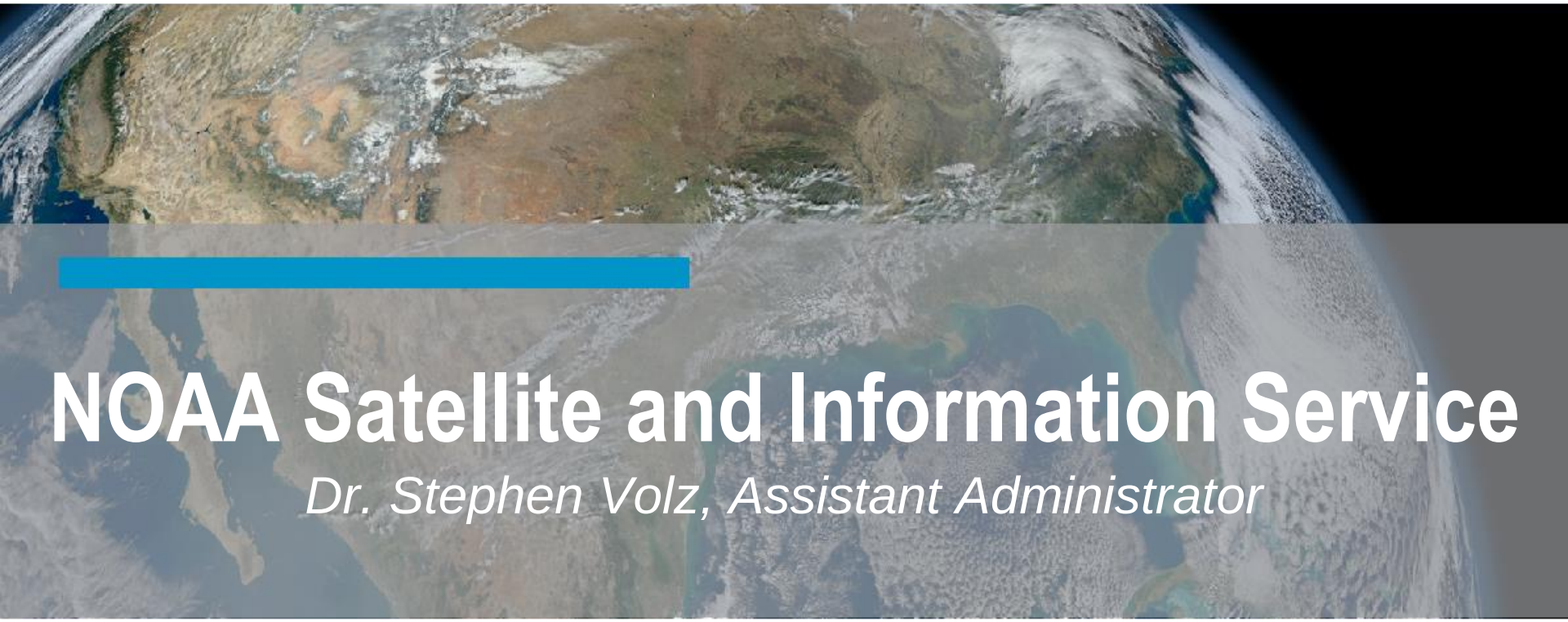


NOAA Satellite and Information Service

Dr. Stephen Volz, Assistant Administrator

NESDIS Program Overview and Decadal Survey Priorities

ESAS2017 Steering Committee and Panels Meeting

June 3, 2016

Outline

- NOAA Objectives
- NESDIS Satellite Programs
- NESDIS Budget & Guidance
- Architecture Planning
- Objectives for the ESAS2017 Decadal Survey

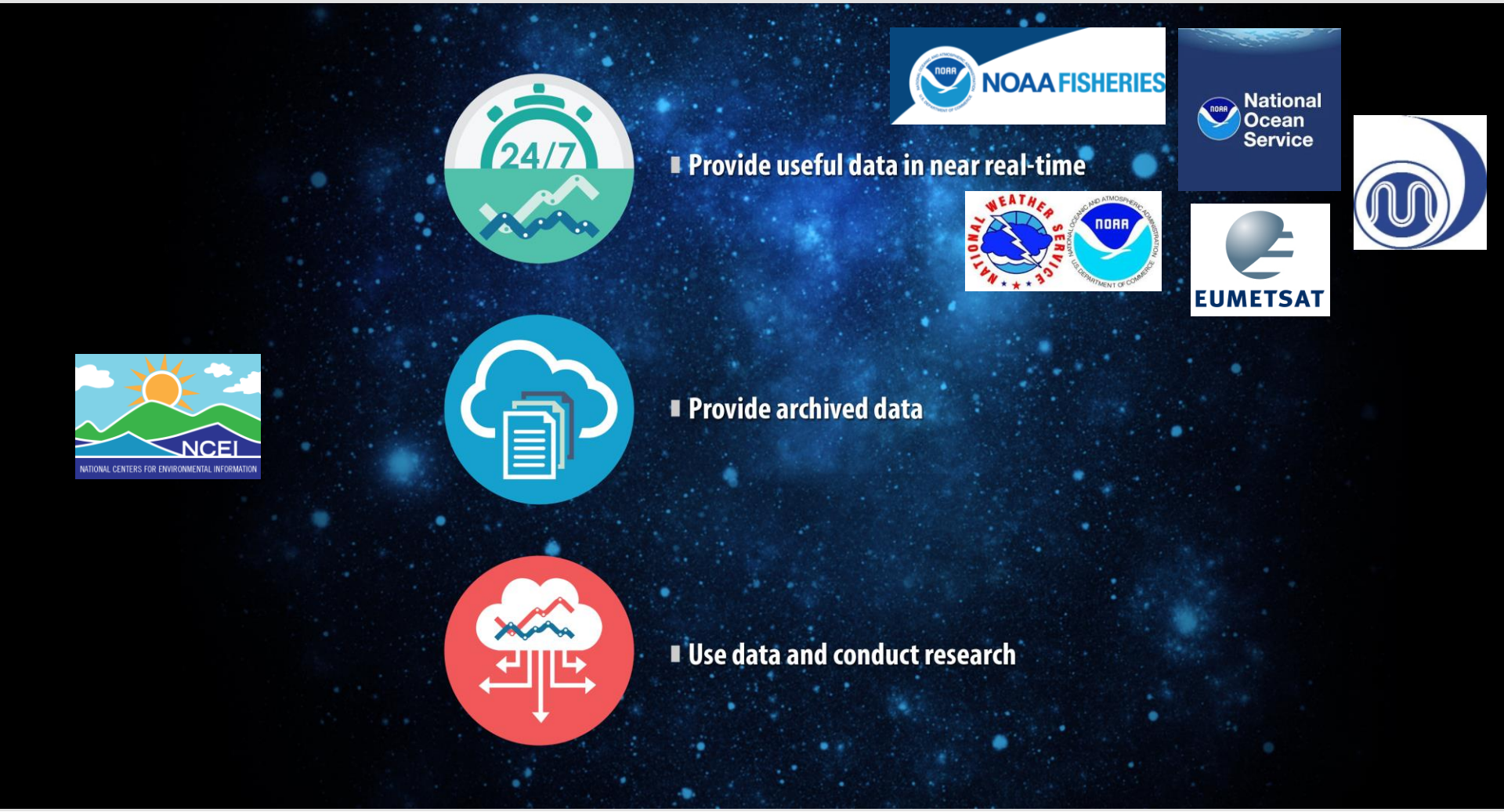
NOAA's role in civilian space-based Earth Observation

"The Budget supports NOAA's broad environmental mission and redefines NASA and NOAA Earth-observing satellite responsibilities whereby NOAA will be responsible only for satellite missions which contribute directly to NOAA's ability to issue weather and space weather forecasts and warnings to protect life and property."

-FY16 President's Budget Request

NOAA is committed to meeting the observational requirements of its Line Offices – the National Weather Service (NWS), the Marine Fisheries Service (NMFS), and the Ocean Service (NOS) – with systems developed, deployed, and leveraged by NESDIS and the Office of Marine and Aviation Operations (OMAO). The NOAA Observing Systems Council (NOSC) serves as the coordinating body for trades and discussions.

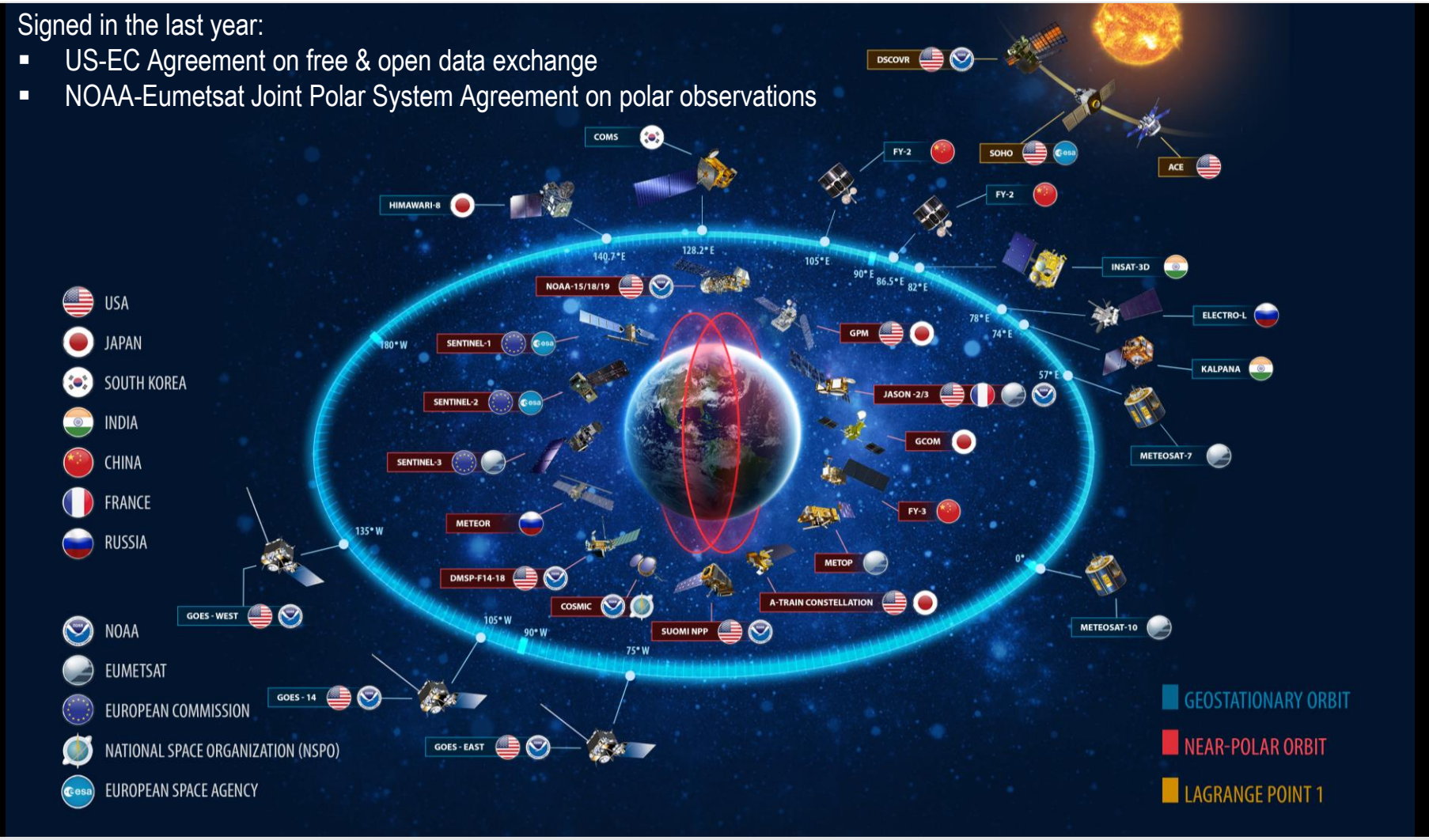
Expanding Understanding of Our Dynamic Planet



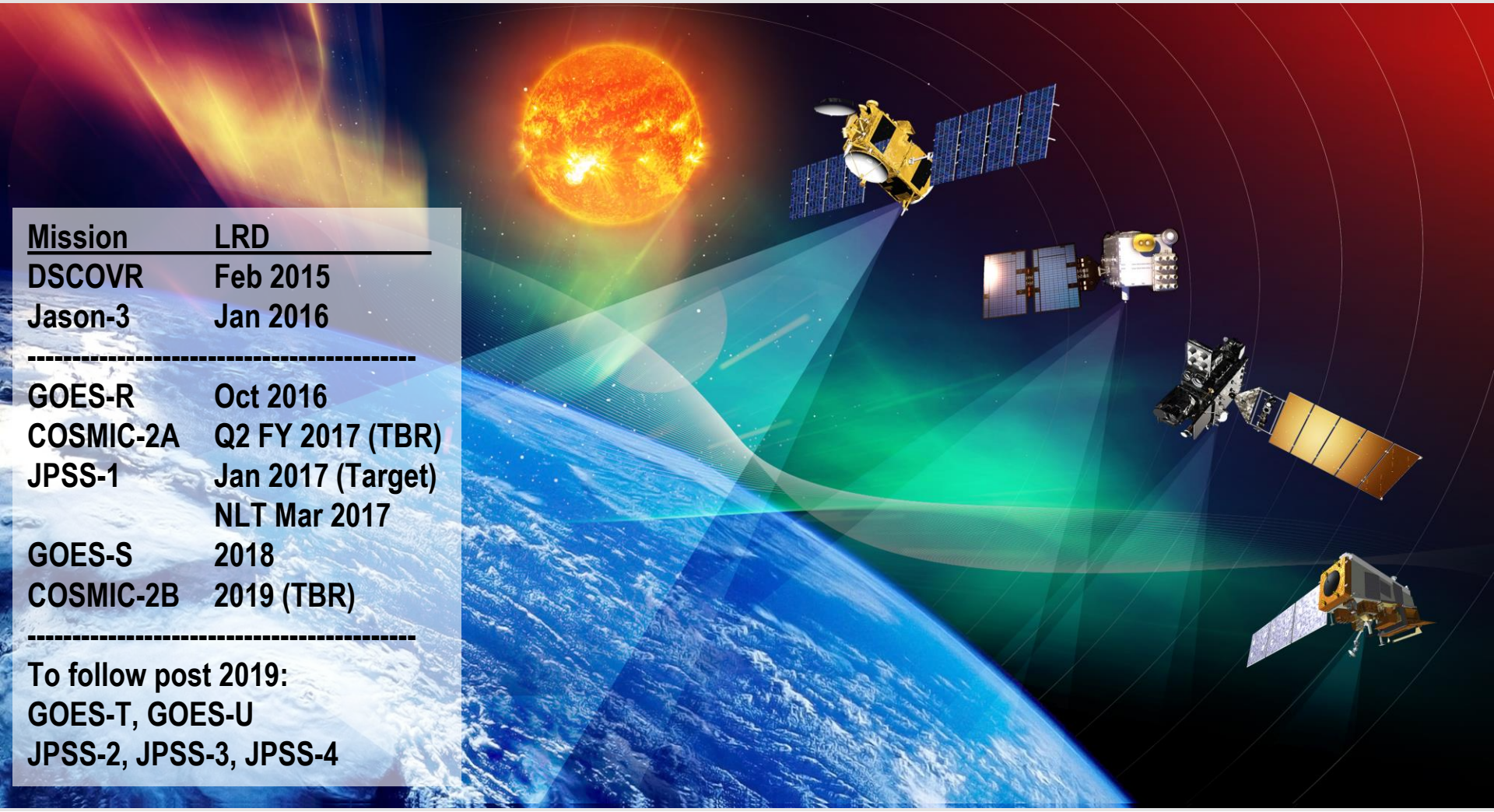
Partners in the Global Space-Based Observing System

Signed in the last year:

- US-EC Agreement on free & open data exchange
- NOAA-Eumetsat Joint Polar System Agreement on polar observations



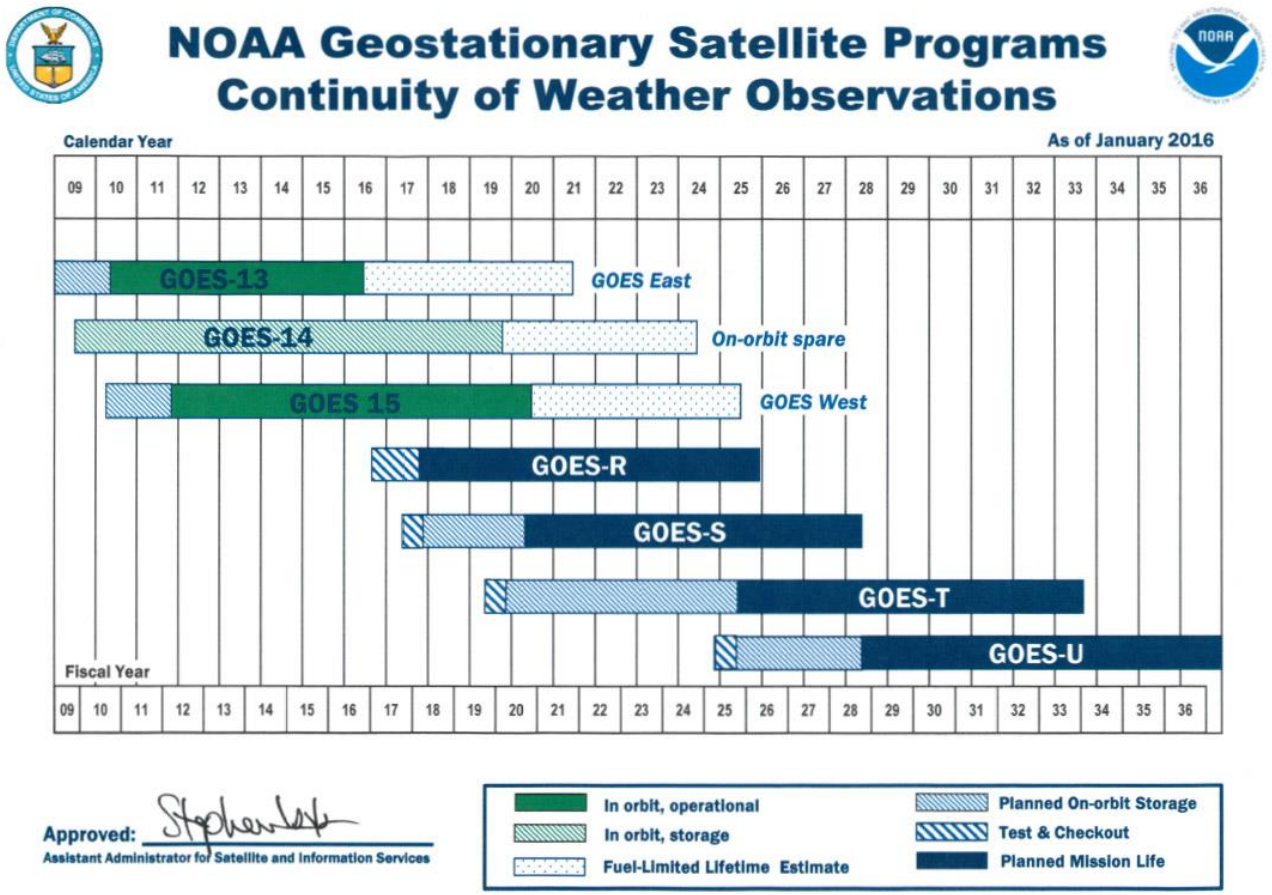
Recent and Upcoming Launches



Mission	LRD
DSCOVR	Feb 2015
Jason-3	Jan 2016
GOES-R	Oct 2016
COSMIC-2A	Q2 FY 2017 (TBR)
JPSS-1	Jan 2017 (Target) NLT Mar 2017
GOES-S	2018
COSMIC-2B	2019 (TBR)

To follow post 2019:
GOES-T, GOES-U
JPSS-2, JPSS-3, JPSS-4

GOES Flyout Chart

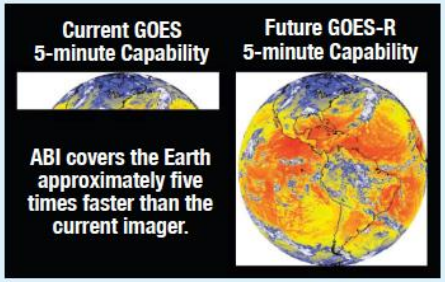


GOES-R Instrument Suite

GOES-R Instruments:
Earth, Solar and Space Weather

Advanced Baseline Imager (ABI)

ABI is the primary instrument on board GOES-R for imaging Earth's weather, climate, oceans and the environment. ABI will view the Earth with 16 spectral bands (compared to five on current GOES) and will provide three times more spectral information, four times the spatial resolution and more than five times faster coverage than the current system.



Geostationary Lightning Mapper (GLM)

GLM will be the first-ever operational lightning mapper flown from geostationary orbit. GLM maps total lightning (in-cloud and cloud-to-ground) activity continuously day and night over the Americas and adjacent ocean regions. Research and testing has demonstrated GLM's potential for improvement in tornado warning lead time and false alarm rate reduction.

Space Environment In-Situ Suite (SEISS)

SEISS is an array of sensors that will monitor proton, electron and heavy ion fluxes at geosynchronous orbit. Information provided by SEISS will be used for assessing radiation hazards to astronauts and satellites and to warn of high flux events, mitigating damage to radio communication.

Magnetometer

The Magnetometer will provide measurements of the space environment magnetic field that controls charged particle dynamics in the outer region of the magnetosphere. These particles can be dangerous to spacecraft and human spaceflight. The geomagnetic field measurements will provide alerts and warnings to satellite operators and power utilities.

Extreme Ultraviolet and X-Ray Irradiance Sensors (EXIS)

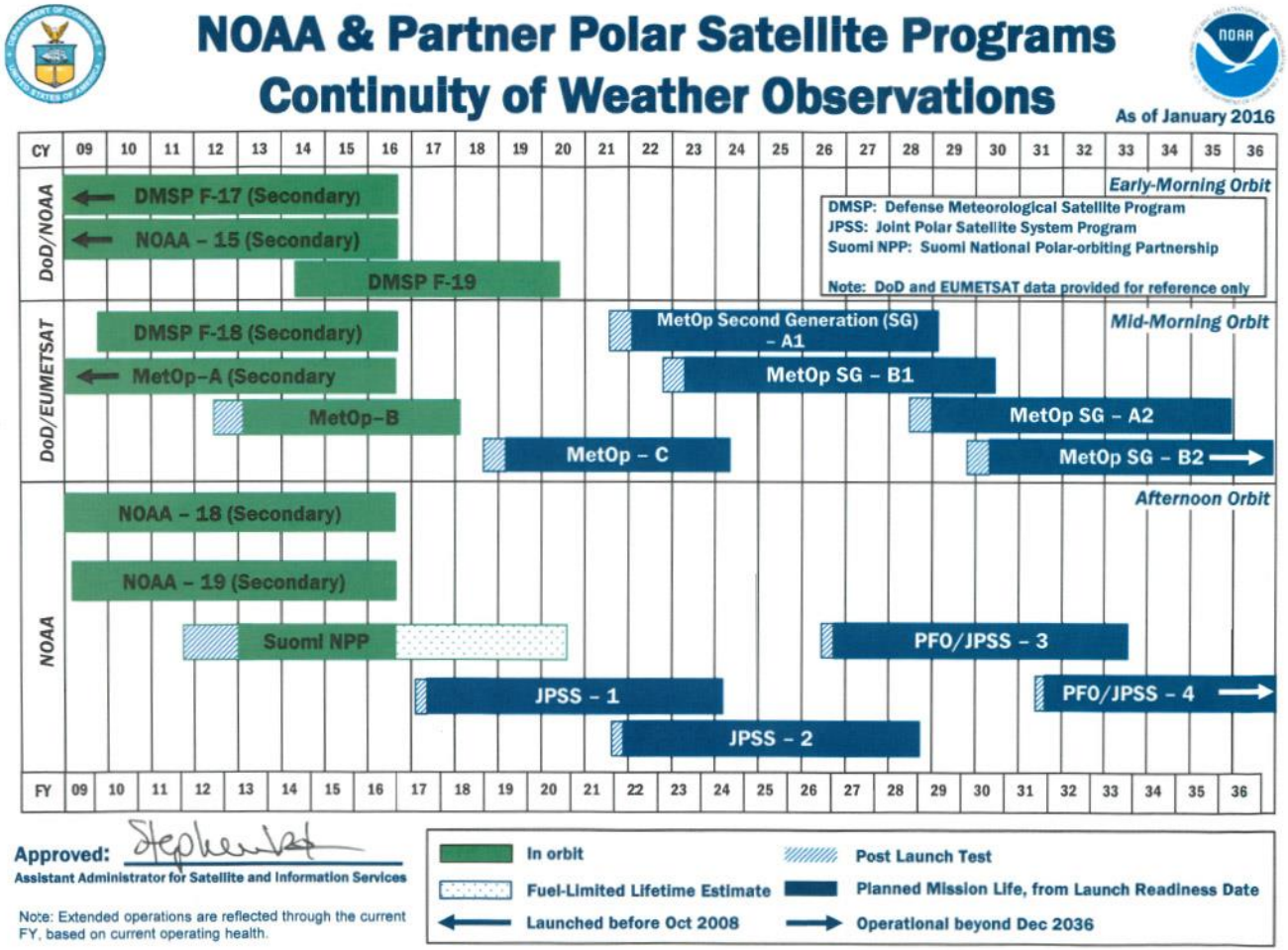
EXIS detects and monitors solar irradiance in the upper atmosphere. The X-Ray Sensor monitors solar flares that can disrupt communications and degrade navigational accuracy, affecting satellites, astronauts, high latitude airline passengers and power grid performance. The Extreme Ultraviolet Sensor monitors solar variations that directly affect satellite drag/tracking and ionospheric changes, which impact communications and navigation operations.

Solar Ultraviolet Imager (SUVI)

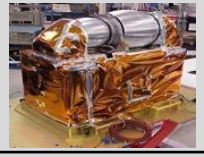
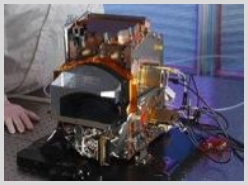
SUVI is a telescope that observes and characterizes coronal holes, solar flares, and coronal mass ejection source regions. SUVI data enables improved forecasting of space weather and early warnings of possible impacts to the Earth environment, including disruption of power utilities and communication and navigation systems as well as possible damage to orbiting satellites and the International Space Station.

- Earth Observing instruments
  - Advanced Baseline Imager – ABI
  - Geostationary Lightning Mapper – GLM
- Solar Observing Instruments
  - Space Environment In-Situ Suite – SEISS
  - Magnetometer
  - Extreme ultraviolet & X-Ray Irradiance Sensors – EXIS
  - Solar ultraviolet imager – SUVI
- Same instrument complement for all four satellites in the GOES-R series
  - All instruments under contract and mostly delivered

Polar Flyout Chart

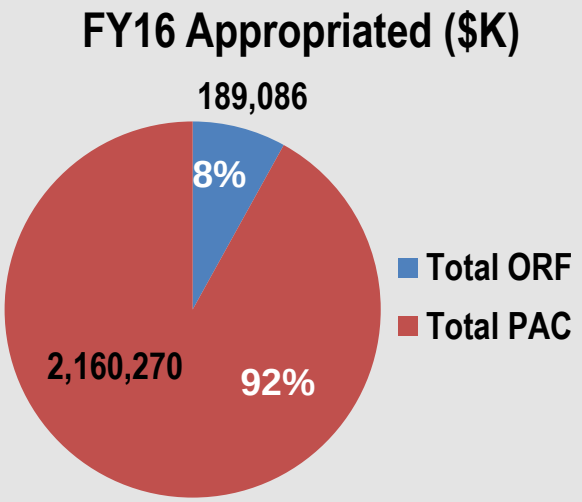


JPSS Instrument Suite, Same for All Versions

JPSS Instruments		Measurements & Products	Vendor
	**ATMS** - Advanced Technology Microwave Sounder	High vertical resolution temperature and water vapor information critical for forecasting extreme weather events, 5 to 7 days in advance	Northrup Grumman Electronic Systems
	**CrIS** - Cross-track Infrared Sounder		Harris (was Exelis)
	**VIIRS** – Visible Infrared Imaging Radiometer Suite	Critical imagery products, including snow/ice cover, clouds, fog, aerosols, fire, smoke plumes, vegetation health, phytoplankton abundance/chlorophyll	Raytheon Space and Airborne Systems
	**OMPS** - Ozone Mapping and Profiler Suite (shared with NASA)	Ozone spectrometers for monitoring ozone hole and recovery of stratospheric ozone and for UV index forecasts	Ball Aerospace and Technologies Corp.
	**CERES** – Clouds and the Earth's Radiant Energy System (S-NPP and JPSS-1) **RBI** – Radiation Budget Instrument (JPSS-2, 3, 4; provided by NASA)	Scanning radiometer which supports studies of Earth Radiation Budget (ERB)	CERES - Northrup Grumman Aerospace Systems RBI – Harris (was Exelis)

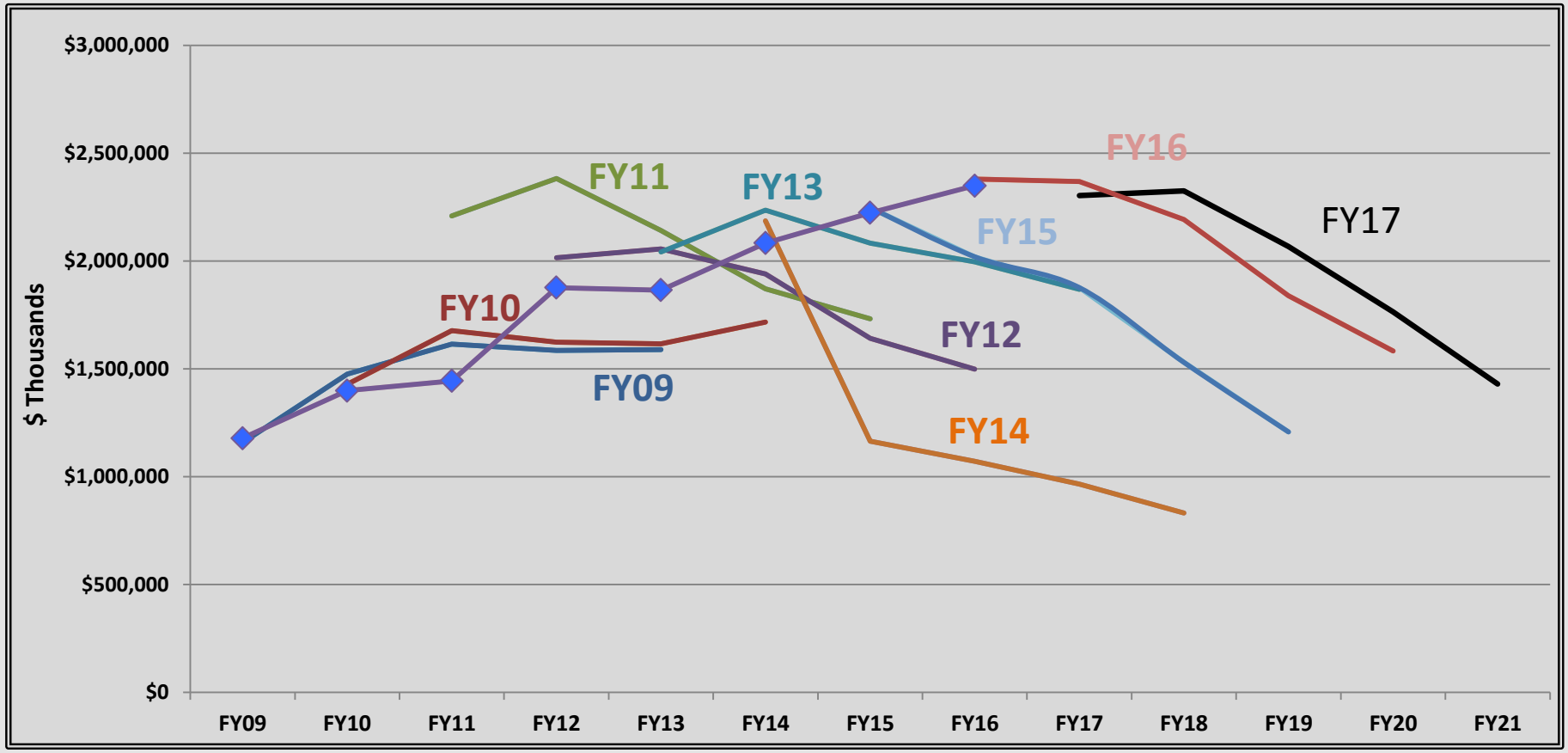
NOAA NESDIS Budget Allocations

- NESDIS budget clearly discriminates between development (PAC) and operations and sustainment (ORF) authorizations
- NESDIS PAC funding is closely connected with well-defined Life Cycle Cost (LCC) mission/program commitments, limiting flexibility to adjust to changing circumstances
  - Includes all satellite systems and all ground system development: GOES-R, JPSS, DSCOVR, COSMIC-2, Jason-3, OSGS, SARSAT/A-DCS



- NESDIS ORF funding is historically fixed funding (LOE) with limited flexibility for changing scope or circumstances
  - Includes all sustained operations, data centers, and science and algorithm development beyond core mission data products: STAR, NCEI, OSPO, OSC, CRSRA

NESDIS Requested and Enacted Budgets



FY 2017 NESDIS Overview

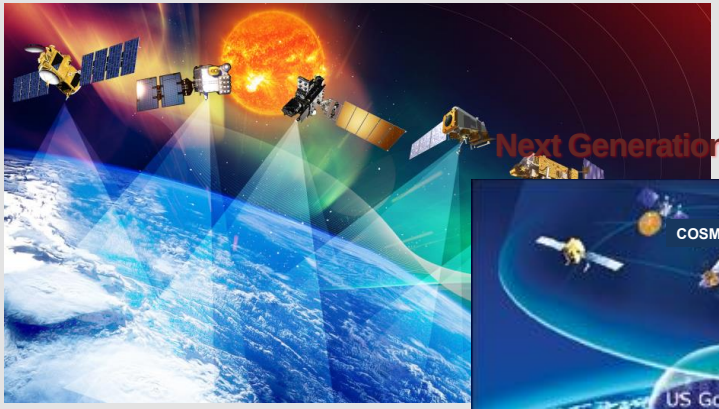
- FY 2017 Budget Request provides **$2,303.6 million total for NESDIS;** a $45.7 million decrease (1.9%) from the FY 2016 Enacted
  - +$0.5 million for Technical Adjustments
  - +$3.0 million for Calculated Inflationary Adjustments
  - -$49.2 million for Program Changes
- This request supports the priorities of the Administration, Department of Commerce and NOAA. In meeting these priorities, in FY 2017 NESDIS will:
  - Launch GOES-R, and continue building S, T, and U to ensure continuous Geostationary coverage of the western hemisphere
  - Launch JPSS-1, continue to build JPSS-2, and plan for PFO to ensure availability of data for weather prediction models
  - Launch COSMIC-2A constellation of six satellites, together with the USAF and Taiwan, providing critical tropical Radio Occultation measurements
  - Assess viability of Commercial Data through pilot purchases
  - Maintain 24x7 satellite operations, product development, processing and distribution, and maintain the critical national environmental data archive

Architecture of the Future

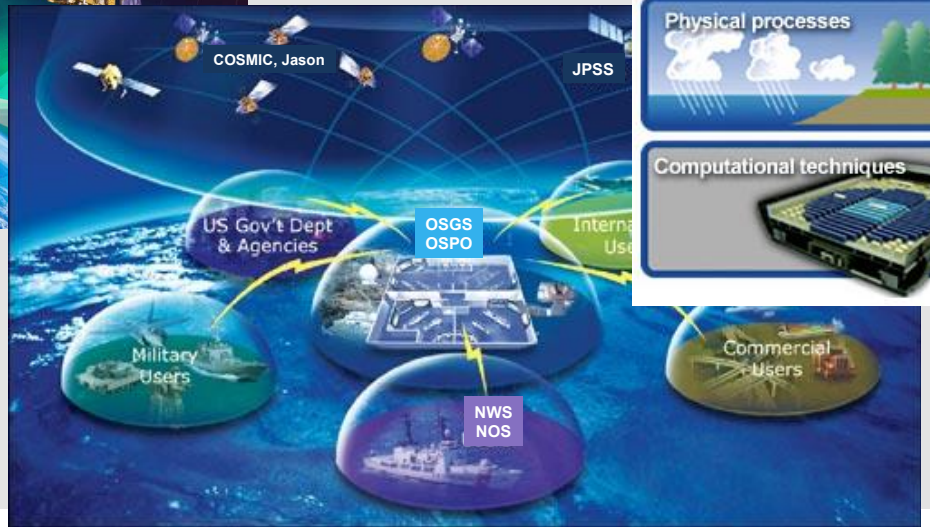
Develop a space-based observing enterprise that is flexible, responsive to evolving technologies, and economically sustainable.

--FY15 NOAA Annual Guidance

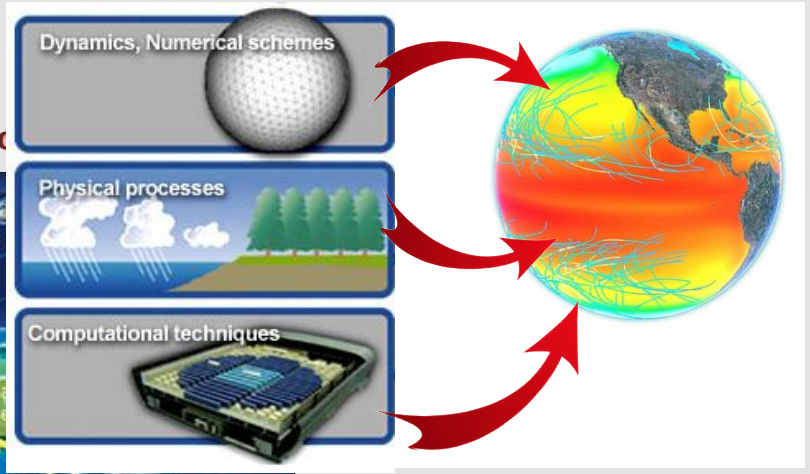
Global Earth Observing Satellite System



Next Generation Integrated & Adaptive Gro



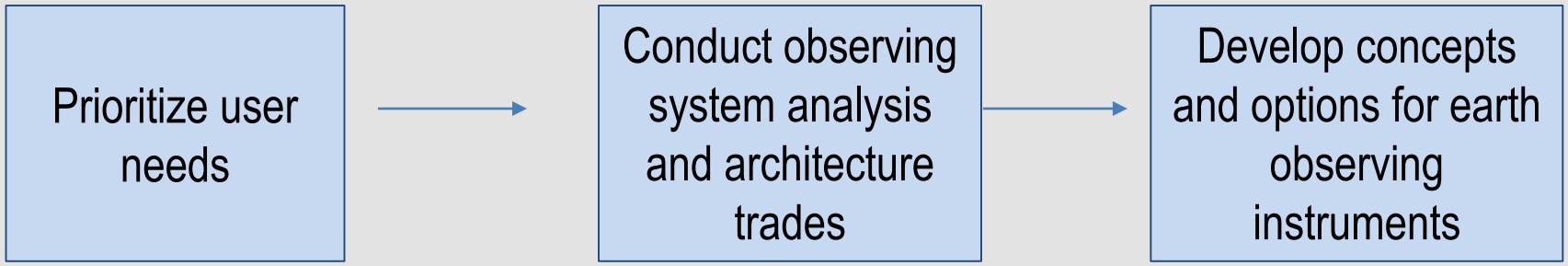
Integrated & Assimilated Operational Data Flow



Beyond JPSS and GOES-R: Re-Architecting NESDIS from an Enterprise Perspective

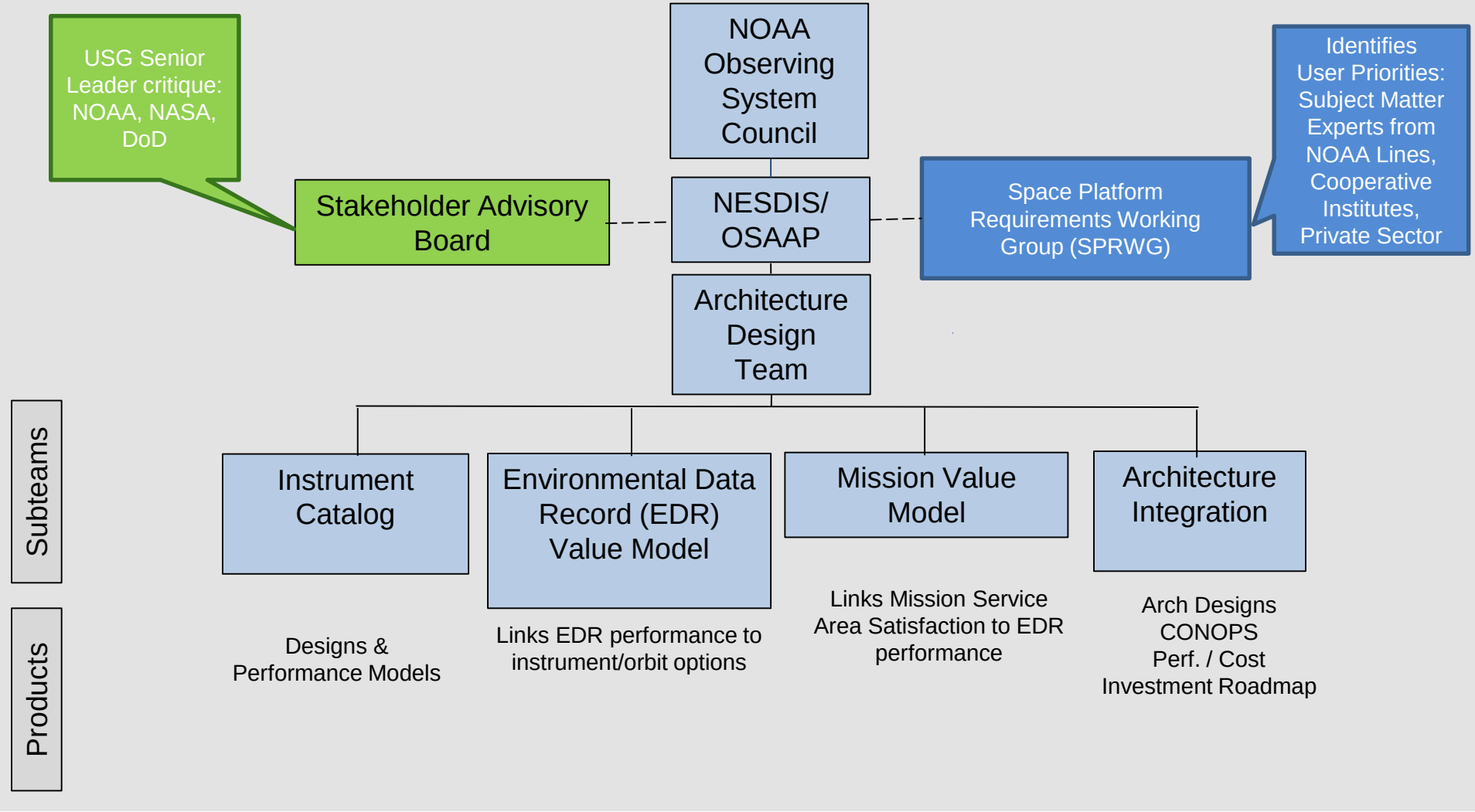
- Re-engineer an Enterprise Ground approach. NESDIS Office of Satellite Ground Services (OSGS) already embarked on this task, working with existing (OSPO) and incoming (JPSS & GOES-R) ground systems
- Initiate space segment future architecture design activity, led by NESDIS Office of System Architecture and Advanced Planning (OSAAP)

*The NOAA Satellite Observing System Architecture (NSOSA) Study will determine most cost effective space segment architectures for **NOAA** weather, space weather, and environmental remote sensing (excluding land mapping) missions, beyond Program of Record to 2050*



All considering complexity, cost, performance, technical risk, partitioning, and launch options

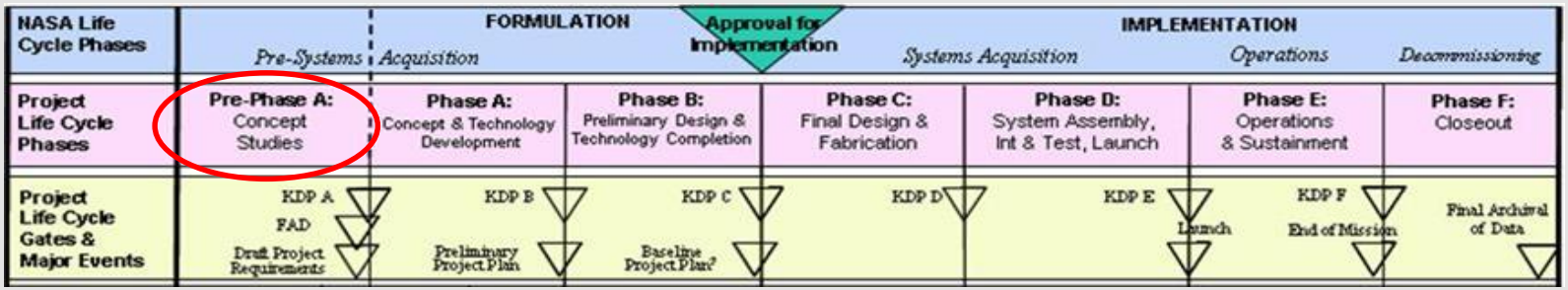
NSOSA Study Team Structure and Products



Initial Space Architecture Considerations

Why now?

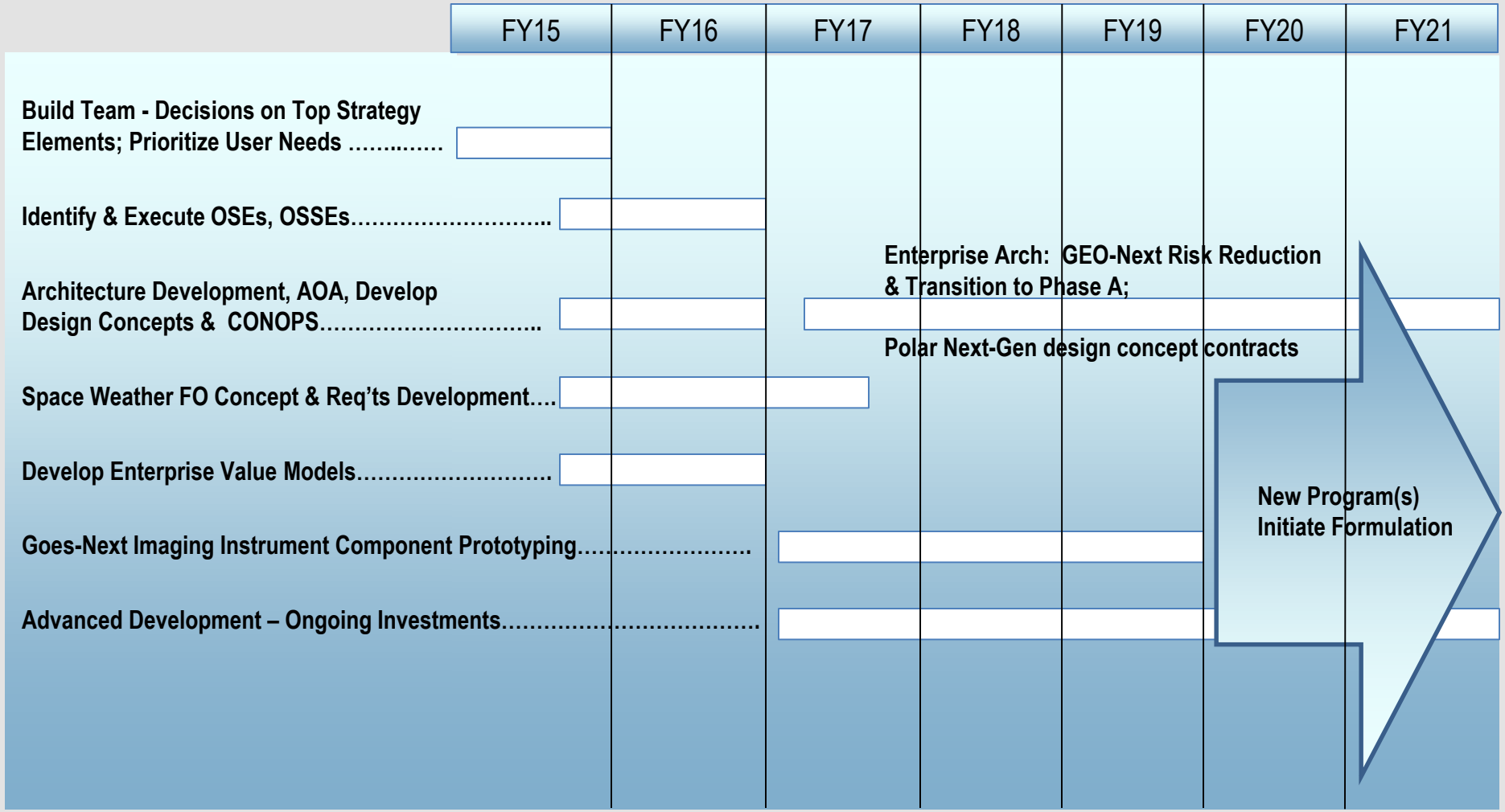
- For robustness, initial concept design must begin 12-14 years in advance of need
  - –Successor to GOES-R: FY 2028, Successor to PFO: FY 2031
- Sufficient early investment can contribute to fewer cost overruns



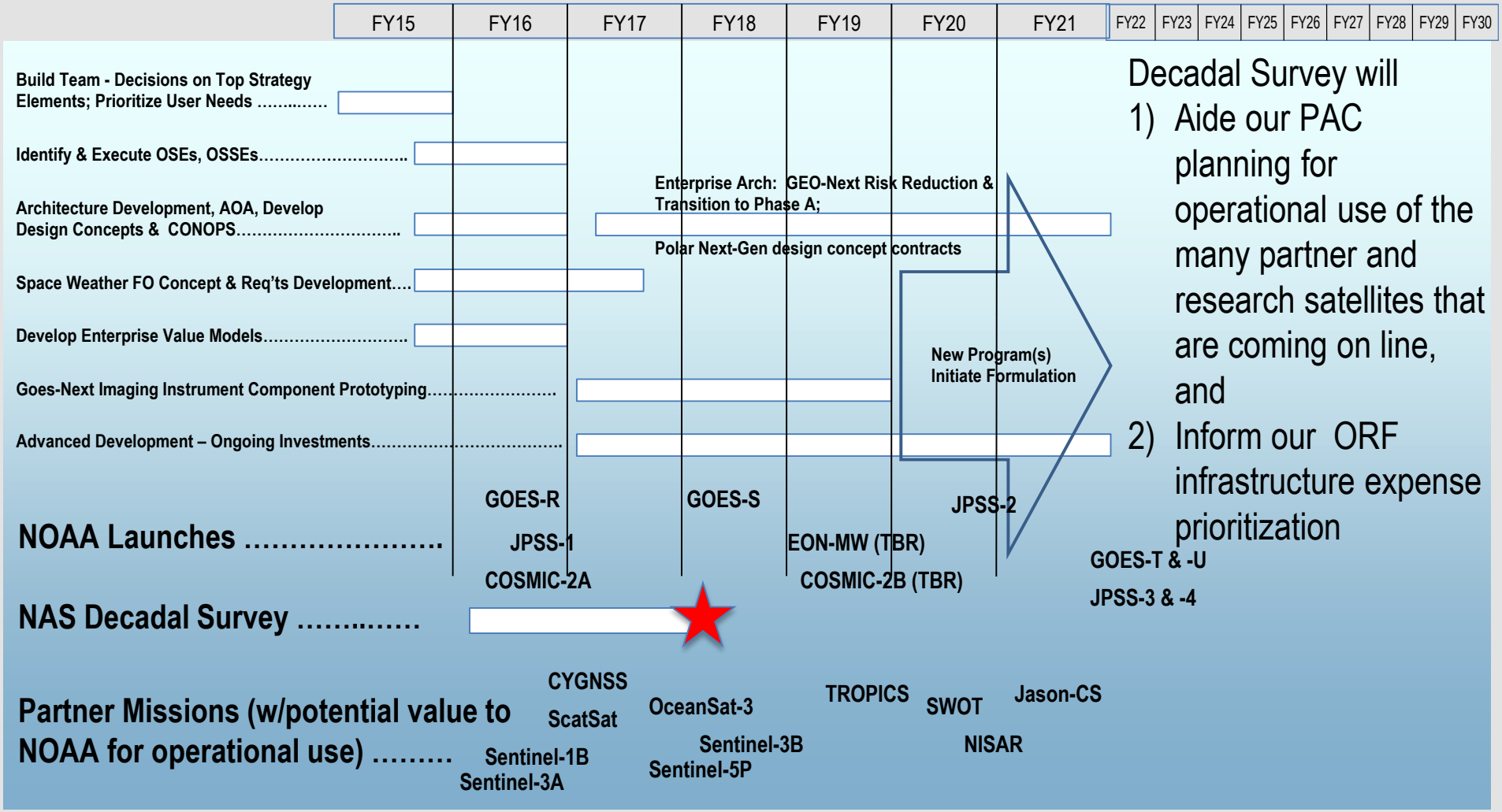
Different from and complimentary to the Decadal Survey

- While the decadal will provide a prioritized list of science and applications objectives, the NESDIS architecture studies will provide implementation options for operational services
- Both will build on foundational understanding of user needs
- Science objectives for the coming decade can inform operational implementation in the following decades

Notional Next Generation Schedule



Notional Next Generation Schedule



Decadal Survey will

1) Aide our PAC planning for operational use of the many partner and research satellites that are coming on line, and
2) Inform our ORF infrastructure expense prioritization

NOAA Priorities for ESAS2017 (1 of 2)

Our context:

- NOAA's portfolio for large missions is well established for the next 10+ years, with JPSS and GOES constellations well underway.
- Smaller missions are not as well established, and new starts require new funding
- NOAA's operations are now and will continue to be reliant upon international partnerships, hence all changes on must be considered with those relationships in mind

NOAA priorities for the Survey:

- New science that is needed to improve forecasting capability into and beyond the next decade
- Research missions and technology investments that would be:
  - Beneficial to the development of next-generation (beyond the next decade) foundational weather missions
  - Nearer term (5-10 years) and complementary to our foundational weather measurements
  - Amenable to potential interagency collaboration and to potential exploitation by multiple Agencies

From the SOT:
… consider which scientific advances are needed to add to NOAA's future predictive capabilities. This includes taking into the account the overlap and interdependencies between water, weather and climate, and encouraging the development of extended, and diversified forecasts.

NOAA Priorities for ESAS2017 (2 of 2)

NOAA priorities (continued):

- Study to evaluate best practices for making enhanced use of the extensive earth observations data archives, and for bringing in new data sets
  - Evaluate best practices for incorporating new data sets with old, while maintaining the integrity of the long term data record and continuity of operations
- Assess and provide recommendations on the value of non-traditional providers of Earth observation data for potential operational use, and whether such partnerships are being used effectively
  - Consider emerging international providers of space-based observations as either complements to or replacements for NOAA's internally developed and deployed observational assets
- Consider the emergence of a commercial sector which may provide high quality earth observations, and provide recommendations on issues including:
  - Methodology for assessing quality (calibration & validation),
  - Data rights and data access for operational and research use,
  - Appropriate balance of product delivery risk vs. leveraging of commercial sector investments

From the SOT:
…Will, with the expectation that the capabilities of non-traditional providers of Earth observations continue to increase in scope and quality, suggest approaches for evaluating these new capabilities and integrating them, where appropriate, into NOAA … strategic plans. The committee will also consider how such capabilities might alter NOAA's … flight mission and sensor priorities in the next decade and beyond.

Thank you!