NOAA NESDIS Space Weather Update

NOAA Satellite and Information Service
www.nesdis.noaa.gov

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Our aspiration

Provide a truly integrated digital understanding of our earth environment that can evolve quickly to meet changing user expectations by leveraging our own capabilities and partnerships

NESDIS Reimagined

Pillars of NESDIS Observing System Implementation

Integrated, Adaptable and Affordable: Orbits, Instruments & Systems

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.

LEO

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

Space Weather

Reliably monitoring space weather from L1, GEO and LEO can protect the nation's valuable, vulnerable infrastructure. New capabilities at L5 and HEO can 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.

We will set out a path for NESDIS to use the opportunities provided in this changing landscape and continue to lead the field of environmental observation.
This will be done by prioritizing five strategic objectives

NESDIS Reimagined

GEO & Space Weather

1

Advance observational leadership in geostationary and extended orbits

LEO

2

Evolve LEO architecture to enterprise system of systems that exploits and deploys new observational capabilities

Common Ground Services

3

Develop agile, scalable ground capability to improve efficiency of service deliverables and ingest of data from all sources

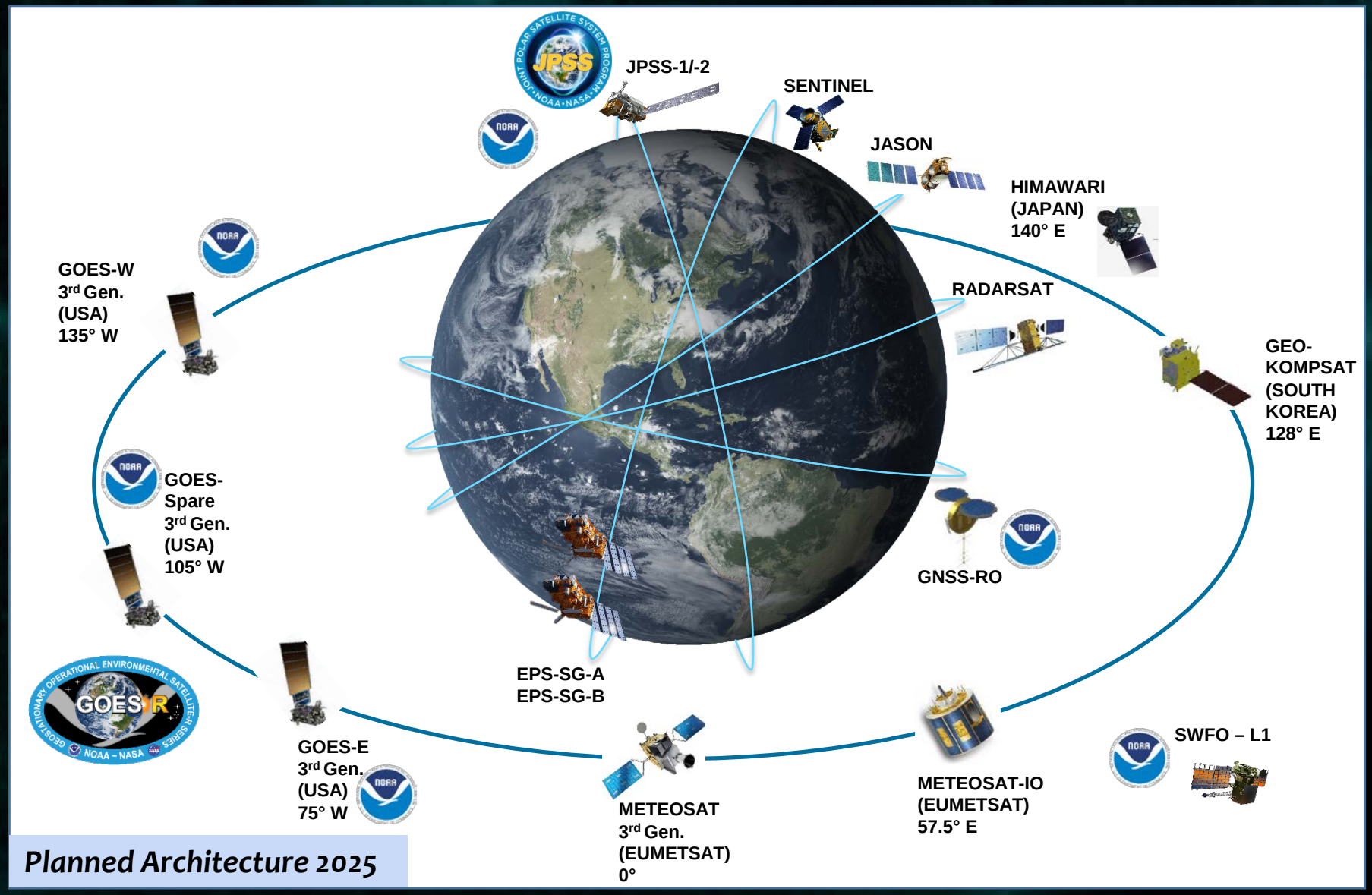
4 

Provide consistent ongoing enterprise-wide user engagement to ensure timely response to user needs

5 

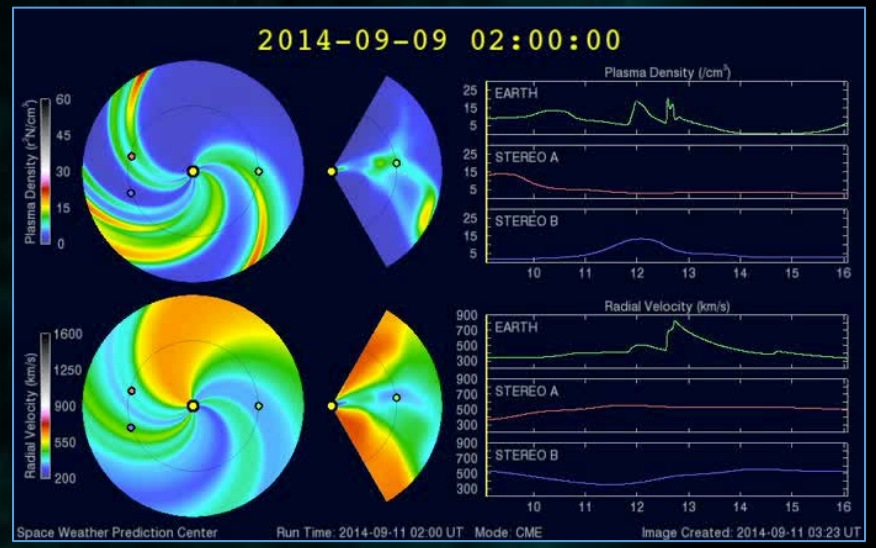
Deliver integrated program development to provide a suite of products and services

Near-Term Observational Capability

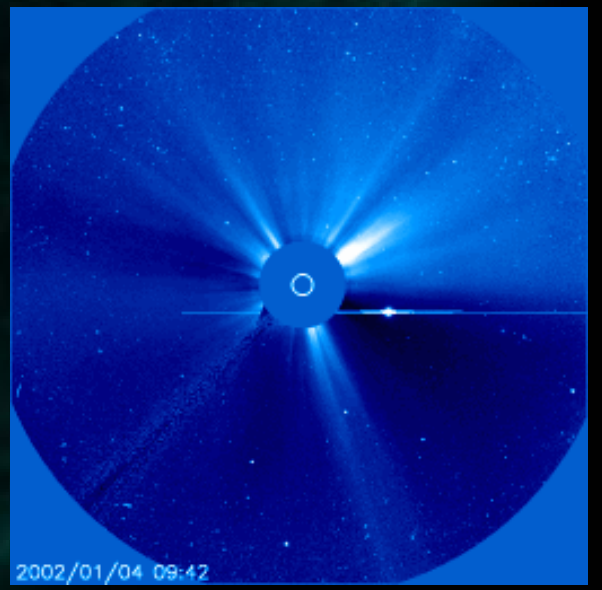


Solar Wind and CME Imagery for Space Weather Prediction

- Coronal Mass Ejection (CME) Imagery
  - Visible light imagery of CMEs used for 1-4 day warnings of geomagnetic storm conditions
  - Primary source: ESA/NASA Solar and Heliophysics Observatory (SOHO, 1995) - solar power limited to 2025
  - Backup: *none*

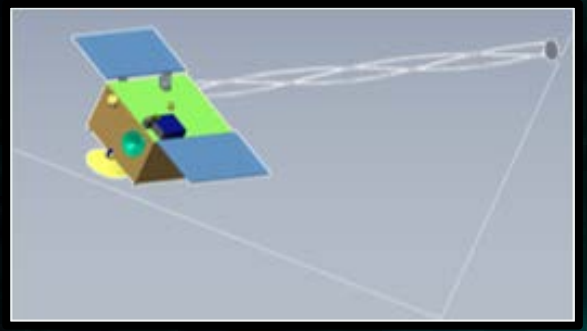


- Solar Wind In-Situ at Sun-Earth Lagrange – L1
  - Solar wind magnetic field and bulk plasma provide 15-60 minute warning of geomagnetic storm conditions
  - Primary source: NOAA/Deep Space Climate Observatory (DSCOVR), launch 2015
  - Backup: NASA Advanced Composition Explorer (ACE) launch 1997 – propulsion limited to 2026

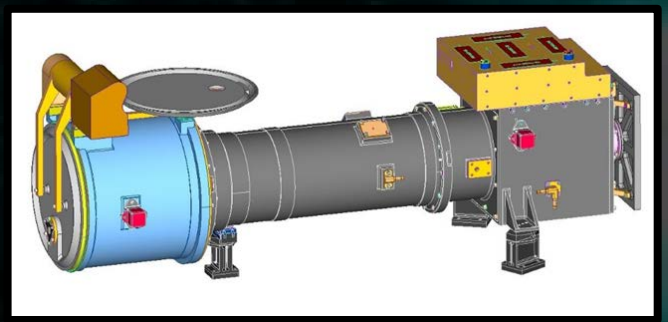


SWFO Program Key Technical Components

3-Axis Stabilized ESPA Class Spacecraft

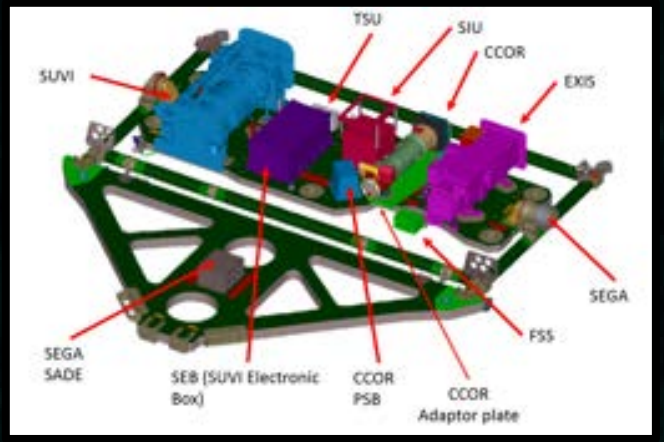


Compact Coronagraph (CCOR)



GOES-U Solar Pointing Platform (SPP)

CCOR + SUVI + EXIS



SWFO-L1 Mission Overview

- Space Weather Operational Observation at Earth-Sun Lagrange Point 1
- IAA with NASA to procure an ESPA Grande compatible spacecraft and a SWIS (Solar Wind Instrument Suite)
- NOAA ground services
- Rideshare with NASA IMAP
- Nominal orbit: L1
- Nominal launch: 2024
- SWFO-L1 Instruments: CCOR, SWIS
- Potential ESA contributed instrument (X-Ray flux monitor)

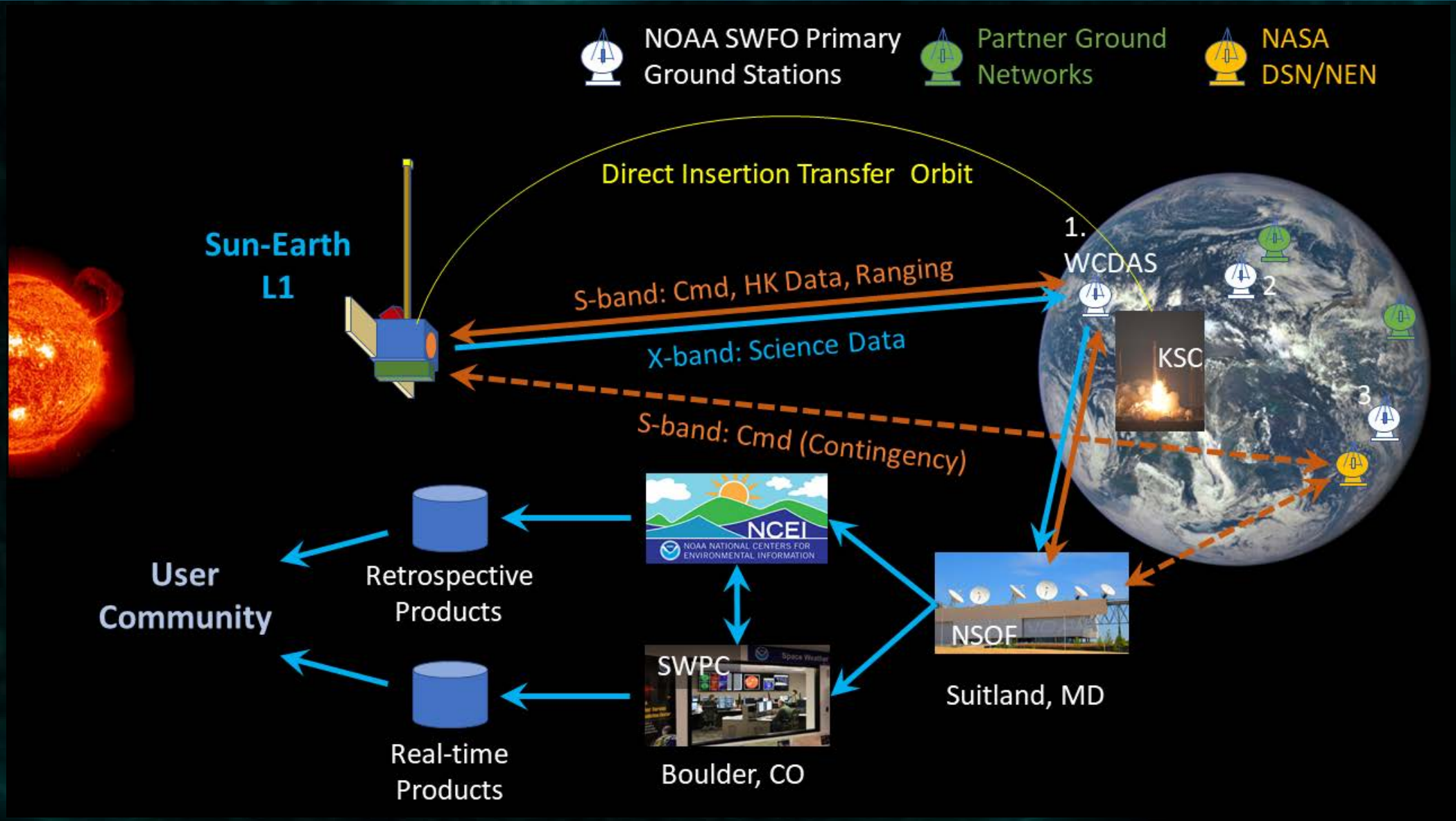
Coronagraph Project

- Compact Coronagraphs under development by NRL via an IAA
- CCOR for SWFO-L1 Satellite, deliver 2022
- CCOR for GOES-U, deliver 2021
- Potential CCOR for ESA-L5 Satellite, deliver 2023

Coronagraph Accommodation on GOES-U

CME imaging from geostationary orbit
CCOR Integrated onto GOES-U SPP
Commanding and data flow through GOES-R ground services
Nominal launch: 2024

SWFO Mission Architecture



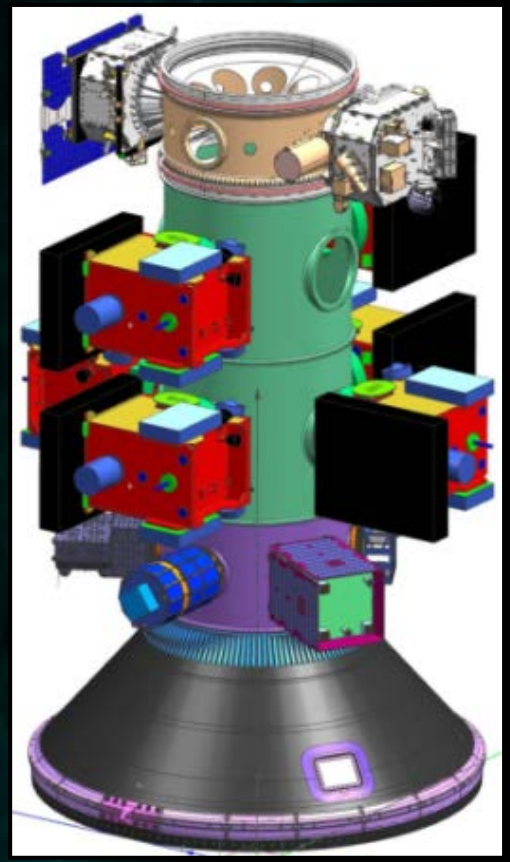
SWFO Procurement Status

- CCOR COVID-19 Impacts
- Proposal evaluation underway, blackout period is in effect for
  - Spacecraft
  - Solar Wind Plasma Sensor
  - Magnetometer
  - Supra Thermal Ion Sensor
- Project in contact with ESA for X-Ray Flux monitor (XFM)
- Ground segment definition continues

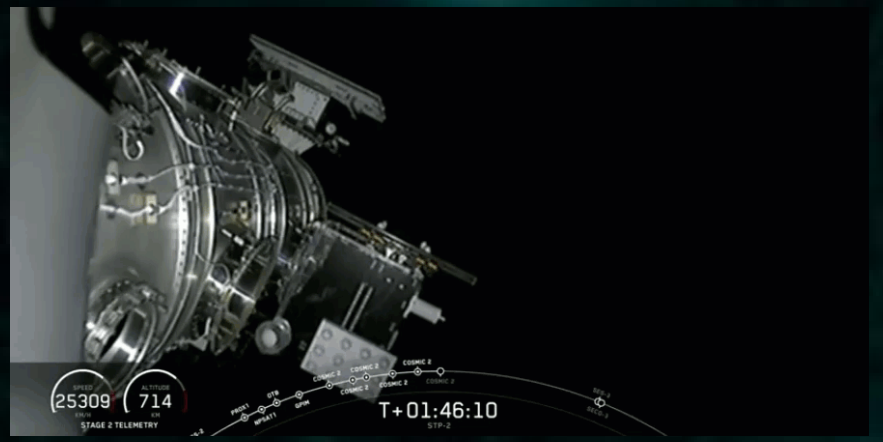
COSMIC-2/FORMOSAT-7 Mission

6 Satellite constellation around the equator (24 degree inclination orbit)
Each satellite has 3 instruments:
- TriG GNSS-RO receiver (TGRS) – Primary Instrument
- Ion Velocity Meter (IVM) – Secondary Instrument
- RF Beacon – Secondary Instrument

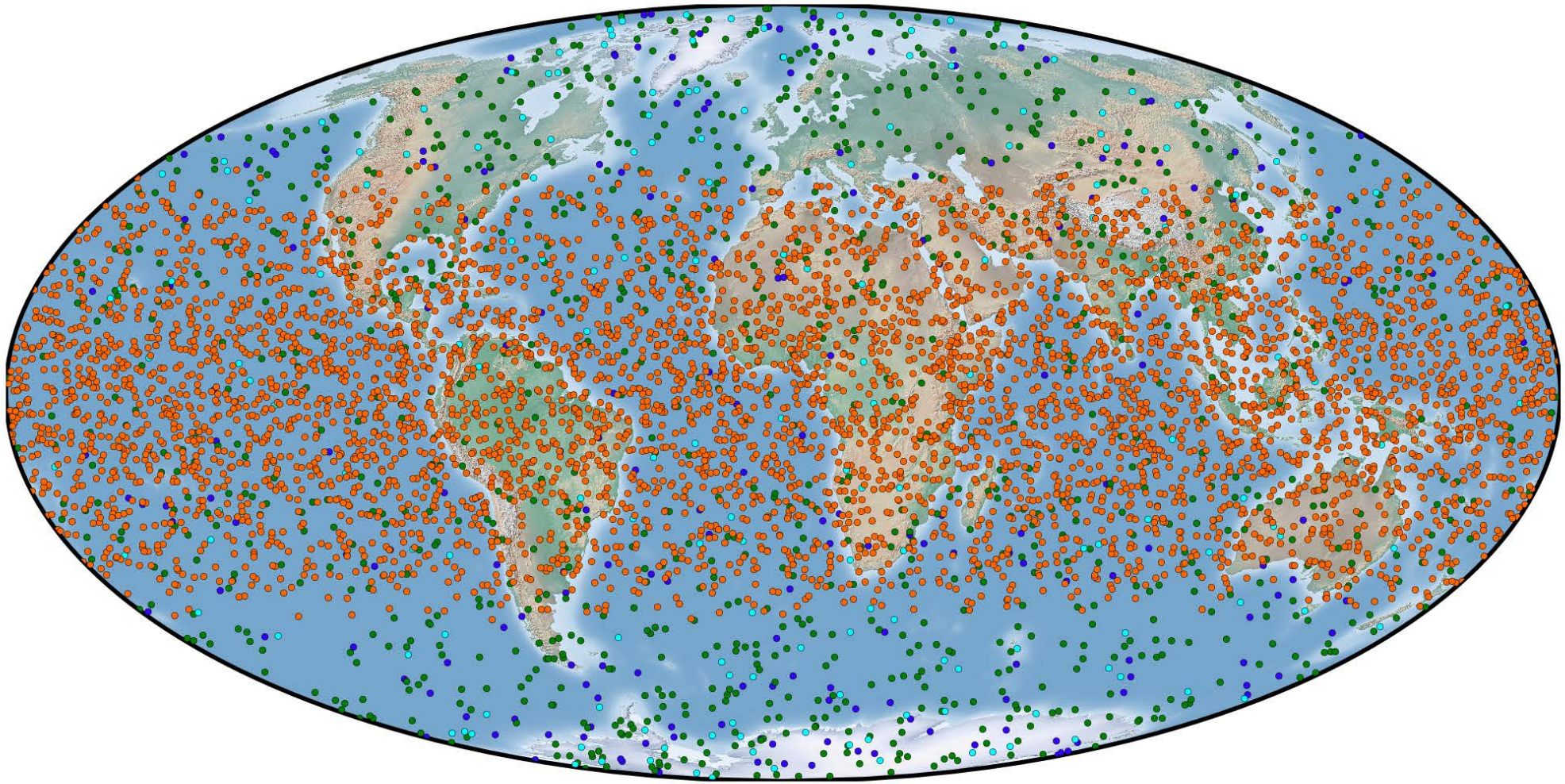
Mission Design Life: 5 years
Launch Date: June 25, 2019
Launch Vehicle: Falcon Heavy (STP-2 mission stack shown in right figure)
All weather coverage (4,000+ occ/day) with 30 min avg data latency



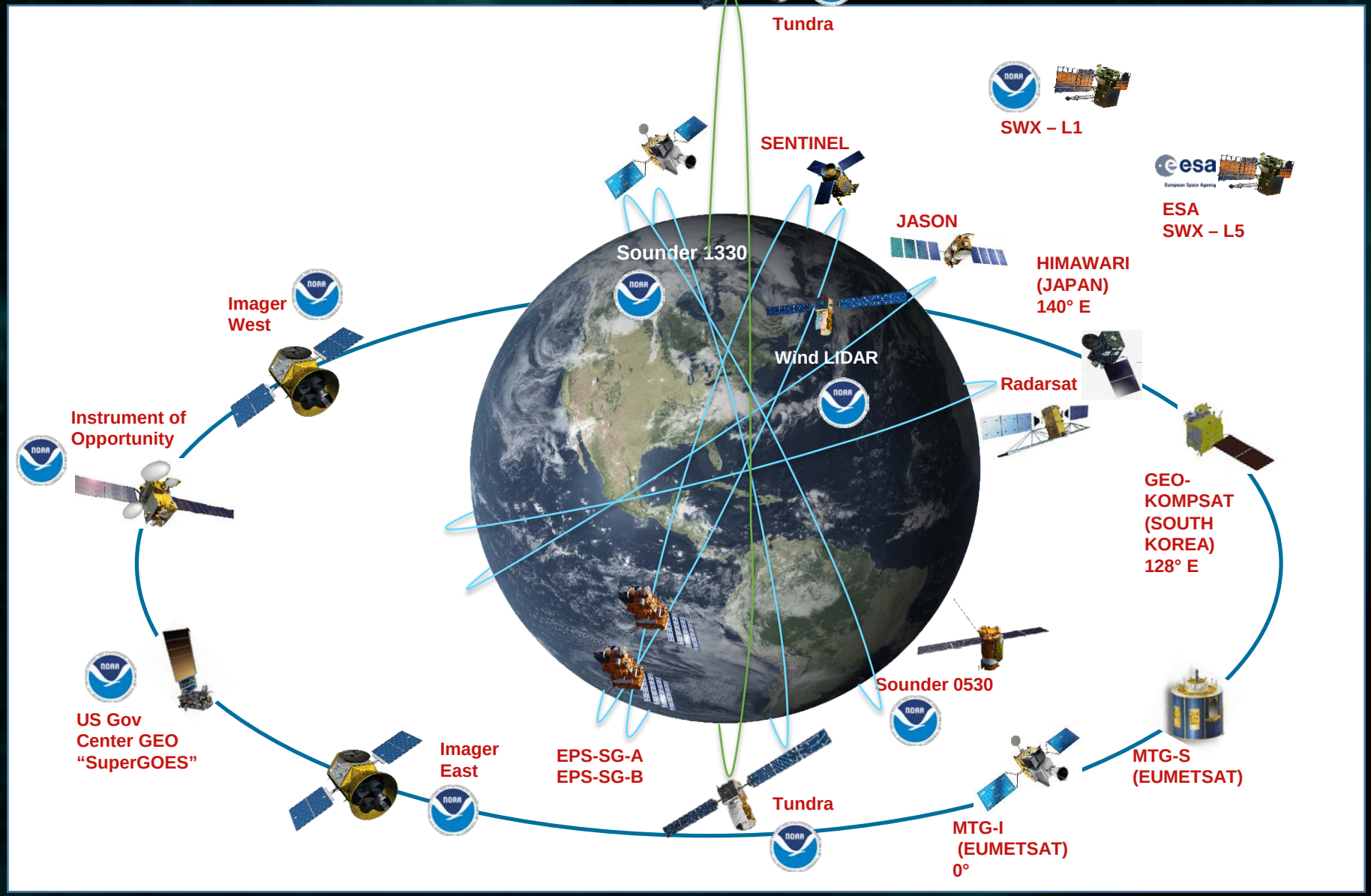
COSMIC-2 Spacecraft in STP-2 Launch Stack



COSMIC-2 and Partner Data



Evolution of NOAA and Partner Space Architecture



Space Weather Operations and Research Infrastructure Workshop - Status

- National Academies via an ad hoc committee is organizing a workshop that will consider options for continuity and future enhancements of the NOAA space weather operational architecture. Objectives, among others, include:
  - Identify programmatic and technological options to ensure continuity of the baseline, in particular consider options to extend the Space Weather Follow On (SWFO) Program; and
  - Consider options for technology, instrument, and mission development to support in situ and remote sensing space weather observations from either ground- or space-based vantage points, the latter including L-1, L-5, L-4, GEO, and LEO.
- Workshop to be conducted in two parts (both open; agenda to be published soon)
  - Virtual 1.5 day workshop June 16-17, 2020
  - In person 1.5 day workshop in September TBD, 2020 (likely DC area)

Backup

For more information visit: **www.nesdis.noaa.gov**

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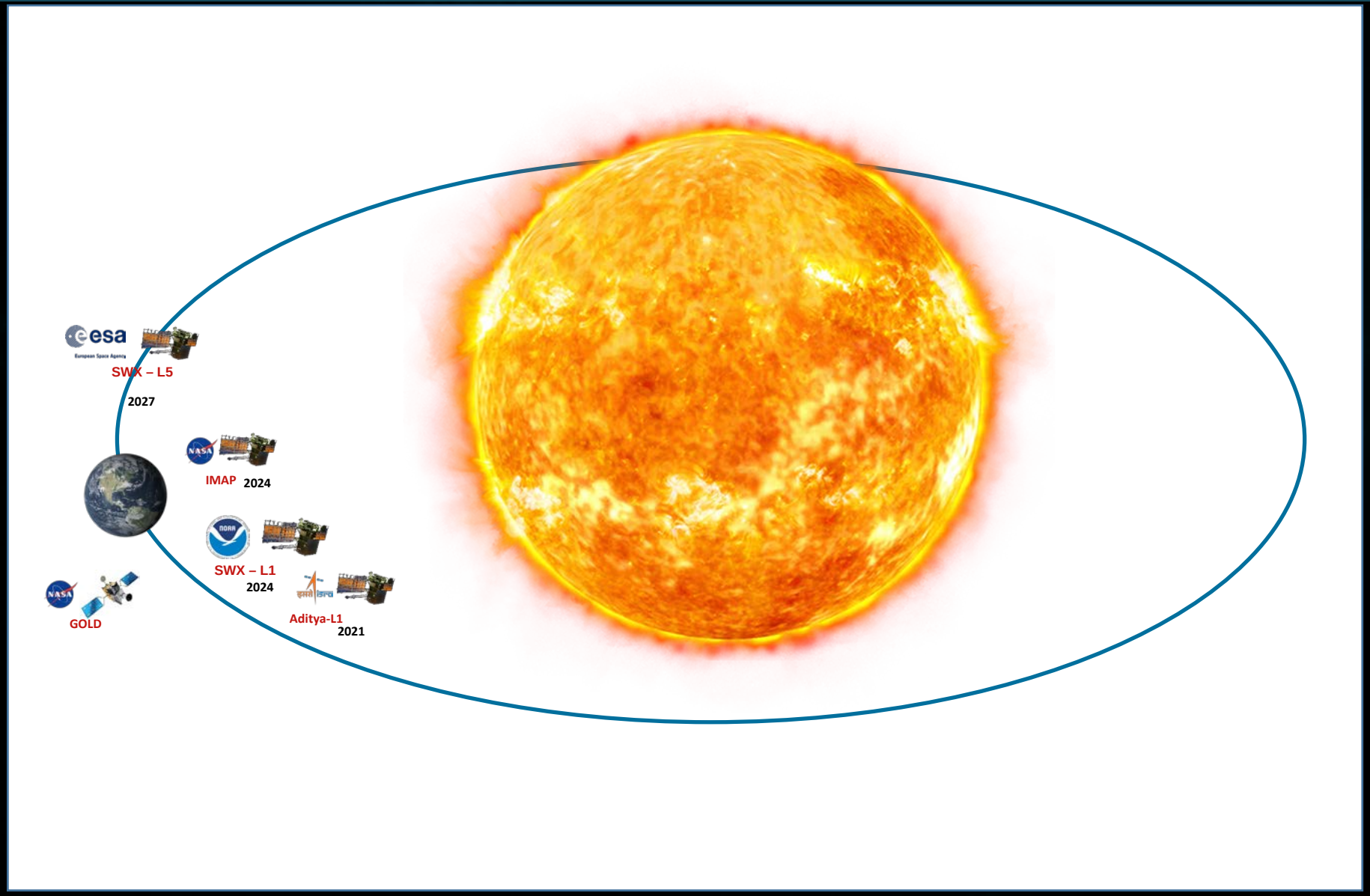
Evolution of Space Weather Architecture



Space Weather Operations and Research Infrastructure Workshop - Charter

The NASEM will conduct a workshop via an ad hoc organizing committee to examine the future observing infrastructure which is intended to supply critical input to the space weather notification system that characterizes and forecasts space weather events

A report of the workshop proceedings will be produced

The workshop results will present options to the Space Weather Follow On (SWFO) Program that will sustain a set of space-based observations and measurements that will ensure continuity of critical operational data

Space Weather Operations and Research Infrastructure Workshop - Scope

The NASEM will conduct a workshop via an ad hoc organizing committee to examine the user needs for the space weather notification system supported by operational observations (Phase 1).

The workshop will examine present infrastructures and investigate options for improvement beyond the baseline capabilities of the present operational program (2030-2030 timeframe, post SWFO1)

Infrastructure Workshop Phase 2 will address items beyond the scope of Phase 1, e.g. future research needed to understand the sun-earth system

Space Weather Operations and Research Infrastructure Workshop – Scope (cont.)

- User needs defined by the SWPC scales of notification, e.g. G1-5 indicating the severity of geomagnetic storm intensity
- Needs further defined by the observations and input needed to generate these notifications
- Operational models in the SWPC system need baseline observations but could benefit from improved input

SWFO– in the last two years …

NOAA/NESDIS has established the baseline operational Space Weather Follow On (SWFO) Program

- Funded in the NOAA budget for L1 coverage
- Began flight fabrication of the Compact CORonagraph (CCOR) with NRL
- Funded in the NOAA budget for CCOR on GOES-U
- Established a joint project office with NASA for SWFO
- Established an agreement with the NASA IMAP mission for a rideshare for SWFO-L1
- Let procurement RFPs for instruments, RFO for spacecraft
- Launched the COSMIC-2 mission with Taiwan
- Initiated arrangements with ESA for data sharing with the L5 mission
- Negotiating with ESA for potential ground-station and instrument cooperation