NESDIS Update to the Space Weather Operations and Research Infrastructure Workshop

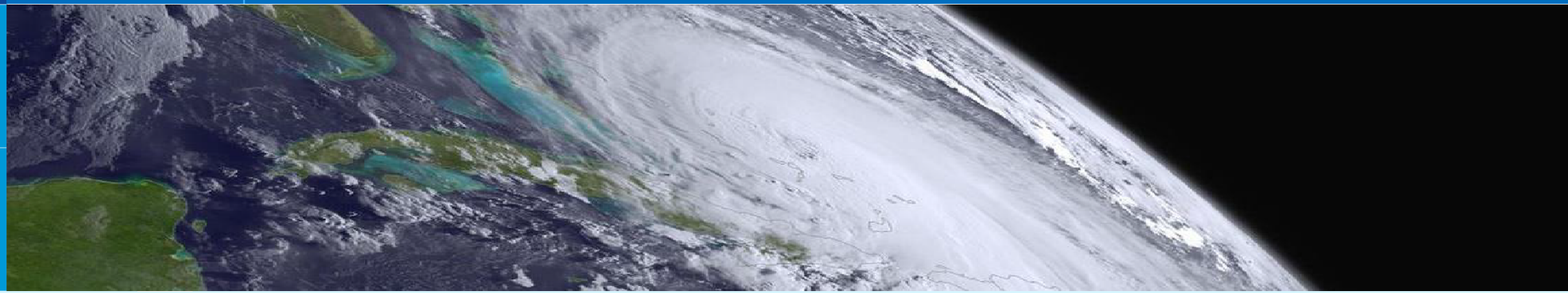
Dr. Stephen Volz

Assistant Administrator for Satellite and Information Service

NOAA

Satellite and Information Service

September 10, 2020

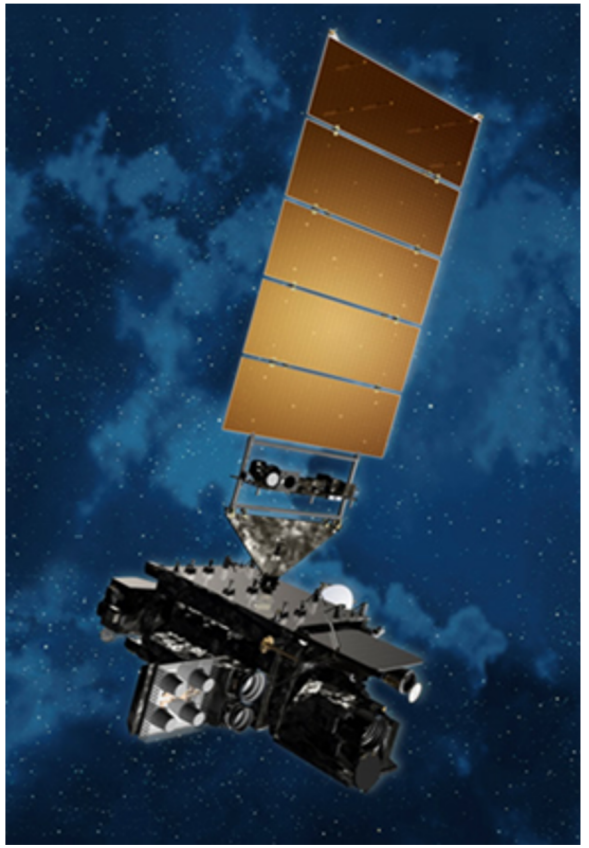


Outline

- NESDIS Mission & Program Updates
- Executing the Future Observing System
  - Architecture
  - Organization
  - Partnerships
- Primary Challenges

NESDIS's Mission is Essential to National Security, Safety, and Prosperity

- Operates the Nation's weather satellites, 24/7
- Acquires next-generation Earth & Space Weather observation satellites
- Provides data and imagery for predictive environmental and atmospheric modeling
- Provides definitive assessments of the U.S. and global climate
- Maintains one of the most significant archives of environmental data on Earth



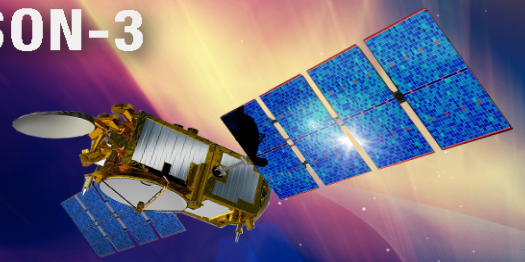
95% of the data used in weather forecast models come from satellites

NESDIS Program of Record

DSCOVR

OPERATIONAL JULY 27, 2016

JASON-3

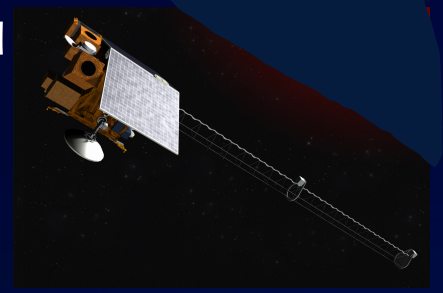


OPERATIONAL JULY 1, 2016

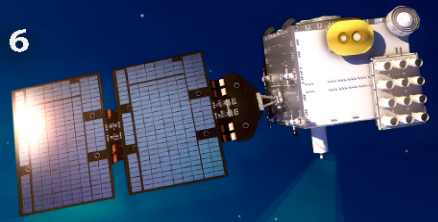
Sentinel 6 Michael Freilich – Fall 2020

SWFO-L1

LRD: FY2024

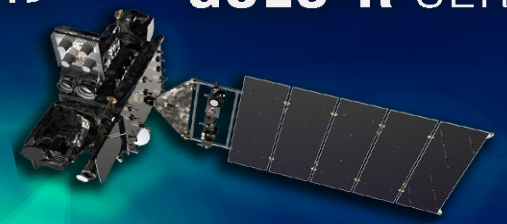


COSMIC-2



COSMIC-2 - June 2019

GOES-R SERIES



GOES-16 - OPERATIONAL Dec 18, 2017
GOES-17 - OPERATIONAL Feb 12, 2019
GOES-T - FY 2022
GOES-U - FY 2025

JPSS SERIES

NOAA-20 - OPERATIONAL May 30, 2018
JPSS-2 - FY 2023
JPSS-3 - FY 2026
JPSS-4 - FY 2031

Major Program Commitments

Development Programs: FY20 budget $1,251M

JPSS – Joint Polar Satellite System

- JPSS through 2038: FY20 $745M, LCC ~$19B for 4½ satellite program

GOES-R – Geostationary Operational Environmental Satellites

- GOES-R through 2036: FY20 $304M, LCC $11.7B for 4 satellite program

SWFO – Space Weather Follow On

- SWFO through 2029: FY20 $64M, LCC ~$700M for single satellite

Ground Systems, Architecture, Advanced Planning

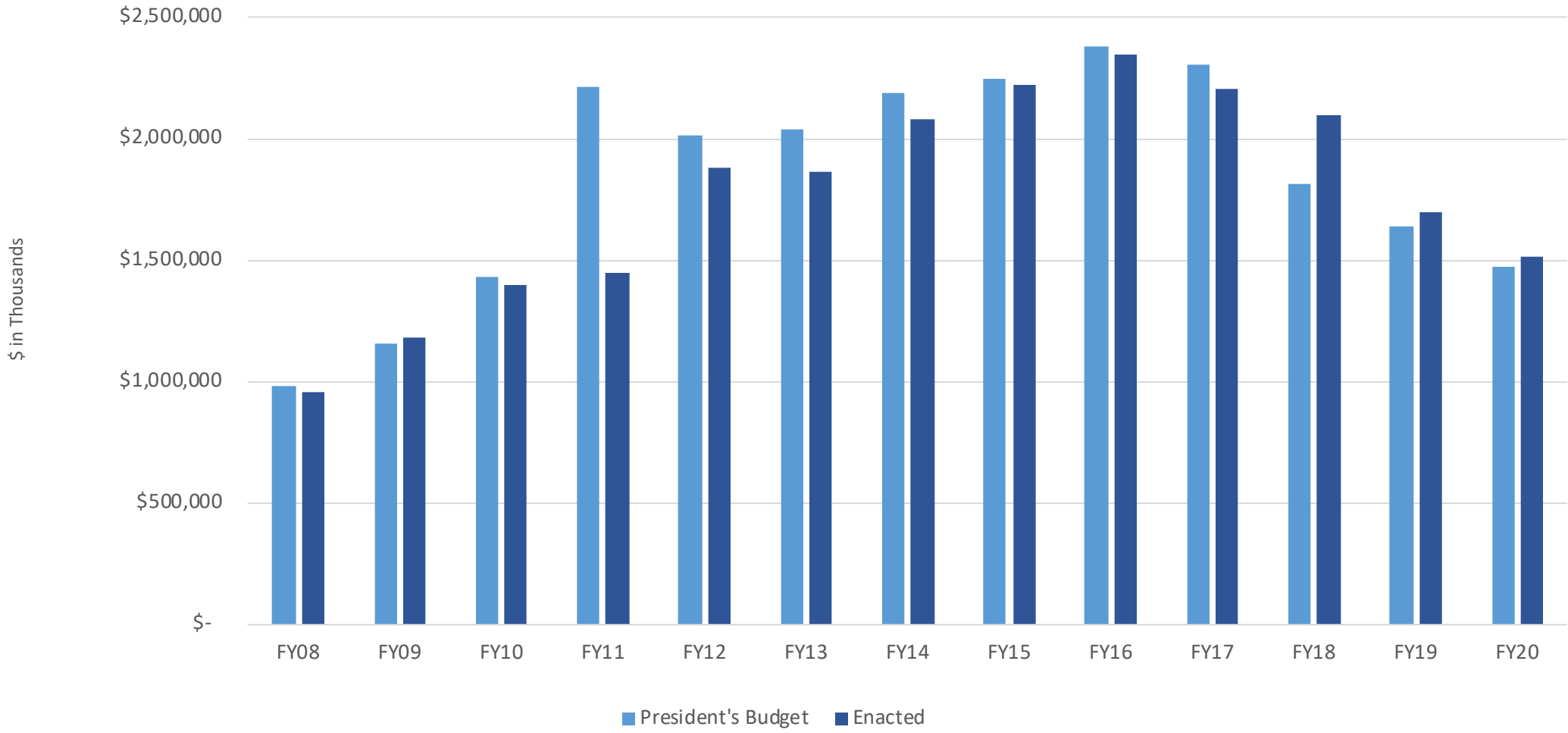
- COSMIC-2, OSGS, SAE, Requirements: FY20 $126M

Operations, Science, and Data Archives: FY20 Budget $261M

- Annual operations funding FY20 $261M, adjusted (with difficulty) as systems evolve for support and execution

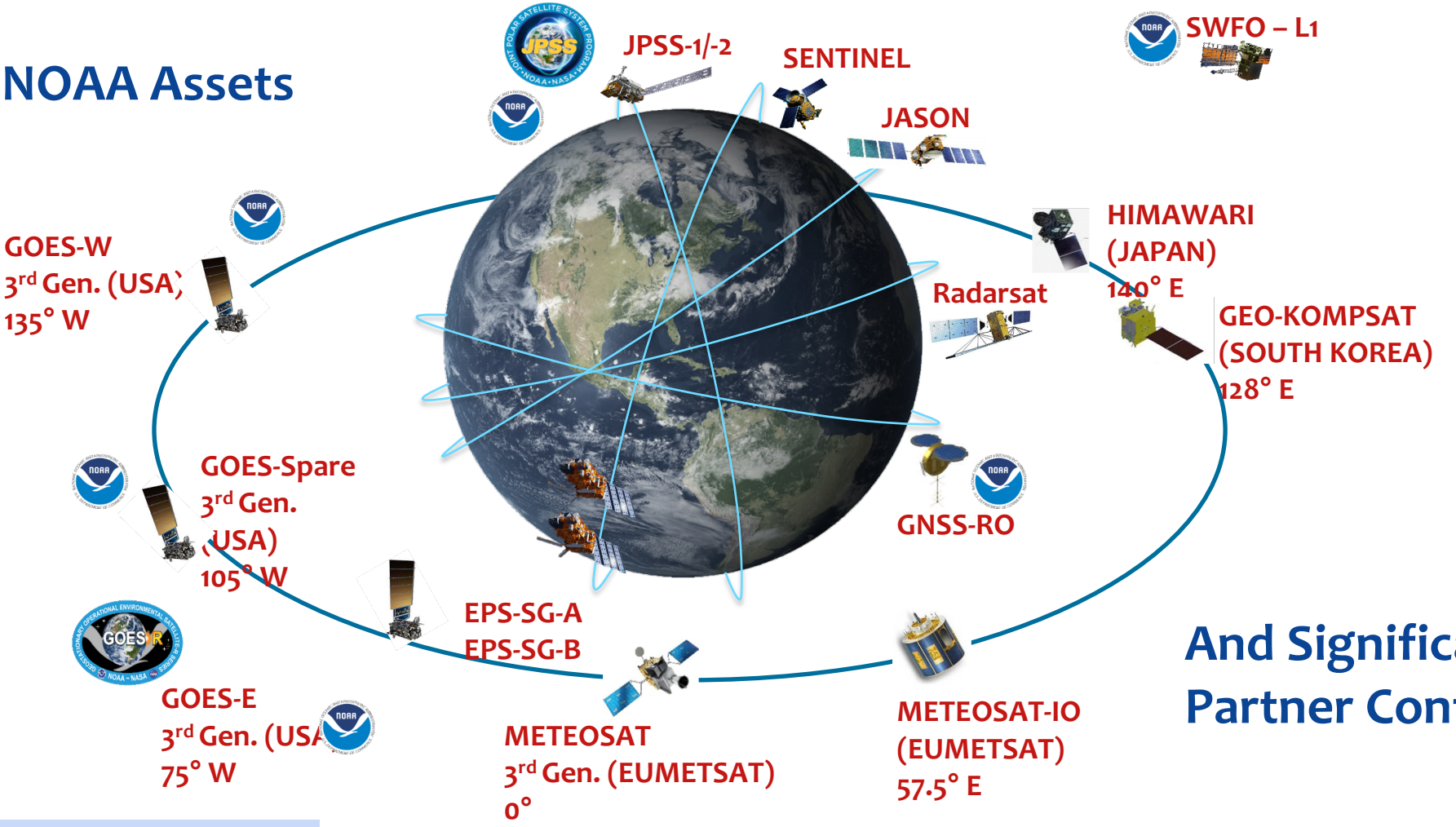
NOAA is committed to long term planning, with the necessary investments to do it.

NESDIS Budget Trends



Today's Space Architecture is Highly Capable, But Not Adaptable, and we must define its replenishment now.

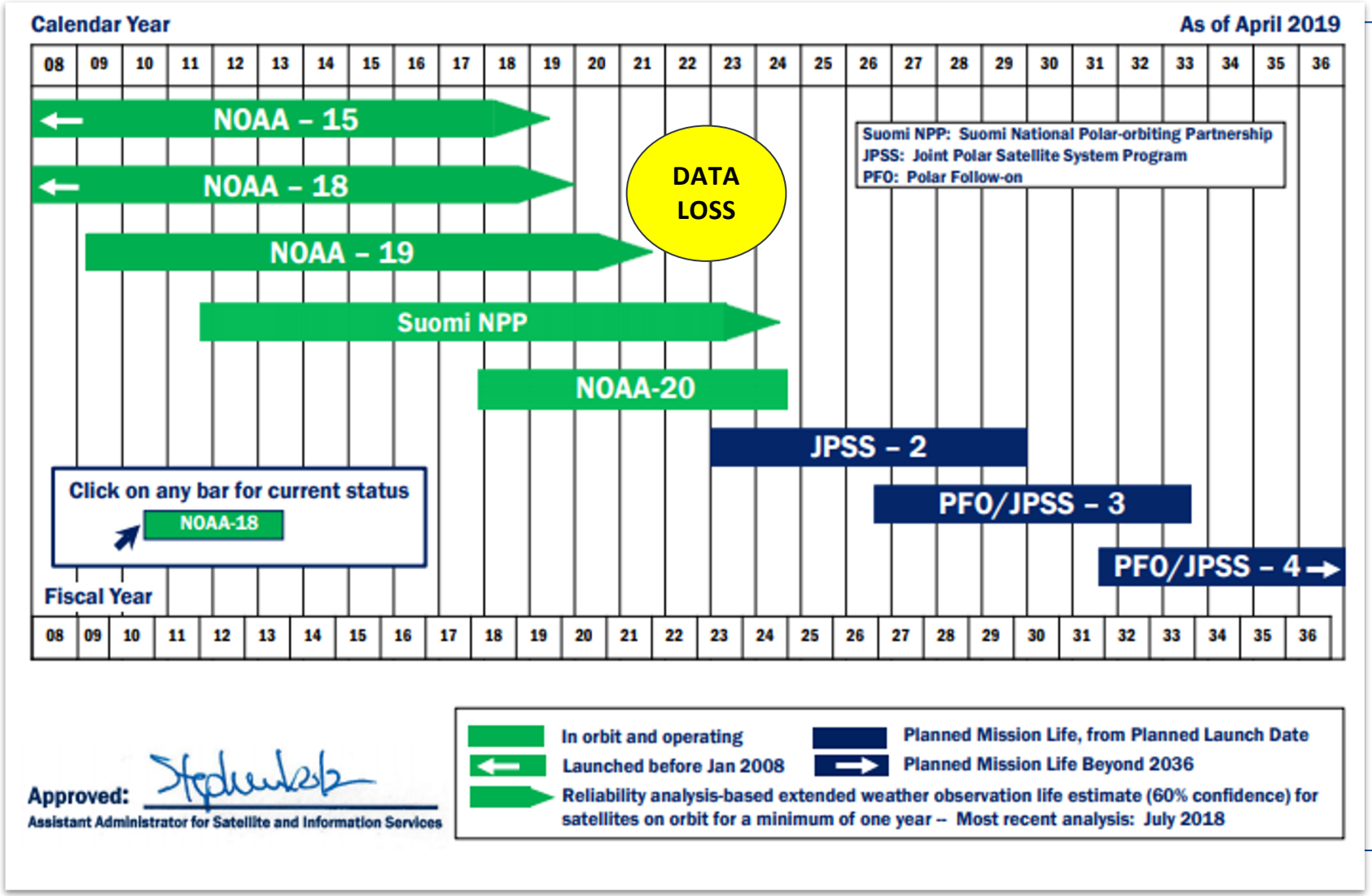
Includes NOAA Assets



And Significant Partner Contributions

Planned Architecture c. 2025

Continuity & Performance in LEO Observations

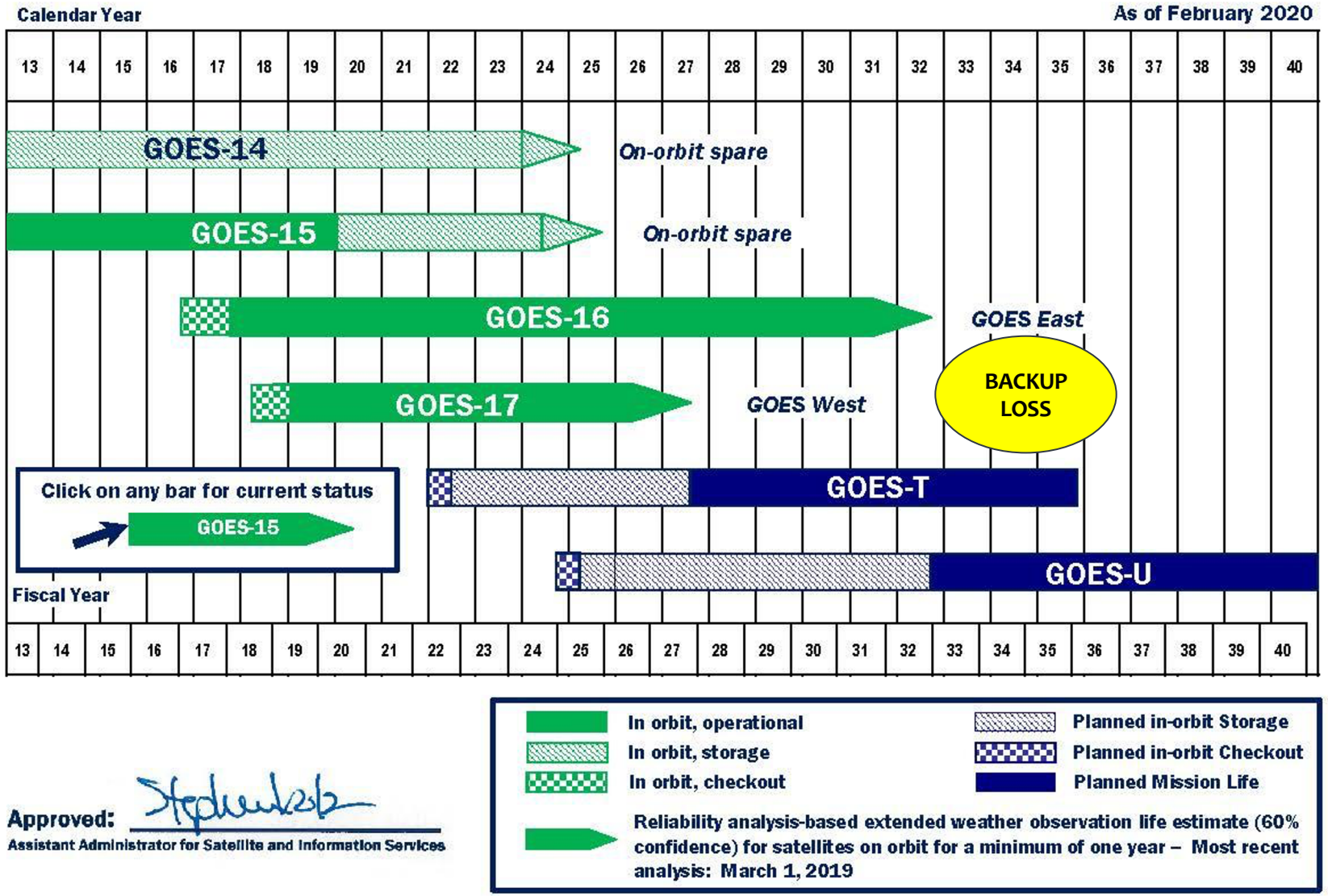


Legacy POES (NOAA-15,-18,-19) are not baseline requirements, but continue to provide useful observations for NWP.

USAF satellite systems will provide some observations going forward, after DMSP is discontinued.

Critical replacement sounding data is needed at that time to maintain performance, and to provide improved NWP forecasts.

Continuity & Performance in GEO Observations



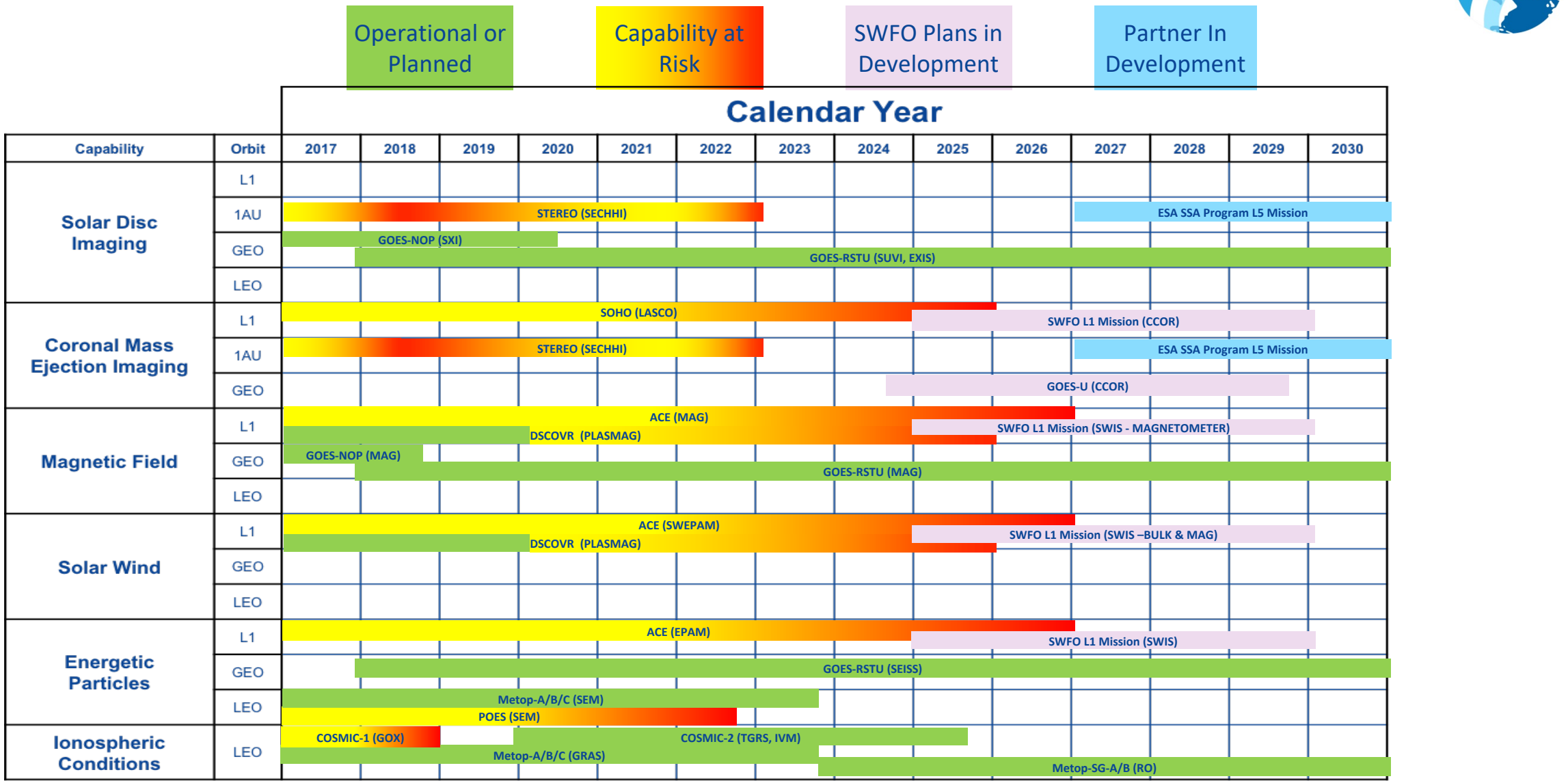
Approved: _____
Assistant Administrator for Satellite and Information Services

The GOES-R Series will lose backup capability by ~2030.

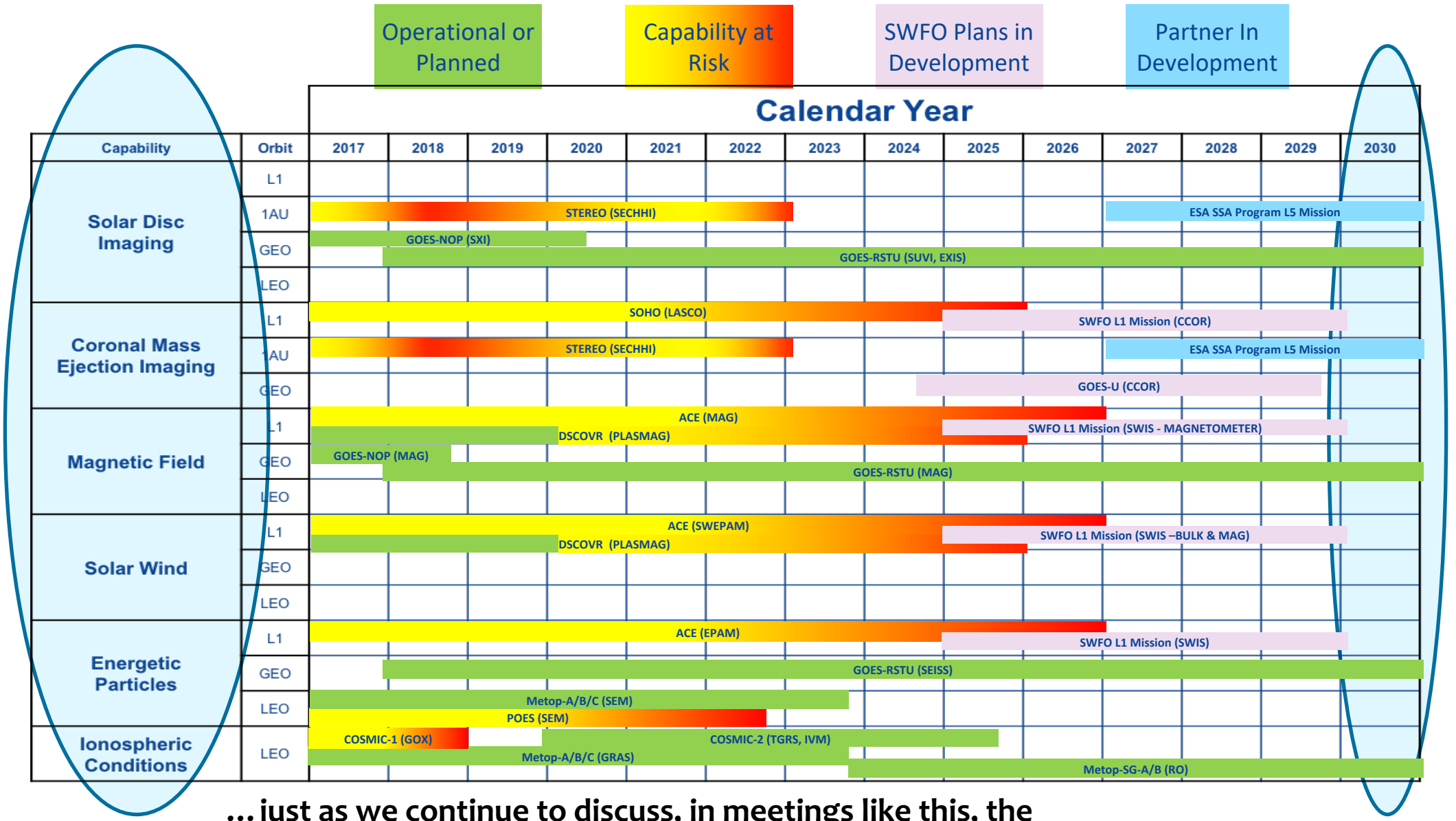
Replacement observations needed by that time to maintain continuity.

Earth system changes, growing User needs, and improved modeling capabilities drive need for improved observing systems

Establishing an Integrated Space Weather Observing system



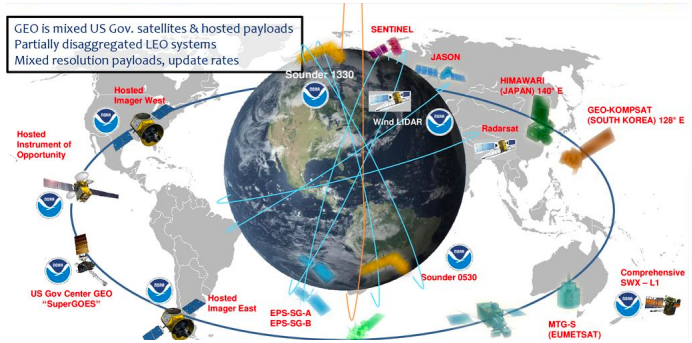
Establishing an Integrated Space Weather Observing system



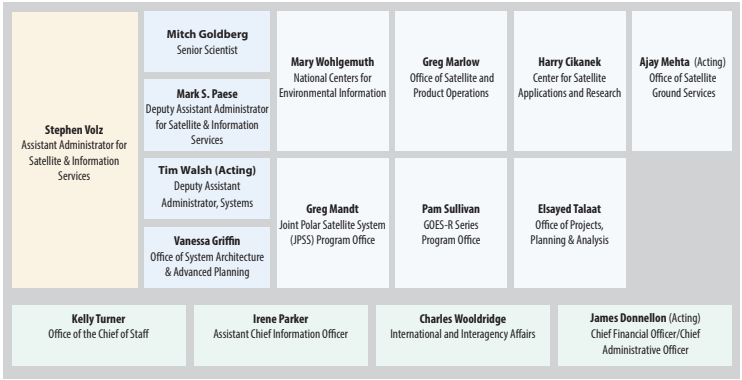
We are planning now for the systems to continue past 2028.

…just as we continue to discuss, in meetings like this, the necessary observables to achieve our mission

Executing the Future Observing System



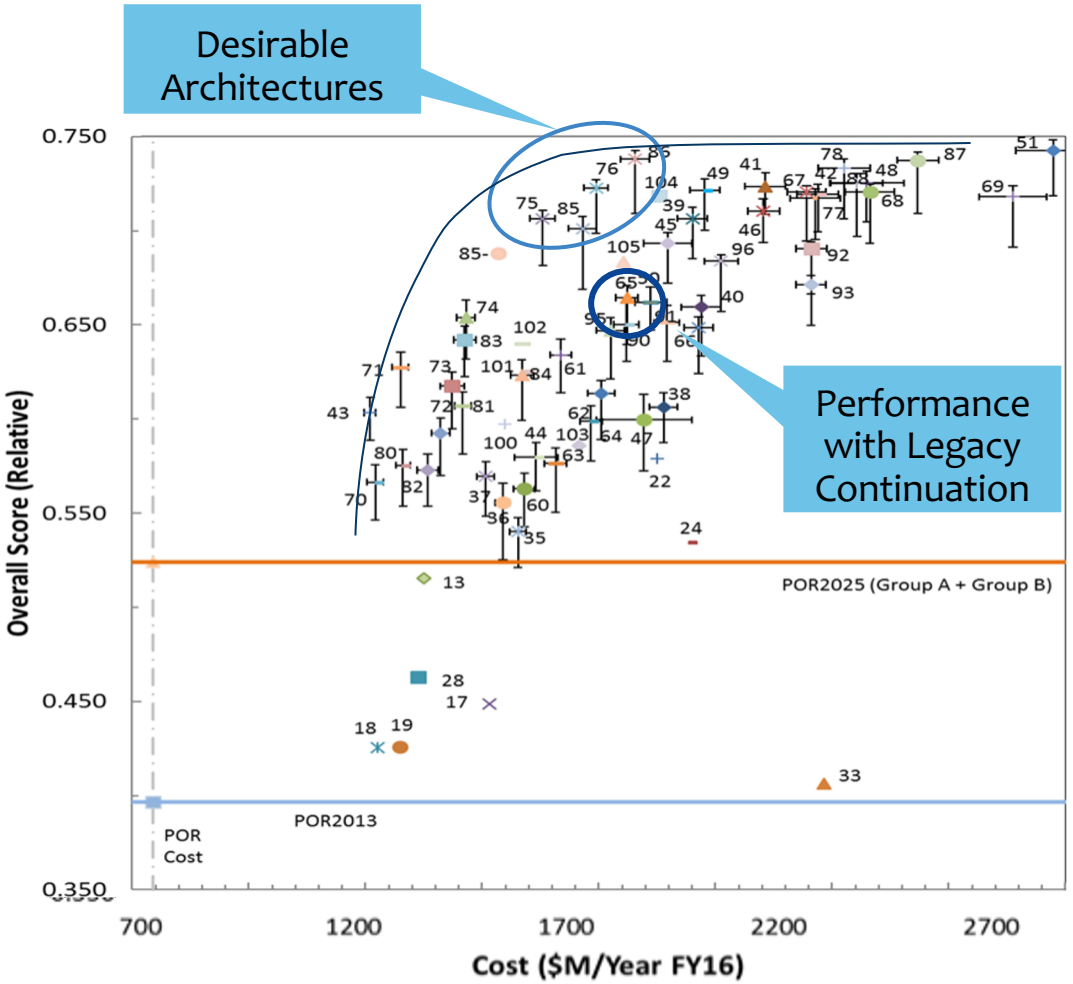
Architecture



Organization

Partnerships

NOAA Satellite Observing System Analysis - NSOSA Enables NOAA to Focus on High Value Options



Common desirable features of these Architectures:

Mix of observations

- Mix of small and medium platforms
- Enhanced imagery and high-latitude coverage
- New & more observations needed by models

More agility

- Disaggregated LEO – smaller building blocks
- Onramps for new technologies
- Evolving and integrating partner observations

New business models

- Data purchases, ride shares, hosted payloads
- Commercial communication & data-relay services
- Instruments of opportunity

GEO-XO and Space Weather Industry Concept Analyses

- Funded through a Broad Agency Announcement (BAA) Call, FY20 funds are being used to partner with industry for options to replenish GEO and Space Weather data:
- Instruments
  - Regional, real-time weather imagery
  - Space weather data
  - Lightning mapping; hyperspectral sounding, ocean color
  - High latitude observations – highly elliptical orbits (Tundra) for Arctic and space weather observations
- Implementation solutions
  - Standard satellite bus, including GEO/Tundra shared
  - Hosting services, for NOAA instruments on others' platforms and for partners to fly on NOAA satellites
  - Small satellites for space weather instruments
  - Commercial data and services

Future Space Weather Builds on NSOSA Findings

Next Generation Space Weather will provide:

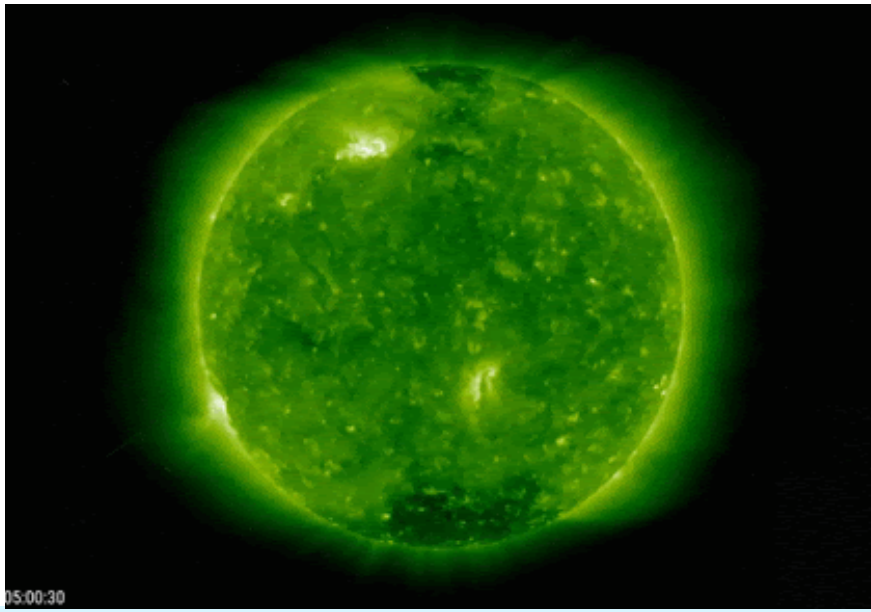
- Baseline critical real-time imagery and in situ space weather measurements
- New data to revolutionize space weather forecast models, enable space commerce and exploration needs
- Accurate, timely and high-reliability warning of geomagnetic storm events

Analyzing concepts recommended by NSOSA:

- Spacecraft in either GEO or Tundra (over the Arctic) based on need
- Space weather satellites rideshare to GEO or L1
- Hosting instruments on commercial satellites, partner instruments on NOAA satellites

Budget Activities:

- FY20 budget funds concept analyses and requirements definition
- FY21 & FY22 requests funds to initiate Space Weather Observation definition



NESDIS Strategic Objectives

NESDIS Reimagined

1. Advance terrestrial observational leadership in geostationary and extended orbits

2. Advance Space Weather observational leadership in LEO, GEO, and extended orbits.

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

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

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

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

NESDIS Strategic Objectives

NESDIS Reimagined

1

Advance terrestrial observational leadership in geostationary and extended orbits

GEO Initiative

2

Advance Space Weather observational leadership in LEO, GEO, and extended orbits.

SWFO Program

3

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

Next Gen Sounder Initiative

4

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

DACS Initiative

5 

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

6 

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

Four Pillars of NOAA's Next-Gen Earth Observation

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

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.

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

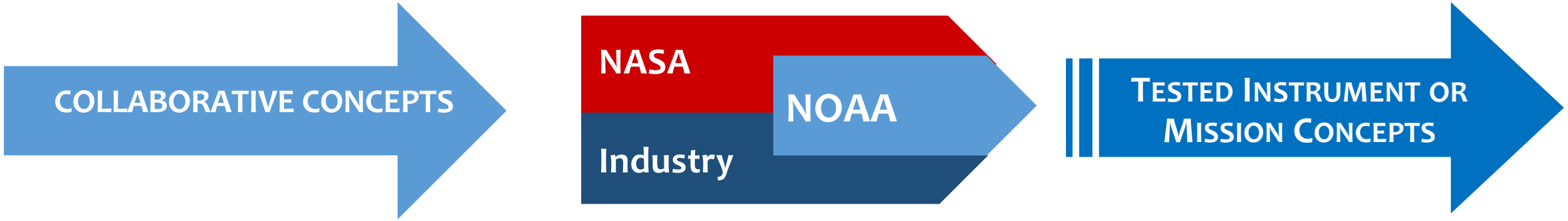
Reliably monitoring coronal mass ejections from L1, GEO, and LEO can protect the nation's valuable, vulnerable infrastructure. New capabilities at L5 and high earth orbit can provide additional insight and improve forecasts.

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.

Joint Venture: Leveraging New Capabilities Through Partnerships

Central to the Joint Venture process is the demonstration of new technology and capabilities developed by and with partners including NASA and industry. NOAA will then infuse the best of these into our systems.



ARCHITECTURE PLANNING

Informing the NOAA satellite architecture planning are concepts generated in collaboration with commercial, research, and other agency partners, on a continual feedback loop.

TRL 2-7

Potential NASA ESTO Collaboration

Industry concept studies for future LEO soundings

TRL 8/9

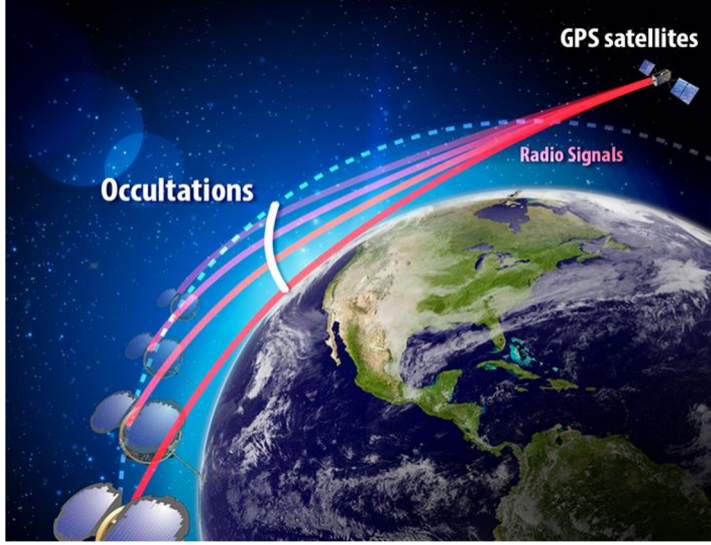
Possible Enhanced Operational Opportunity with NASA Earth Venture Mission (EVM)-3

PROGRAM EXECUTION

Joint Venture endeavors investigate promising instrument and/or mission concepts. The best results are incorporated into NOAA satellite development programs

TRL = Technology Readiness Level

Commercial Weather Data Pilot/Purchase



Radio Occultation Data Operational Purchase:

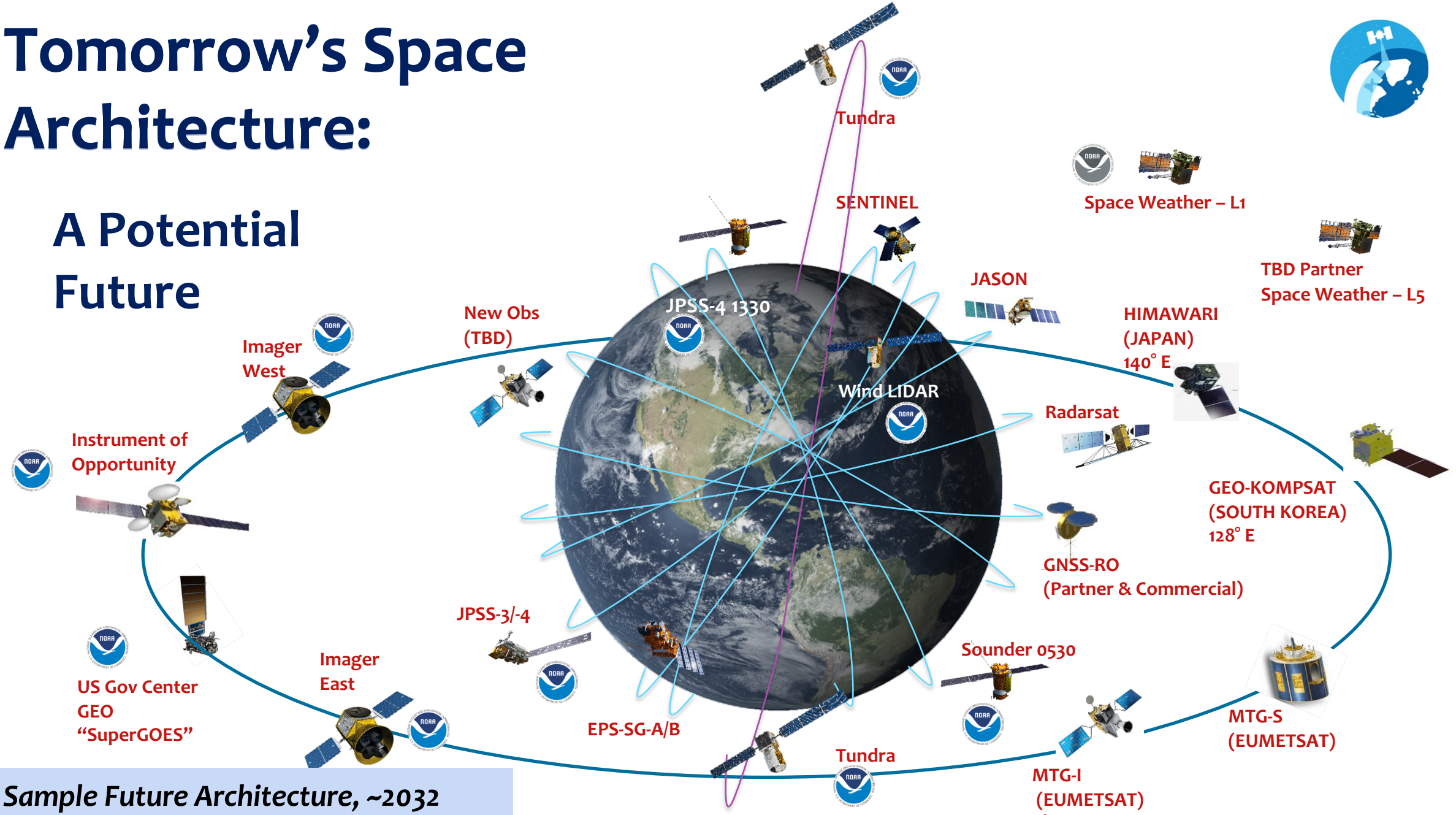
- RFP released August 4 to initiate purchase of commercial RO data for operational use
  - Pending proposals received, NESDIS plans to award contract(s) in early FY 2021
  - 2-year Indefinite Delivery Indefinite Quantity (IDIQ), multiple Delivery Orders for data
- NOAA's Space Weather Prediction Center will evaluate data for possible operational use
  - Total Election Content for use in NOAA's GloTEC model
  - Electron Density Profiles available for research use

Upcoming activities:

- **Ongoing market research:** Near-term plans include RFI to understand current and planned availability of commercial data to support mission needs across the NESDIS portfolio
- **Continuing Commercial Weather Data Pilots:**
  - Continue CWDP to investigate additional commercial weather capabilities beyond RO
  - PROSWIFT Act would establish CWDP for space weather in NOAA

Tomorrow's Space Architecture:

A Potential Future



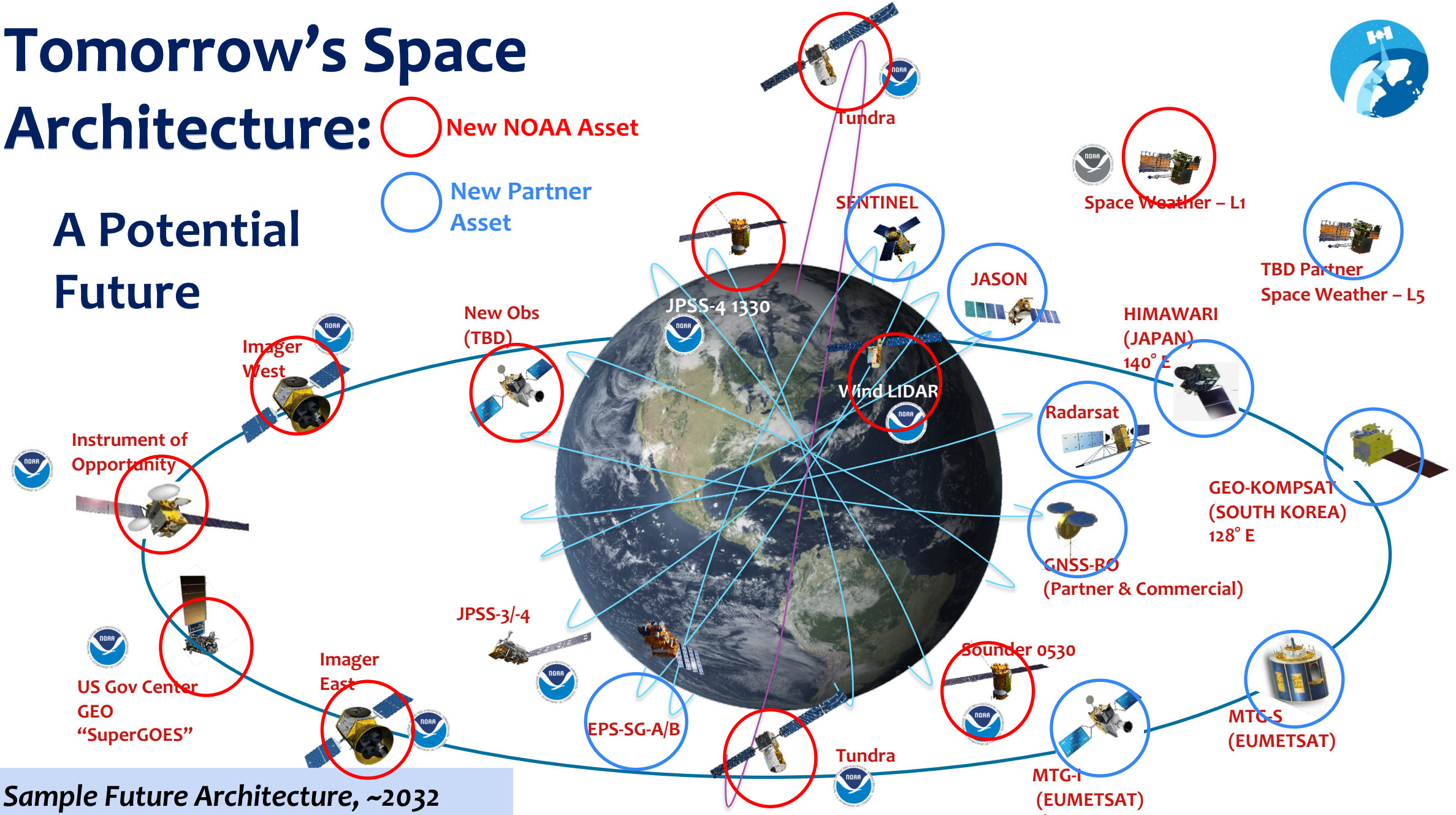
Sample Future Architecture, ~2032

Tomorrow's Space Architecture:

A Potential Future

New NOAA Asset

New Partner Asset

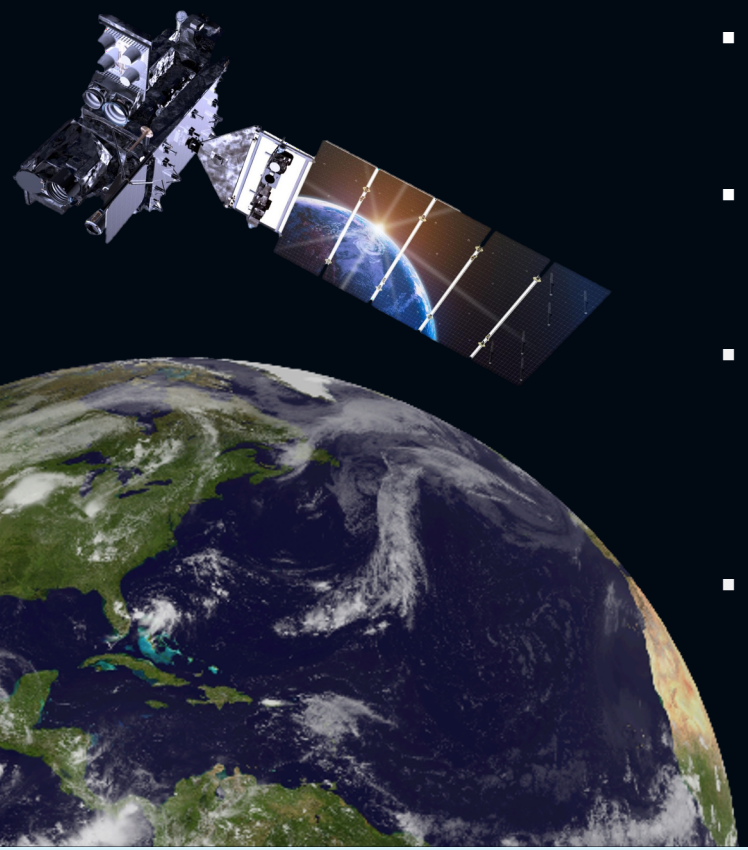


Sample Future Architecture, ~2032

Building Our Future: FY21 Initiatives & Beyond

Expanding agreements with strategic partners to exploit innovation in instrument design, small satellites, and cloud capabilities.

NOAA's FY 2021 requests moves us toward our future:



- **GEO Subactivity:** begin Phase A for GEO-XO payload & deployment options
- **Joint Venture:** industry assessment of sounding capability as first step in LEO
- **Commercial Data Purchase and Pilot:** additional RO data purchases, pilot for additional data types
- **Data-agnostic Common Services (DACS):** exploit partner data through cloud-enabled common ground services

Building Our Future: FY21 Initiatives & Beyond

Expanding agreements with strategic partners to exploit innovation in instrument design, small satellites, and cloud capabilities.

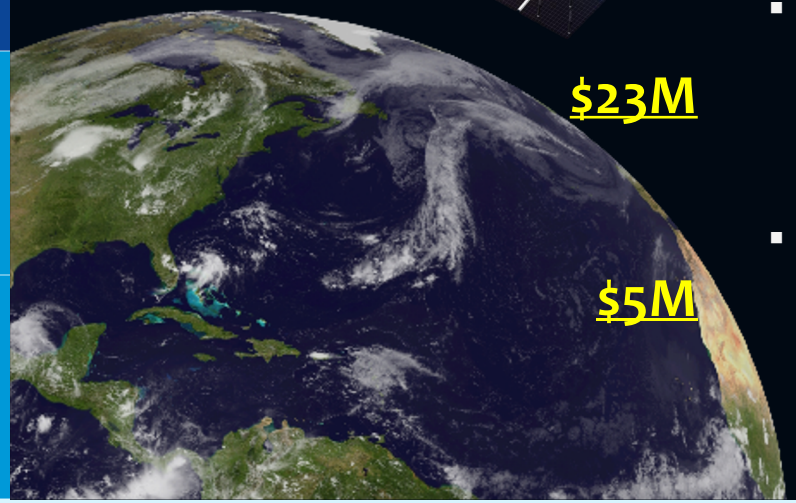
NOAA's FY 2021 requests moves us toward our future:

FY21: $10M

- **GEO Subactivity:** begin Phase A for GEO-XO payload & deployment options

$5M

- **Joint Venture:** industry assessment of sounding capability as first step in LEO



$23M

- **Commercial Data Purchase and Pilot:** additional RO data purchases, pilot for additional data types

$5M

- **Data-agnostic Common Services (DACS):** exploit partner data through cloud-enabled common ground services

Deliverables

GOES-R continuity ~2030+

LEO continuity ~2025+

Integrated observations 2021+

NESDIS Mission Focus Areas

- Investing in the next generation satellite and ground systems that will deliver observing system capabilities as soon as 2025 and up to 2050.
- Maintaining and growing commercial and international partnerships to deliver a resilient and high-performing observing system
- Refreshing our Information Technology to exploit existing and emerging technology trends


Community Meeting on NOAA Satellites
Informing the Future of NOAA Satellite Observations
September 29 – October 2, 2020
https://www.nesdis.noaa.gov/sat-community-2020
VIRTUAL MEETING
Join us on LinkedIn!
linkedin.com/company/nesdis
NOAA

NOAA

Satellite and Information Service

September 10, 2020

Thank You