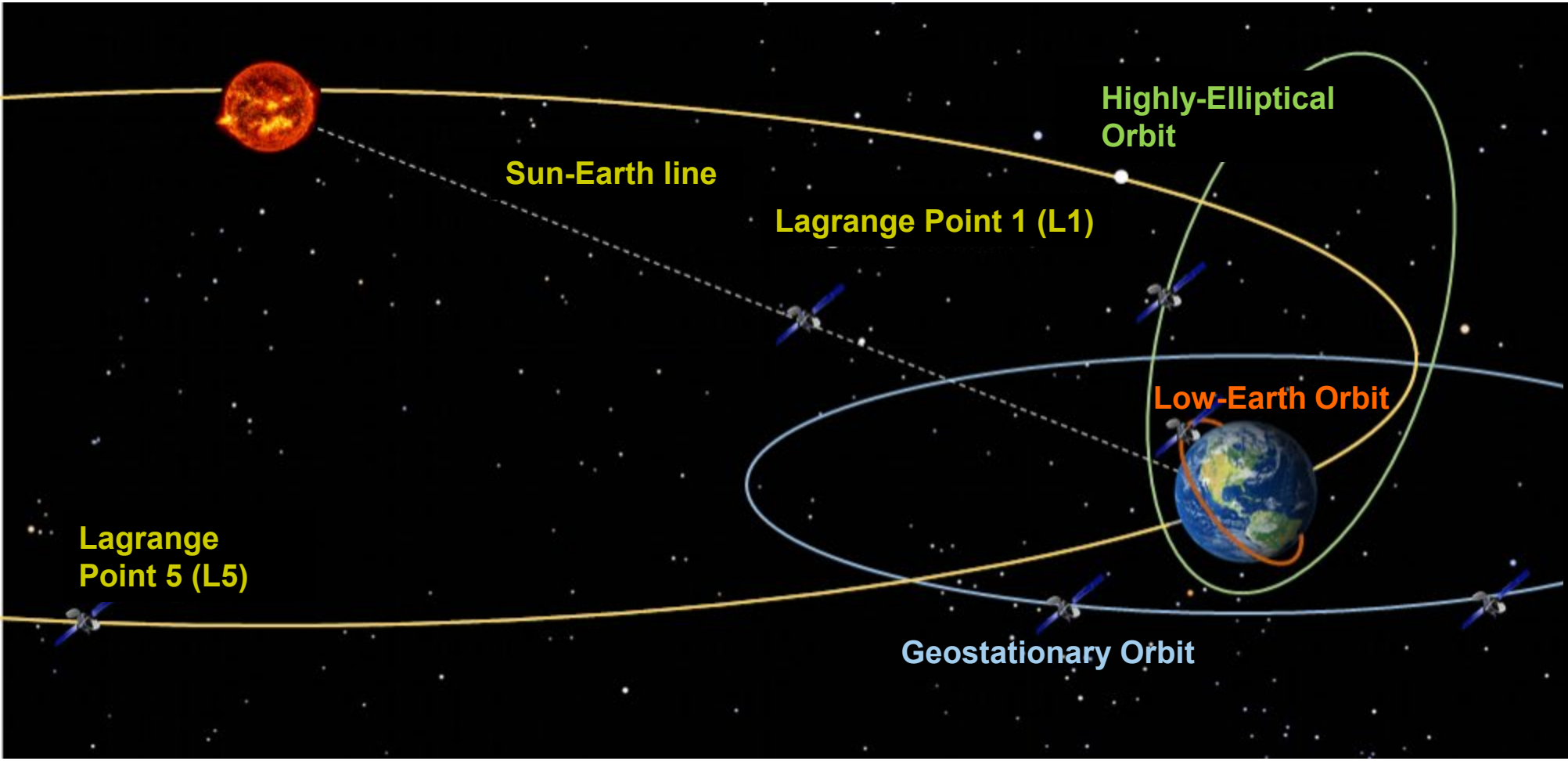
Coupled to Geoelectric to provide forecast

Geoelectric
Grid Resilience



Expansion to Canada

We collect space weather data to know what is happening and to predict the effects and issue warnings and alerts.



Measurements are collected in many locations.

From L5 we get early info about solar activity soon to face Earth.

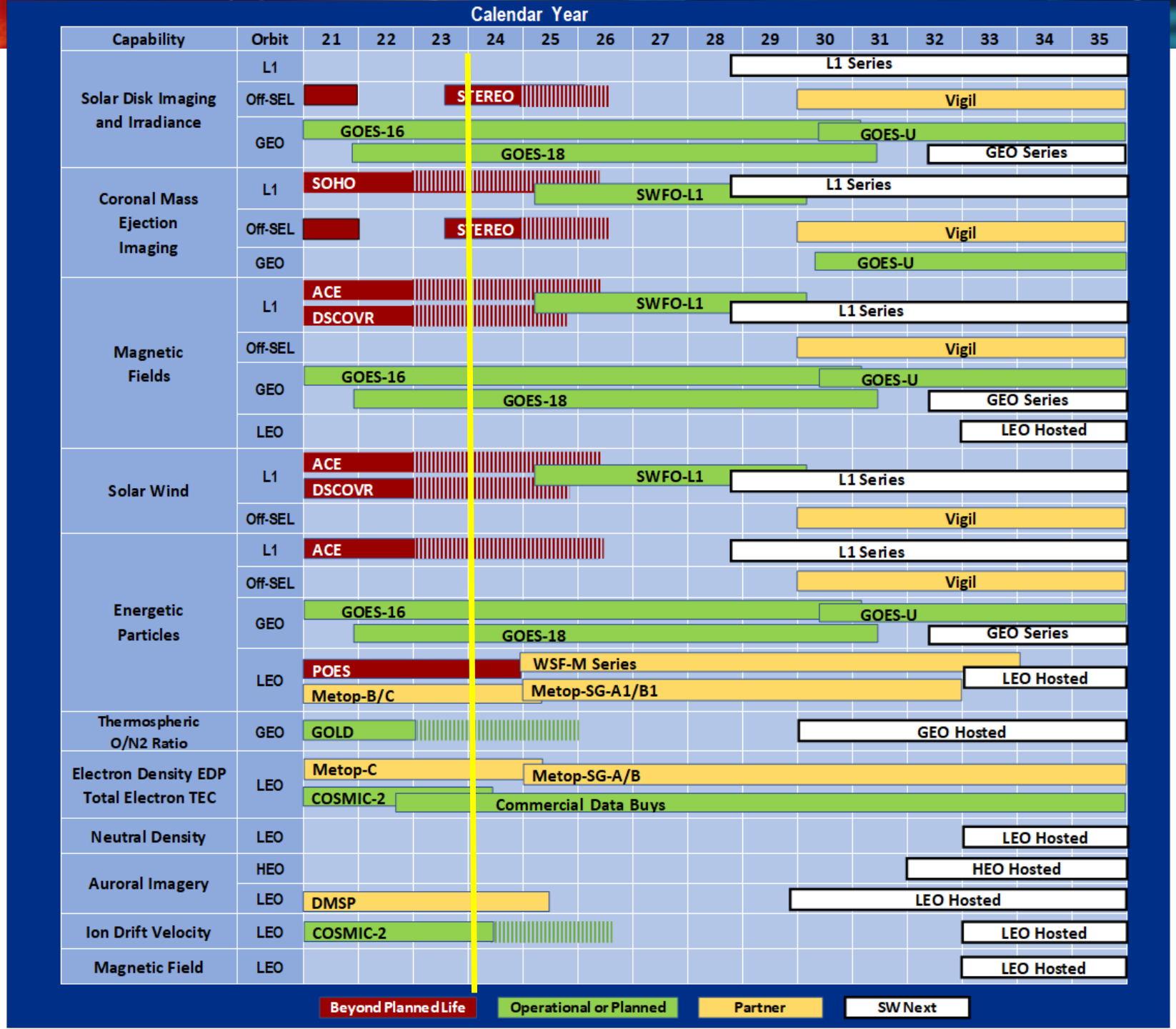
From L1 we get early warning of what is coming towards us.

From Earth orbit we measure the local space weather effects, radiation, particles, etc.

Our current satellite constellation is fragile

- DSCOVR, SOHO, ACE are operating beyond predicted end of life.
- Developing follow on systems (SWFO L1, SWNext L1) before current platforms cease to provide useable data.

NOAA's space-based observations will provide critical data continuity *if sufficiently funded*.

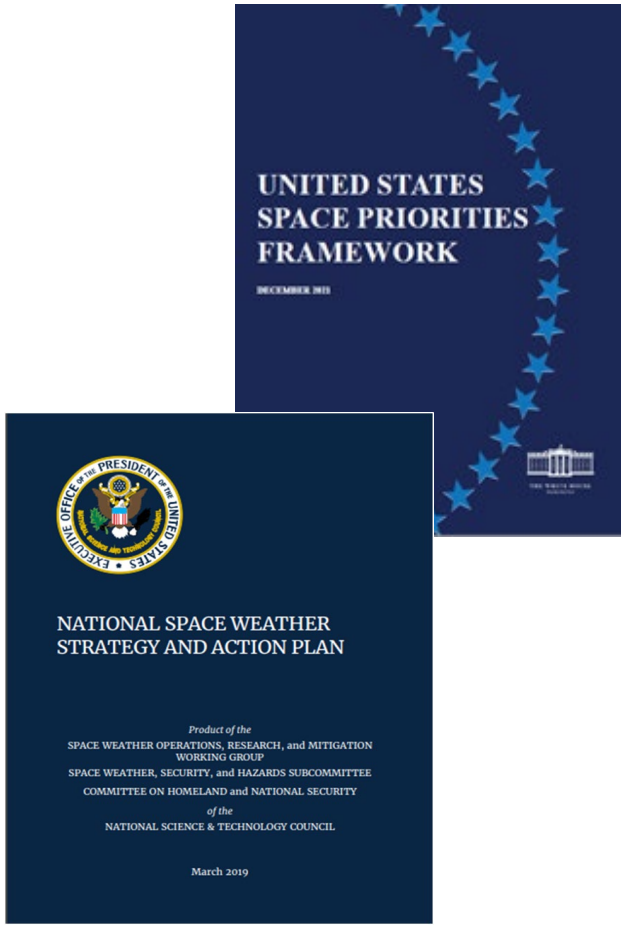


Plans are notional and subject to appropriations.

Space Weather as a National Priority

Growing demands on NOAA

- Promoting Research and Observations of Space Weather to Improve the Forecasting of Tomorrow Act (**PROSWIFT**)
- **OSTP SWORM** - Space Weather Strategy and Action Plan
- **National Space Council** - U.S. Space Priorities Framework
- NOAA Weather, Water and Climate Board (**WWCB**)
- NASA-NOAA **Interagency Agreement** for Human Spaceflight Activities (18 Jan 2022)
- NOAA-NASA-NSF-DOD **Memorandum of Agreement** for Space Weather R2O2R (July 2023)
- Space Policy Directive-3 - **Space Situational Awareness**



PROSWIFT Act

PROSWIFT integrates national space weather activities; codifies and strengthens efforts toward a **whole-of-community approach** for space weather

NOAA's Responsibilities

- Provide **operational** space weather monitoring, forecasting, and long-term data archiving
- **Maintain ground- and space-based assets** for space weather forecasting, prediction, and warnings
- Provide **research to support operational** responsibilities (**LACKING**)
- **Develop requirements** for space weather forecasting technologies and science

S. 881

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".

PROSWIFT Implementation

Space Weather Advisory Group (SWAG) Recommendations

R.1.1. **Fund the Federal Space Weather Enterprise.**

R.2.1. **Create and fund an applied research program office** for space weather within NOAA to coordinate, facilitate, promote, and transition applied research across the national space weather enterprise.

R.2.3. **Expand NOAA R2O2R functionality to enable the transition to full operations.**

R.6.2. **Provide long-term support for operational ground-based and airborne sensors and networks.**

R.9.2. **Provide and fund critical operational space weather services beyond near-Earth.**

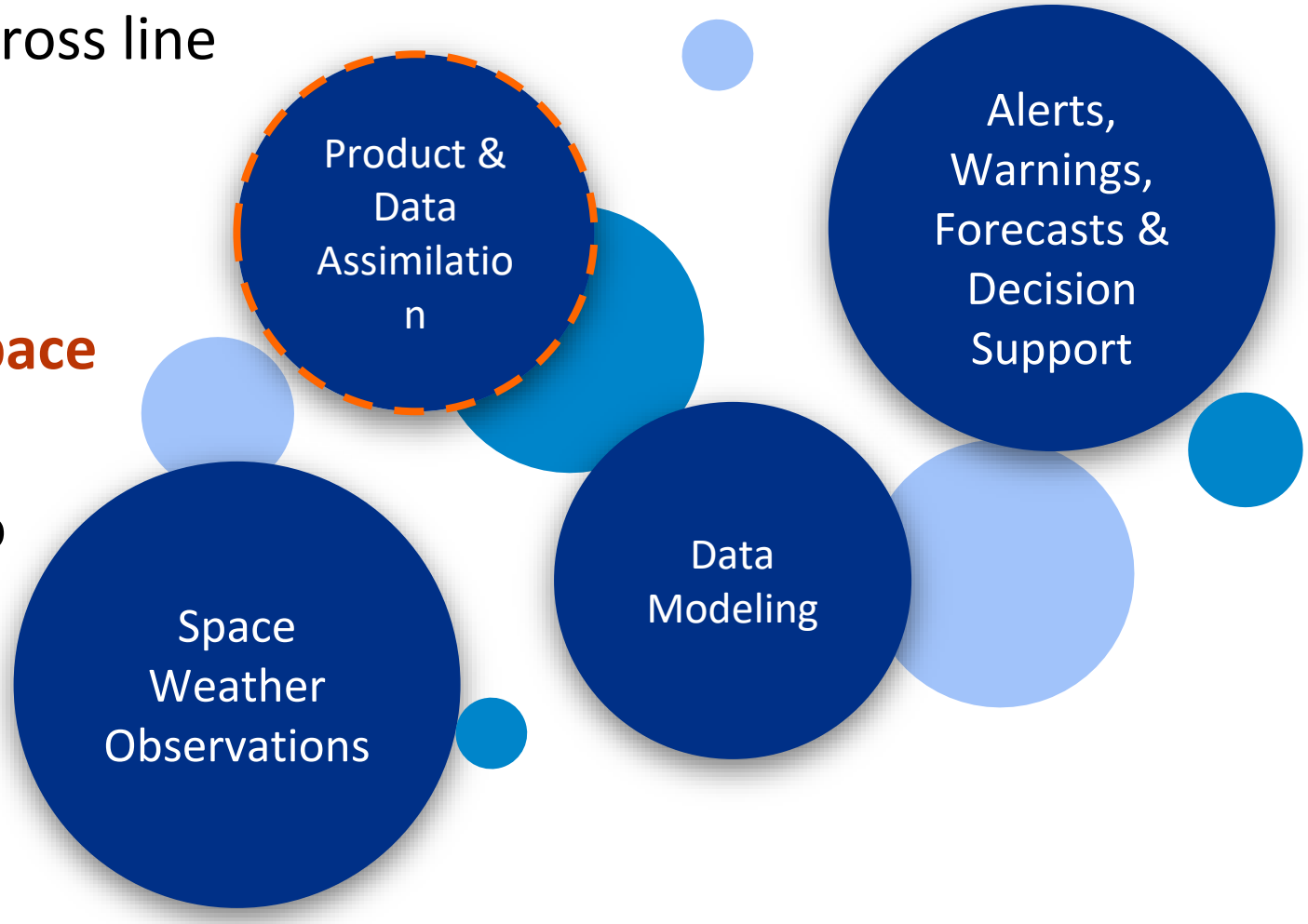
R.24.2. **Support coordinated R2O2R workshops and testbed activities for space traffic coordination.**

SWAG report: https://www.weather.gov/media/nws/REPORT-Findings-and-Recommendations-04292022.pdf

Investment Needed

Advancing the NOAA Space Weather Enterprise

- One-NOAA Strategy to **align priorities** and **build connective tissue** across line offices
  - NESDIS
  - NWS
  - OAR **(currently lacking a space weather program)**
- One-NOAA communications to **champion the strategy (internal NOAA coordination greatly needed)**

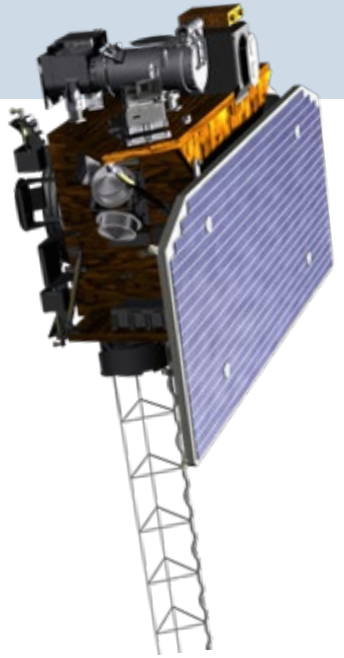


Space Weather Follow On (SWFO) program

SWFO sustains NOAA's foundational set of space-based space weather observations and measurements to ensure continuity of critical data.

- **Development underway for:**
  - SWFO-L1 Observatory (Bus + Instruments)
  - Compact Coronagraph (CCOR) for GOES-U
  - Ground Segment
- **Established agreements** with NASA, NRL, and European Space Agency (L1 & L5 cooperation)
- **Completed SWFO Program & Flight Project Critical Design Reviews** (May 2022)
- **On track for launches** in 2024 (CCOR-1 on GOES-U Mission) and 2025 (SWFO L1 Mission)

CCOR-1 integration onto GOES-U
Image Credit: Lockheed Martin



SWFO-L1 Spacecraft
Image Credit: Ball Aerospace

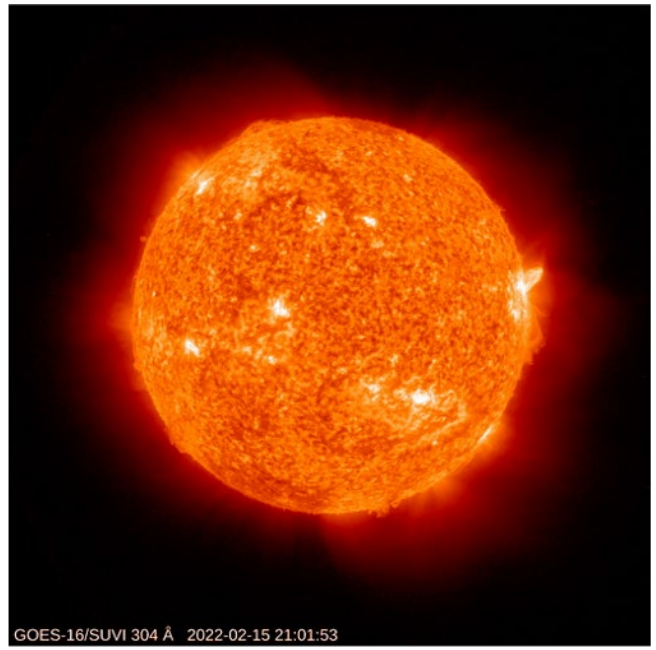
Spacecraft assembly
Image credit: Ball Aerospace

Investment Needed

Space Weather Next (SW Next) program

SW Next will **maintain and extend** space weather observations from a range of different observing points, selected to most efficiently provide comprehensive knowledge of the Sun and the near-Earth space environment.

- **Planning for continuity of observations**:
  - L1 and L5 orbits
  - Geostationary and Low-Earth orbit
  - Ground support networks
- **Formulation underway** for Program, L1 Series Project, and L5 Project
- **Engaging stakeholders** via user outreach, partnerships, and market research



Questions for Discussion

- **How can we develop the required space weather functionalities within NOAA to address our space weather needs?**
- **How do we craft a better impact story?**
  - How do we develop ways to assess and communicate the value proposition for operational observations and services?
- **How do we transition research observations to operational status? Which ones should we transition?**

Thank You!